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An Exploration of Stakeholder Impacts on the Decommissioning of Offshore Oil and Gas Facilities – The Design, Development, and Analysis of Stakeholder-Oriented Critical Paths for United Kingdom and Australia

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Declaration

This thesis has been written as part of a Collaborative Doctoral Programme undertaken at both the University of Aberdeen, Scotland, United Kingdom and Curtin University, Australia.

I declare that to the best of my knowledge and belief, this thesis is the record of my own work. Any personal data used in this thesis have been processed in accordance with the provisions of the Data Protection Act 1998 of the United Kingdom and the Privacy Act 1988 (Cth) and/or the Australian Privacy Principles of Australia. All quotations have also been distinguished by quotation marks and all sources of information have been specifically acknowledged. This thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Aaron Wei Jie Tung
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Abstract

The literature review found that although it has been 25 years since the events of Brent Spar, stakeholders continue to negatively impact oil and gas decommissioning projects around the world. In late 2019, Germany and the Netherlands protested against the Brent Field Decommissioning Programme put forth by Shell UK to the OSPAR Commission (Thomas 2019). In June 2020, Woodside Energy was pressured by its stakeholders to abandon the plan to leave the Echo Yodel pipelines in-situ, despite having considerable evidence supporting the leave in-situ decision (Milne 2020). The review also found there is a lack of academic literature in the field of management that studies oil and gas decommissioning. It is therefore reasonable to conclude that stakeholder impacts on oil and gas decommissioning projects are a result of the lack of understanding of the oil and gas decommissioning landscape.

A mixed-method research involving case studies of 63 past oil and gas decommissioning projects and semi-structured interviews with 40 industrial representatives across the United Kingdom and Australia was conducted. The overarching aim of the research is to enhance project managers' understanding of the oil and gas decommissioning landscape. Two stakeholder-oriented critical paths were developed in this research, one for the United Kingdom landscape, and the other for the Australian landscape, providing project managers and other audiences with information regarding stakeholder interactions throughout an oil and gas decommissioning project lifecycle.

It is argued that this thesis made several contributions to theory and practice:

- This thesis contributes to oil and gas decommissioning theory by revealing features of an oil and gas decommissioning project, in terms of list of project activities, milestones and deliverables, duration of project activities, and dependencies between project activities, stakeholder impacts, and planning considerations.
- The stakeholder-oriented critical paths developed in this thesis contribute to oil and gas decommissioning practice by providing project managers with a tool incorporating information regarding project activities, milestones and deliverables, duration of project activities, and dependencies between projects activities, stakeholder impacts, and planning considerations. Project managers can use the stakeholder oriented critical paths when planning oil and gas decommissioning projects.
- This thesis contributes to project management theory by introducing the concept of stakeholder oriented critical paths, which builds upon Kelley Jr and Walker's (1959) concept of critical paths by adding the dimension of stakeholder impacts into the picture.
- This thesis contributes to stakeholder management theory by proposing a new method of mapping stakeholders, enabling stakeholder managers to prioritise stakeholders based on the chronological order of the stakeholder interactions occurring throughout a project lifecycle.
- This thesis contributes to stakeholder management theory by revealing that stakeholder engagement fatigue is a real and commonly occurring phenomenon, caused by over engagement and repetitiveness in stakeholder engagement activities and processes.

- This thesis contributes to knowledge by building on and combining existing conceptual frameworks regarding extent of trust between organisations and stakeholders (Eskerod & Vaagaasar 2014; Moffat & Zhang 2014; de Oliveira & Rabechini Jr 2019; Karlsen, Græe & Massaoud 2008), extent of alignment in purpose between organisations and stakeholders (Huxham &Vangen 2013; Savage et al. 2010), extent of alignment of processes between organisations and stakeholders (Box & Platts 2005; Alsudiri, Al-Karaghouli & Eldabi 2013), co-creation of knowledge between organisations and stakeholders (Aarikka-Stenroos & Jaakkola 2012; Kazadi, Lievens & Mahr 2016; Keeys & Huemann 2017; Jull, Giles & Graham 2017), and stakeholders' perception of procedural justice (Kim & Mauborgne 1998), culminating in a new conceptual framework for effective stakeholder engagement.
- This thesis contributes to regulatory law by proposing solutions to address gaps in current oil and gas decommissioning legislation, regulations, and guidelines.

Overall, findings from this exploratory research provide valuable insights to guide future research in oil and gas decommissioning.

Publications

Tung, Aaron, Otto, Claus. (2019). "Decommissioning Cost Reduction by Effective Planning of Decommissioning Projects Using Facility Removal Date as a Reference Point." Paper presented at the *Society of Petroleum Engineers Symposium: Decommissioning and Abandonment, Kuala Lumpur, Malaysia. December 3-4, 2019.* https://doi:10.2118/199195-MS

Tung, Aaron, Otto, Claus. (2019). "Lessons Learnt from OSPAR and the North Sea: The Importance of Establishing a Regional Decommissioning Agreement in the South China Sea Region." Paper presented at the *Society of Petroleum Engineers Symposium: Decommissioning and Abandonment, Kuala Lumpur, Malaysia. December 3-4, 2019*. https://doi:10.2118/199207-MS

Tung, A. (2020). "Design and Analysis of Stakeholder Oriented Critical Paths for Offshore Decommissioning Projects in the United Kingdom and Australian Landscape using Mixed-Methods." Paper presented at the *Offshore Technology Conference, Houston, Texas, United States of America. May 4-7, 2020.* https://doi.org/10.4043/30539-MS

Tung, A. (2020). "A Comparison of Stakeholder Engagement Strategies for Offshore Decommissioning Projects in the United Kingdom and Australian Landscape." Paper presented at the *Offshore Technology Conference, Houston, Texas, United States of America. May 4-7, 2020.* https://doi.org/10.4043/30824-MS

Tung, A. (2021). "Co-Creation of Knowledge – An Effective Mechanism for Managing Decommissioning Stakeholders". The APPEA Journal 61.

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List of Abbreviations

ABEX	Abandonment Expenditure
AACE	American Association of Cost Engineers
APMBoK	Association of Project Management Body of Knowledge
APM	Association of Project Management
APPEA	Australian Petroleum Production and Exploration Association
ARO	Asset Retirement Obligations
ASCOPE	ASEAN Council on Petroleum
BEIS	Department for Business, Energy and Industrial Strategy [UK]
BPEO	Best Practicable Environmental Option
BSEE	Bureau of Safety and Environmental Enforcement [USA]
CA	Comparative Assessment
CFO	Chief Financial Officer
CMSTG	Cell Management Stakeholder Task Group
CNR	Canadian National Resources Limited
CNRI	Canadian National Resources International UK Limited
CoP	Cessation of Production
D&R	Decommissioning and Rehabilitation
DBCA	Department of Biodiversity, Conservation and Attraction [Western Australia]
DECC	Department of Energy and Climate Change [UK]
DIIS	Department of Industry, Innovation and Science
DMIRS	Department of Mines, Industry Regulation and Safety [Western Australia]
DMP	Department of Mines and Petroleum [Western Australia]
DP	Decommissioning Programme
DTI	Department of Trade and Industry [UK]
DWER	Department of Water and Environmental Regulation [Western Australia]
EA	Environmental Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment

eNGOs	Environmental Non-Governmental Organisations
EOR	Enhanced Oil Recovery
EP	Environmental Plan
EPA	Environmental Protection Authority
ES	Environmental Statement
ESP	Electrical Submersible Pump
E&P	Exploration and Production
FEED	Front End Engineering and Development
FPSO	Floating Production, Storage and Offloading Unit
FPS	Forties Pipeline System
GBS	Gravity-Based Structure
HLV	Heavy Lift Vessel
HPHT	High Pressure High Temperature
HSE	Health and Safety Executive
IMO	International Maritime Organisation
IPMA	International Project Management Association
IOR	Improved Oil Recovery
IRG	Independent Review Group
JNCC	Joint Nature Conservation Committee [UK]
JVP	Joint Venture Partners
MER	Maximizing Economic Recovery
MJTA	Malaysia-Thailand Joint Authority
NASA	National Aeronautics and Space Administration
NDRI	National Decommissioning Research Initiative [Australia]
NEBA	Nett Environmental Benefit Analysis
NFFO	National Federation of Fishermen's Organisations [UK]
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority [Australia]
NOPTA	National Offshore Petroleum Titles Administrator [Australia]
NORM	Naturally Occurring Radioactive Material
NPV	Net Present Value
NWS	North-West Shelf, Western Australia
OGA	Oil and Gas Authority [UK]

OGTC	Oil and Gas Technology Centre [UK]
OGUK	Oil and Gas UK
OPEX	Operation Expenditure
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning [UK]
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
P&A	Plugging and Abandonment
PERT	Program Evaluation Review Technique
PMBoK	Project Management Body of Knowledge
PMI	Project Management Institute
PMT	Project Management Team
PRINCE2	Projects in Controlled Environments
PTTEP	PTT Exploration and Production Public Company Limited
ROV	Remote Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fishermen Federation
SFT	Statens Forurensningstilsyn (Norwegian Climate and Pollution Agency)
SimOps	Simultaneous Operations
SSIV	Subsea Isolation Valve
TMT	Top Management Team
UKNDC	National Decommissioning Centre [UK]
UKCS	United Kingdom Continental Shelf
UNCLOS	United Nations Convention on the Law of the Sea
WBS	Work Breakdown Structure
WOMP	Well Operations Management Plan
WWF	World Wide Fund For Nature

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Chapter 1: Introduction

1.1 – Rationale for Research

Stakeholder impacts can have the potential to cause cost overruns, schedule delays, and changes to project scopes, and they can be critical to the success or failure of a project (Eskerod & Jepsen 2013; Ackermann & Alexander 2016; Olander 2007). A prime example of the type of projects that have been historically subjected to considerable stakeholder impact is oil and gas decommissioning. This is evident by the events of the 1995 Brent Spar incident (Gordon, Paterson & Usenmez 2018a), the 2019 Brent Field decommissioning protests (Thomas 2019), and the recent 2020 Echo Yodel decommissioning project (Milne 2020)

All three of the aforementioned oil and gas decommissioning projects were subjected to considerable stakeholder impact, resulting in changes to project scopes, costs, and schedules. In 1995, due to pressure by Greenpeace, Shell was forced to abandon the plan to sink the Brent Spar in the North Atlantic instead of bringing it to shore for disposal (Gordon, Paterson & Usenmez 2018a; Paterson 2015). Similarly, in 2020, due to pressure by stakeholders, Woodside abandoned their plan to leave the Echo Yodel facilities in the Australian's North-West Shelf (Milne 2020).

A possible reason why stakeholder impacts are still causing considerable concerns for organisations and governments at the time this thesis was written is because the body of knowledge in oil and gas decommissioning is still in its infancy (Shaw, Seares & Newman 2018). While a young body of knowledge does suggest that there are significant challenges in oil and gas decommissioning, it also signifies that there are significant opportunities to expand the existing body of knowledge in oil and gas decommissioning, particularly within the realm of stakeholder management.

1.2 – Oil and Gas Decommissioning

Oil and gas decommissioning is a process of shutting down and disposing of an oil and gas facility at the end of its production lifecycle. While the process of decommissioning an oil and gas facility appears to be simple from a theoretical point of view, amongst other considerations, there is a wide range of different stakeholders that have significant interests in decisions associated with oil and gas decommissioning (Shaw, Seares & Newman 2018; Genter 2019). Examples of oil and gas decommissioning stakeholders include, by not limited to:

- Legislative and Regulatory Bodies
  (Gordon, Paterson & Usenmez 2018a)
- The Supply Chain (Samudero, Capurso & Zoontjes 2019)
- Environmental Organisations (Shaw, Seares & Newman 2018)
- Commercial Fishermen (Rouse, Kafas, Catarino, et al. 2017)
- Recreational Fishermen (Kaiser, Shively & Shipley 2020)
- Tourism Sector (Bills 2018; Shaw, Seares & Newman 2018)
- Marine Shipping and Transport Companies (Amelia et al. 2018)
- Renewable Industry (Smyth et al. 2015)
- Taxpayers (Bills 2018)

Different stakeholder groups have different interests and concerns, pulling decommissioning decisions in multiple different directions (Shaw, Seares & Newman 2018; Ackermann & Eden 2011; Eskerod & Jepsen 2013). For example, commercial fishermen prefer that oil and gas facilities be removed to ensure safety in navigation (Shaw, Seares & Newman 2018; Rouse, Kafas, Catarino, et al. 2017). However, in contrast, some environmental organisations argue that oil and gas facilities should be left in place to prevent damaging the existing marine ecosystem. **Figure 1-1** (below, page 3) illustrates an example of a marine ecosystem established around an oil and gas facility:

Figure 1-1 – An Extensive Marine Ecosystem Established around an Oil and Gas Facility (Missions Blue 2017)

An adequate understanding of the stakeholder landscape is required to accurately identify stakeholders and understand their interests and concerns (Ackermann & Eden 2011; Mitchell, Agle & Wood 1997). Also, as managing a wide range of stakeholders can be a massive undertaking, some form of prioritisation can help organisations effectively manage their stakeholders (Ackermann & Eden 2011; Mitchell, Agle & Wood 1997).

This research seeks to develop frameworks and insights to enhance project managers' understanding of the oil and gas decommissioning landscape. This is achieved through the design, development, and analysis of stakeholder-oriented critical paths. Findings from this research cumulate in the form of two stakeholder-oriented critical paths, which can serve as tools for project managers when planning future oil and gas decommissioning projects. This thesis will unfold according to the structure discussed in **Section 1.3** (below, page 3).

1.3 – Structure of the Thesis

1.3.1 – Literature Review

As illustrated in **Figure 1-2** (below), the topic of oil and gas decommissioning is an interdisciplinary topic encompassing engineering, environmental science, management, regulatory law, and many others (Zawawi, Liew, Shawn, et al. 2019; Shaw, Seares & Newman 2018; Chandler et al. 2017).

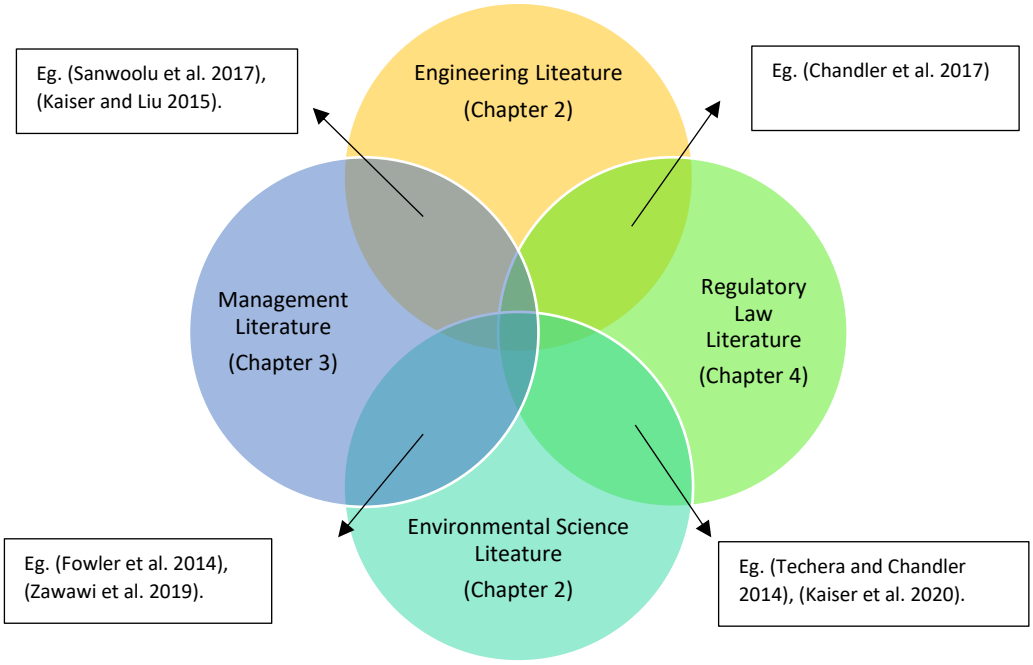

Figure 1-2 – The Interdisciplinary Nature of Oil and Gas Decommissioning

Due to the interdisciplinary nature of oil and gas decommissioning, the literature review is split into three chapters so that each body of literature can be reviewed systematically.

- **Chapter 2: Exploring Oil and Gas Decommissioning**
- **Chapter 3: Managing Oil and Gas Decommissioning**
- **Chapter 4: Regulating Oil and Gas Decommissioning**

Chapter 2: Exploring Oil and Gas Decommissioning explores the engineering and environmental science literature. Engineering literature and environmental science literature are explored in the same chapter because, in oil and gas decommissioning, the two are very closely linked. Engineering designs for the decommissioning of wells, for example, are based on existing knowledge regarding the impact of well decommissioning on the marine environment (Vrålstad et al. 2019). The literature review shows that oil and gas decommissioning has yet to be properly understood by the oil and gas industry because both the academic and industry bodies of knowledge are still in their infancy (Shaw, Seares & Newman 2018). Furthermore, in reviewing the literature, it became clear that there are various decommissioning options and alternatives. It was also found that there are a variety of different stakeholder groups pulling the specific decommissioning option in multiple directions.

Chapter 3: Managing Oil and Gas Decommissioning explore the body of literature concentrating on project management and stakeholder management. The main observation is that in terms of oil and gas decommissioning projects, the area of schedule and risk management, including stakeholder management, has not yet been explicitly explored, indicating a significant knowledge gap. This presents an opportunity to examine the management of schedule and risk by using project management tools such as critical paths and embedding stakeholders into these paths.

Chapter 4: Regulating Oil and Gas Decommissioning explore the regulatory law literature in the field of oil and gas decommissioning. The dominant observations are that there are a range of prescriptive and goal-setting approaches to regulating oil and gas decommissioning projects, and oil and gas decommissioning legislation is relatively under-developed in younger landscapes such as Australia and Malaysia (Barrymore & Ballard 2019; Jagerroos & Kayleigh 2019). Overall, the developing regulatory landscape indicates an opportunity to explore further how oil and gas decommissioning legislation, regulation, and guidelines influence oil and gas decommissioning activities, particularly for the management of the schedule, risks, and stakeholders of oil and gas decommissioning projects.

1.3.2 – Research Methodology

Chapter 5: Research Methodology explores the research methodologies and the philosophical approach that was brought to bear on this research. The author's selection of the research philosophy, approach to theory development, methodological choice, research strategy, time horizon, and research techniques are explained in detail in this chapter. The chapter will then explain the practical reasons for the data collection method and the data analysis techniques and procedures used in this research. Overall, the research will use a mixed-method approach consisting of examining documented case studies, critical path design and analysis, and semi-structured interviews.

1.3.3 – Research Findings

Given the multi-disciplinary nature of the research, several findings emerged. To enable effective examination of each stage of the research, the insights and conclusions are divided into a series of five chapters, all building on one another:

- **Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects**
- **Chapter 7: Development of Stakeholder-Oriented Critical Paths**
- **Chapter 8: Analysis of Stakeholder-Oriented Critical Paths**
- **Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement**
- **Chapter 10: Regulatory Impact on Project Performance**

Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects presents the findings from collecting and analysing past oil and gas decommissioning projects available on the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) website (OPRED 2019). The chapter details the considerations made by oil and gas operators during the planning of oil and gas decommissioning activities based on the case study data. Using the case study data, three initial stakeholder-oriented critical paths were generated, each representing one of the three main decommissioning

options – Leave-In-Place, Partially Leave-In-Place, and Complete Removal. The chapter concludes with a summary of the significant observations.

Chapter 7: Development of Stakeholder-Oriented Critical Paths presents the findings from the development of stakeholder-oriented critical paths. The chapter explores the considerations relating to stakeholder management during the planning of oil and gas decommissioning activities based on interview data. Using the interview data, the initial stakeholder-oriented critical paths were further developed and refined. At the end of the process, two robust stakeholder-oriented critical paths were developed, one representing the UK landscape, and the other representing the Australian landscape.

Chapter 8: Analysis of Stakeholder-Oriented Critical Paths presents the findings from the detailed analysis of the stakeholder-oriented critical path's critical points. The critical points were determined from interview data. The critical points were then analysed to determine the reasons for the interactions between oil and gas operators and stakeholders, the stakeholders' potential impact at the critical point, and the appropriate mechanisms to ensure effective decommissioning. Using the findings, a conceptual model offering insights into the critical points was developed.

Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement presents the findings from the semi-structured interviews regarding the effectiveness of stakeholder engagement. The key factors influencing the effectiveness of engagement between organisations and stakeholders were identified as (a) Extent of trust, (b) extent of alignment in purpose, and (c) extent of alignment in processes. Using the findings, a conceptual model offering insights into the effectiveness of stakeholder engagement was developed.

Chapter 10: Regulatory Impact on Project Performance presents the findings from the semi-structured interviews regarding the regulatory aspect of oil and gas decommissioning – a very particular stakeholder. Several gaps in current regulatory arrangements were identified, and possible solutions were proposed to address those gaps.

1.3.4 – Discussion and Conclusion

Chapter 11: Discussion establishes the contributions to knowledge and integrates the findings from Chapters 6 to 10. It demonstrates that all the initial research questions and objectives noted in ***Chapter 5: Research Methodology*** have been addressed by the creation of two stakeholder-oriented critical paths, revealing considerations when scheduling oil and gas decommissioning projects, stakeholder interactions that occur throughout an oil and gas decommissioning project lifecycle, reasons for those stakeholder interactions, and best practices to manage those stakeholder interactions.

It is then argued that this thesis contributes to knowledge by revealing a series of factors that influence the effectiveness of stakeholder engagement, and these are presented in the findings in the form of conceptual frameworks (see **Section 5.8.8.5**, page 193), providing a better understanding of stakeholder engagement. Finally, it is argued that this thesis contributes to knowledge by revealing a series of gaps within current oil and gas decommissioning legislation, regulation, and guidelines while proposing possible measures and solutions to address those gaps. ***Chapter 12: Conclusion*** provides a concluding statement to the thesis.

Chapter 2: Exploring Oil and Gas Decommissioning

2.0 – Literature Review Overview

The literature review aims to develop an understanding of the topic of oil and gas decommissioning to identify and highlight gaps within the literature. Findings from the literature review are used to guide the research questions in order to extend the current body of knowledge. The literature review for this thesis is presented in the form of three different chapters instead of the traditional single chapter approach:

- **Chapter 2: Exploring Oil and Gas Decommissioning**
  - Engineering Literature
  - Environmental Science Literature
- **Chapter 3: Managing Oil and Gas Decommissioning**
  - Project Management Literature
  - Stakeholder Management Literature
- **Chapter 4: Regulating Oil and Gas Decommissioning**
  - Law Literature

Initial mining of oil and gas decommissioning literature found that the topic has been discussed in various disciplines such as engineering, environmental science, and law. **Table A-1** (see page 555) in ***Appendix A*** categorises oil and gas decommissioning literature according to area of discipline. As the extant literature covers multiple bodies of knowledge, separating the various literature and analysing each within its own field is a much more feasible approach. Presenting the literature review individually in separate chapters also makes it easier for the readers to digest. A conclusion will be presented at the end of the literature review process to summarise the findings from all three chapters and draw them all together.

<u>Chapter 2: Exploring Oil and Gas Decommissioning</u>

The literature review process starts with a review of engineering literature because it is the largest body of knowledge in the field of oil and gas decommissioning (as seen in **Table A-1**, page 555). The review of engineering literature serves the dual purpose of functioning as background knowledge for

the decommissioning process while also highlighting gaps within the literature. The review finds that the process of decommissioning oil and gas facilities has yet to be fully understood by the industry because the oil and gas decommissioning industry is still in its infancy. There is a lack of experience and expertise, which indicates that there are still plenty of opportunities to develop newer and more innovative engineering solutions. The review also finds a variety of decommissioning options and alternatives (such as Complete Removal, Partial Removal, Toppling, Rigs-to-Reefs, Renewable Energy Projects, and Tourism Projects). However, certain decommissioning options are technically not feasible due to the design and location of oil and gas infrastructure. The review identified eight different groups of stakeholders. Additionally, the review also finds that there is a recognition by oil and gas operators that stakeholders can impact the cost, risks, and schedule of an oil and gas decommissioning project. Furthermore, the review finds a lot of cross-disciplinary references, an indication of the interdisciplinary nature of oil and gas decommissioning.

The review then proceeds to examine environmental science literature, the second largest body of knowledge after engineering on the topic of oil and gas decommissioning, suggesting that environmental factors are perhaps the most prioritised consideration by oil and gas operators after engineering. However, the review of environmental science literature finds that there is also a need to consider the cost, safety, and societal aspect of oil and gas decommissioning in addition to technical and environmental considerations. The review finds that stakeholder interests and concerns are pulling decommissioning decisions in multiple directions, which adds complexity to the decision-making and stakeholder management process.

Overall, this chapter finds that managing an oil and gas decommissioning project is a highly complex process, mainly due to the technical challenges of decommissioning and the wide range of stakeholders' interests and concerns which can influence and impact the costs, risks, and schedule of the project.

Chapter 3: Managing Oil and Gas Decommissioning

Noting the complexity of managing oil and gas decommissioning projects, the review then proceeds to explore the evolution of project management literature to understand how complex projects are managed over several years and identify gaps within the literature. The review finds that an oil and gas decommissioning project is unique as it has both the characteristics of a project and a programme. This indicates that there is a gap in the body of knowledge in that area. The review also finds that there is not much project management discipline literature on oil and gas decommissioning. All 16 works in the field of oil and gas decommissioning management identified in this literature review appear to only focus on cost estimation and forecasting. This indicates a significant knowledge gap in the area of schedule and risk management as those areas have not yet been explicitly explored in academic literature. This presents an opportunity to examine the management of schedule and risks by using project management tools such as critical paths.

As engineering and environmental science literature suggests that stakeholders are important. The review then moves deeper into stakeholder management literature to explore its evolution to identify gaps in the literature. The review finds that stakeholder management is an integral part of business ethics, strategy, and corporate social responsibility, which relates to the risk management. The review also finds that stakeholder management literature in oil and gas decommissioning tends to focus on the use of multi-criteria decision-making tools, which suggests using multi-criteria decision-making tools is current best practice to manage stakeholders of an oil and gas decommissioning project. While the literature acknowledges that identifying and engaging stakeholders is still necessary to obtain information to use multi-criteria decision-making tools, the area of stakeholder identification and engagement in the context of oil and gas decommissioning has not yet been explicitly explored in stakeholder management literature. Hence, there is still a knowledge gap regarding stakeholder identification and engagement in the context of oil and gas decommissioning. This also presents an opportunity to explore this avenue using business research methods such as semi-structured interviews.

Chapter 4: Regulating Oil and Gas Decommissioning

The review then explores the legal aspect of oil and gas decommissioning by reviewing oil and gas decommissioning regulations and law journals to highlight gaps in the literature. The review finds that there is a range of prescriptive and goal-setting approaches to regulating decommissioning projects. The acceptable quality of the decision-making process, the stakeholder engagement process, and the demonstration of duty of care also vary depending on jurisdictions. The review also finds that a change in oil and gas decommissioning regulations can have economic, social, and environmental implications. Many oil and gas decommissioning regulations are still in their infancy and are even absent in certain jurisdictions. This indicates an opportunity to explore further the impacts of oil and gas decommissioning regulations, particularly on how they influence an oil and gas operator's management of schedule and risks of oil and gas decommissioning projects. Such information can be used to guide future policies.

The overall conclusion is that oil and gas decommissioning is interdisciplinary and encompasses a wide range of stakeholders. An oil and gas decommissioning project is complex, displaying characteristics of both a project and a programme. There is a knowledge gap in schedule management, stakeholder management, and regulatory law in the context of offshore decommissioning. The presence of multiple knowledge gaps suggests an opportunity for interdisciplinary research to expand the body of knowledge on numerous fronts. Findings from the literature review will be considered when developing the research methodology. More details regarding the research methodology will be discussed in ***Chapter 5: Research Methodology***.

2.1 – Engineering Literature

This section reviews the engineering literature on oil and gas decommissioning by exploring them through the lens of the different types of offshore oil and gas structures. This thematic approach is more beneficial for readers. It allows them to understand the differences in the design of different types of offshore oil and gas structures, the implications on the decommissioning process, and the impact of decommissioning on the stakeholders. Each type of offshore oil and gas structure will be examined, focusing on identifying issues and challenges relating to decommissioning. Gaps identified from the literature will also be highlighted, and each type of structure will be studied thoroughly to determine:

- The Rationale of the Design
- The Method of Installation
- The Challenges and Concerns during Decommissioning
- Possible Stakeholder Groups Involved
- Main Gaps in the Literature

According to the OGUK (Oil and Gas UK) WBS (Work Breakdown Structure) (OGUK 2019), offshore oil and gas structures can be divided into five main groups:

- Wells
- Topsides
- Substructure
- Subsea Facilities
- Pipelines

This finding indicates that research in decommissioning can consider exploring the topic at a deeper level, exploring each of the five groups of offshore oil and gas structures in more detail. According to OPRED (2019), each of these structures presents its own set of challenges and is subjected to different regulations. Furthermore, it is of note that the situation is further complicated by the fact that some structures, such as platforms, are very much highlighted at the level of international law. In contrast, others, such as wells and pipelines, are not (Gordon, Paterson & Usenmez 2018a).

2.1.1 – Wells

In the petroleum industry, a well refers to the hole which connects the subsurface environment to the surface environment. These wells are drilled using various drilling methods to position them appropriately around the hydrocarbon reservoir to optimise the economical production of resources (Bourgoyne Jr et al. 1986). Well decommissioning, or well plugging and abandonment as it is commonly called in the industry, involves placing permanent barriers (also known as plugs) to seal off the wells and prevent any leakage of subsurface fluids into the surface environment. As well plugging and abandonment involve protecting the surface environment, environmental stakeholders may be interested in decisions made in this respect.

Permanent barriers for well plugging and abandonment can be created by mechanical means through the precise placement of mechanical plugs at appropriate depths (Vrålstad et al. 2019), or by chemical means through thermochemical reactions (Zhang, Ramakrishnan & Ellias 2019). **Figure 2-1** (below) shows the typical process of well plugging and abandonment:

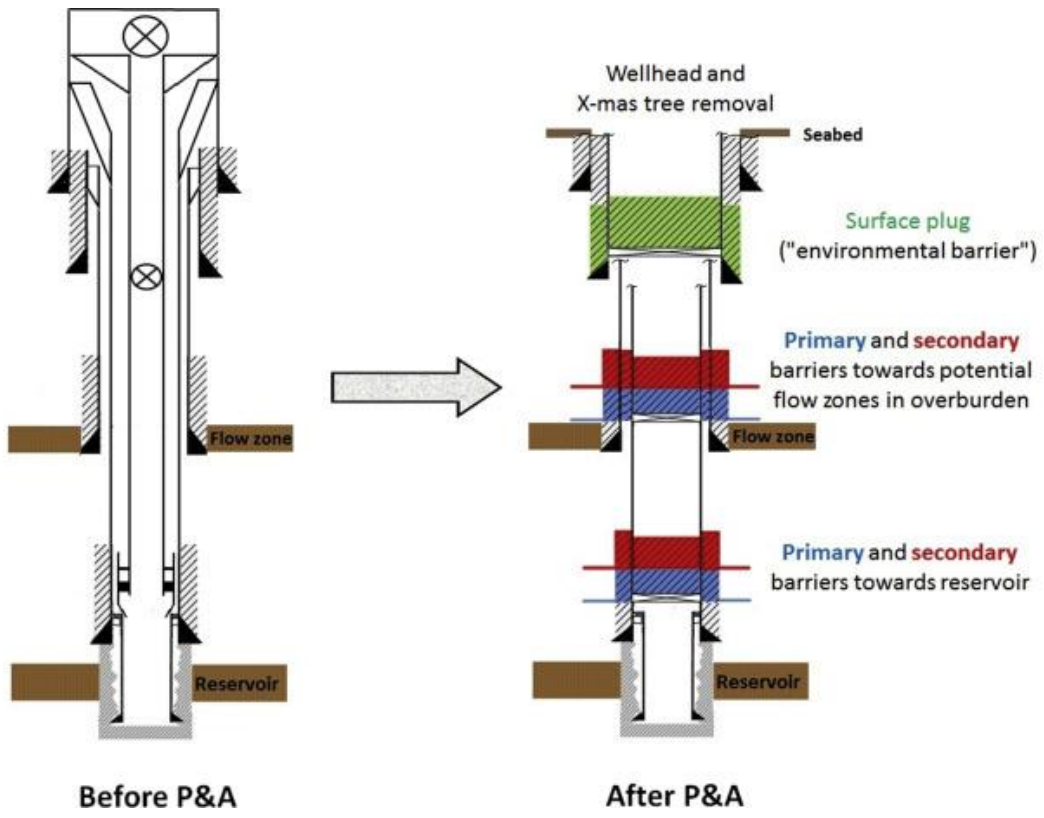

Figure 2-1 – Process of Well Decommissioning / Plugging and Abandonment (P&A) (Vrålstad et al. 2019)

During field exploration and development, the well's design varies significantly depending on the type of produced fluid, geological conditions, and the purpose of the well. For example, a production well will have a different design from an injection well, and an oil-producing well will have a different design from a gas-producing well. Additionally, wells may have been modified over time to maximise hydrocarbon production (Bellarby 2009), which means that the original schematics may not offer accurate information to well engineers. Furthermore, ever-changing geological properties can make subsurface conditions extremely difficult to predict (Rusman et al. 2019; Mittal & Gupta 2019; Haryanto et al. 2019; Imrie et al. 2019). Overall, all these variations indicate that there are many unknowns when it comes to the actual design of the well and actual geological conditions. Since there are many unknowns, this suggests that there are many interactions between the project manager and stakeholders when planning well plugging and abandonment.

In addition to taking account of the design of the well and geological conditions, consideration must be also be given to the integrity of the casings, cement, and downhole tools. Degradation of existing casings and cement over time has been stated in the literature to be a cause of complications during well plugging and abandonment (Yusof, Ros & Omar 2018; Saharuddin et al. 2019; Webber & Mackay 2019; Ritchie et al. 2019; Clyne & Jackson 2014; Li et al. 2018). This is because these existing casings and cement are the only barriers in place that prevent leakage of fluid from the subsurface environment to the surface environment before the setting of permanent plugs. **Figure 2-2** (below, page 16) shows a basic schematic of a well.

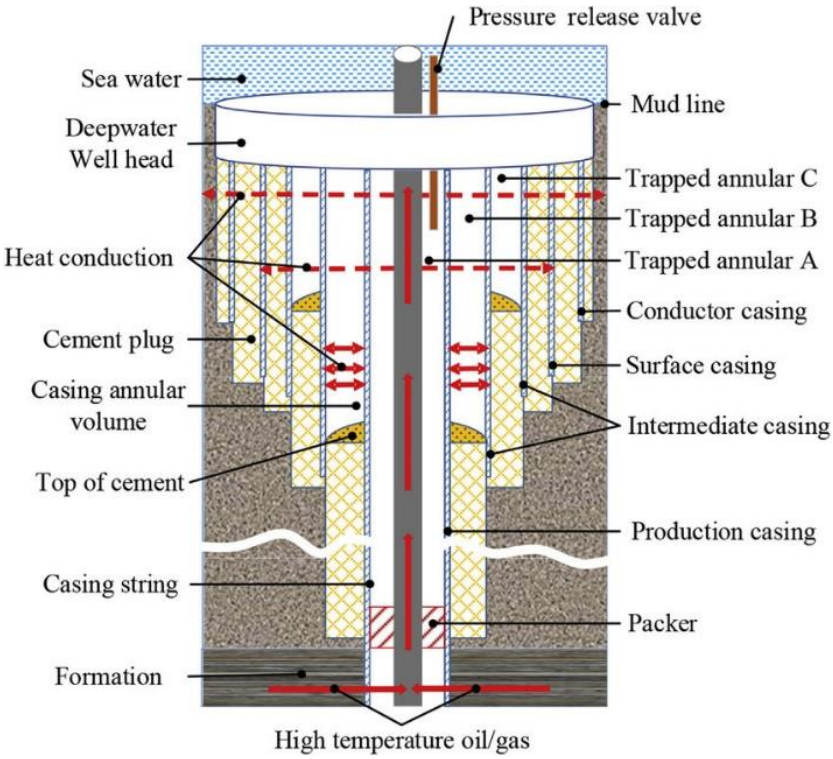

Figure 2-2 – Basic Diagram of a Well (Dong & Chen 2016)

Like buildings and infrastructures, well plugging and abandonment plans will change depending on the well's design and the conditions of the surrounding geological formation. Since there are many unknowns when it comes to the actual well design, well integrity, and geological conditions, this creates many uncertainties for well engineers during both planning and execution of well plugging and abandonment operations. This means that there is a significant opportunity to develop solutions to reduce these uncertainties.

2.1.1.1 – Steel Casings

Casings are steel pipes that act as the main pipelines to transport fluid into and out of the well during drilling and production operations. In some cases, these steel pipes may also be used as barriers to prevent the well's collapse (Bourgoyne Jr et al. 1986). As seen in **Figure 2-1** (above), multiple steel pipes of different sizes and grades are usually placed at various intervals within the well. The outermost casing is termed as the conductor casing, followed by the surface casing and the intermediate casing. The production casing is the innermost casing of the well, usually the casing from which hydrocarbons will be produced.

To maximise the production of hydrocarbons, the depth and trajectory of the well can vary depending on where the hydrocarbons are located in the subsurface environment (Bourgoyne Jr et al. 1986). **Figure 2-3** (below) illustrates the direction and trajectory of different wells.

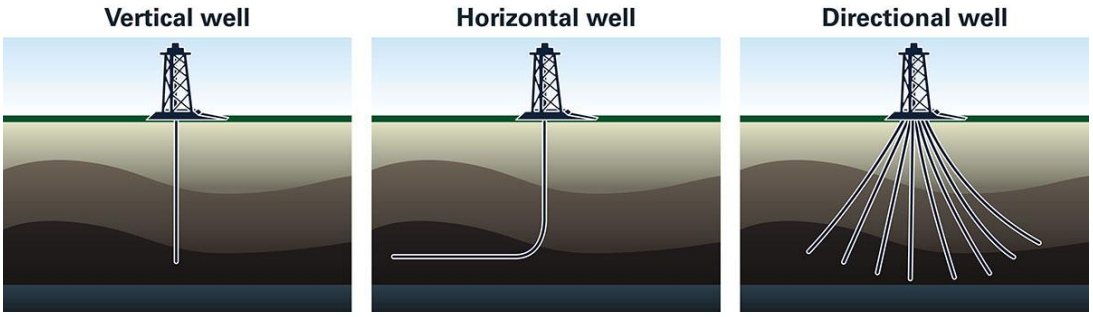

Figure 2-3 – Examples of Different Type of Well Trajectory (Mitchell 2013)

This means that casings are not always installed in a perfectly vertical position. According to King (2014) and Nguyen & Rahman (1996), directional and horizontal wells are better for maximising hydrocarbon production.

During well plugging and abandonment, some of these casings will need to be removed in order to place a more effective permanent barrier in the well (Deshpande et al. 2016; Khalifeh et al. 2013). In certain jurisdictions, such as the United Kingdom, it is a regulatory requirement for oil and gas operators to remove all casings to a minimum of 10 feet below the seabed (IOGP 2017a). However, the removal of casings is stated in the literature to be a major challenge due to casings getting ‘stuck’ during the removal operation because of the well's unique trajectory (Mittal & Gupta 2019; Shine 2019; Xu et al. 2019). The tools and equipment used to cut and remove the casings may also get stuck as they must be able to bend and follow the trajectory of the well to reach the targeted depth, posing additional risks of schedule delays, increased costs, and damage to tools and equipment (Diller 2011; Khalifeh et al. 2013).

A North Sea operator, for example, took 70 days to remove 9,800 feet of steel casings from a single well (Desai, Hekelaar & Abshire 2013). Overall, this suggests that there are likely to be interactions between the project manager and stakeholders regarding schedule-related costs.

Both pressure and temperature are higher in a subsurface environment than in the surface environment. In general, as the depth increases, the reservoir's temperature and pressure increase (Bourgoyne Jr et al. 1986). Consequently, casings are required to be manufactured from steel of very high quality to withstand the high subsurface temperature and pressure downhole (Bellarby 2009). However, as with steel used in the construction industry, casings are also prone to degradation over time. Studies conducted by Zhao & Gao (2009), Sun, Guo & Ghalambor (2004), and Li & Samuel (2016) state that degradation of steel occurs more quickly when subjected to higher reservoir pressure and temperature. This is because the yield strength, tensile strength, and burst strength of the casing decrease as temperature and pressure increase (Sun, Guo & Ghalambor 2004).

According to (Li et al. 2018), the degree of casing degradation can impact the range of well plugging and abandonment options available. For example, Kirby (1999) and Li et al. (2018) indicate that rigless well plugging and abandonment methods are not suitable for wells with poor casing integrity. This is because rigless well plugging and abandonment methods, as the name suggests, do not utilise a drilling rig. Without a drilling rig, the rigless method lacks the safety features to prevent leakage of subsurface fluids into the surface environment if the casing fails during well plugging and abandonment operations. Overall, this suggests that there is also a gap in knowledge in the area of casing materials and well plugging and abandonment technology.

2.1.1.2 – Well Barriers

Cement is usually used as the primary barrier between the well and the subsurface formation, both during well completion and well plugging and abandonment. Cement is more reliable than steel casings in preventing the collapse of the well because of its ability to withstand higher pressure and temperature (Bellarby 2009). During well completion, cements are usually placed at the outermost position of the well as illustrated in **Figure 2-4** (below, page 19).

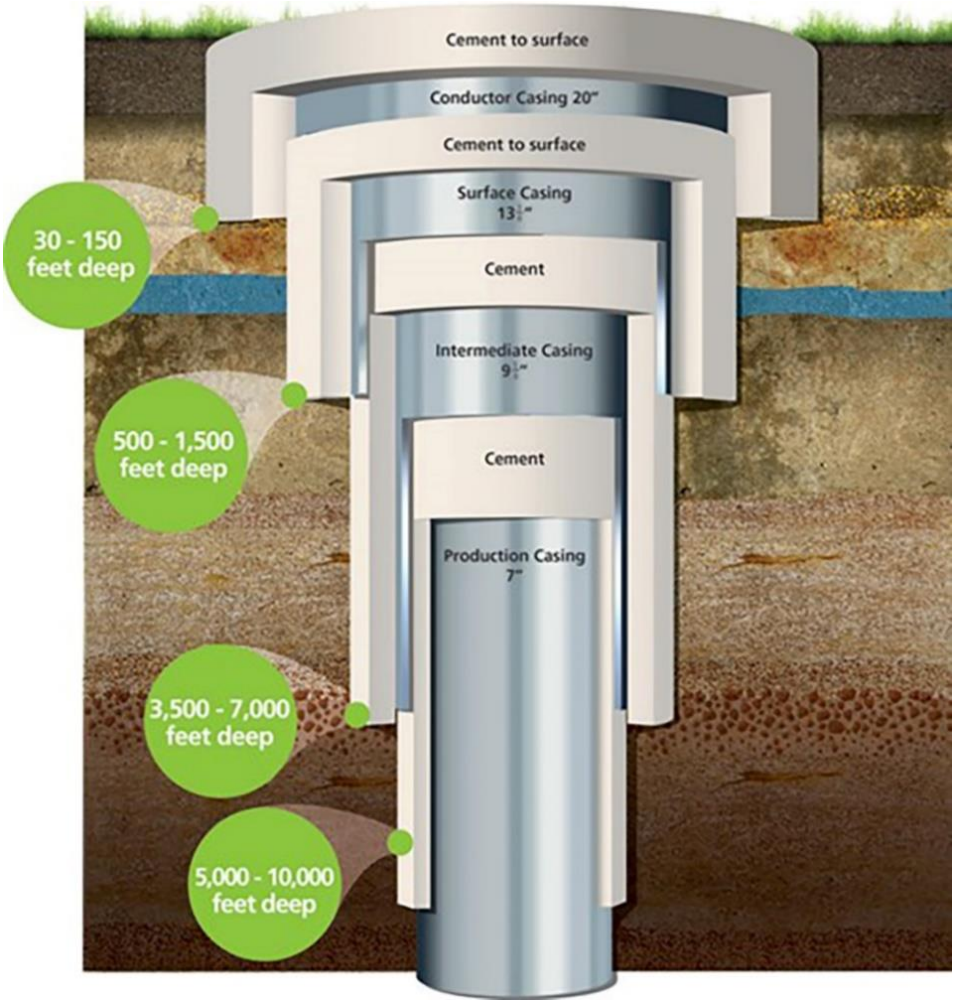

Figure 2-4 – Examples of Cement in a Well (UKOG 2018)

Cement is a synthetic man-made material that can degrade over time (Zhang, Ramakrishnan & Ellias 2019; Fulks, Carragher & Prapoo 2019). As with casings, this can create challenges during well plugging and abandonment because existing cement barriers might fail, resulting in leakage of potentially harmful subsurface fluid into the surface environment (Fields & Martin 1997; Diller 2011; Boothroyd et al. 2016; Boyd Pollett 2017). Failure of old barriers can also result in a sudden spike in pressure, compromising the safety of personnel during well decommissioning (Tularak, Khan & Thungsuntonkhun 2007; Clyne & Jackson 2014; Boyd Pollett 2017; Yap 2018; Zulkipli & Saw 2019; Saikia et al. 2019). Many major oil leaks around the world, such as Macondo (Sammarco et al. 2013) and Montara (Clyne & Jackson 2014), are primarily due to the failure of the cement barriers.

Despite cement being known to degrade over time, cement is currently the most proven material for use during well decommissioning to permanently seal off the wells (Khalifeh et al. 2013; Vrålstad et al. 2019). While the literature does indicate that there are plenty of more cost-effective materials such as bismuth, resin, bentonite, and thermite, current evidence is still unable to convince operators and regulators that these novel materials are capable of fully replacing cement the decommissioning of wells (Khalifeh et al. 2013; Zhang, Ramakrishnan & Ellias 2019; Fulks, Carragher & Prapoo 2019). This indicates that there is still a knowledge gap regarding barrier materials and verification of their integrity.

2.1.2 – Topsides

The topside of an oil and gas facility refers to the deck of the platform. All the equipment involved in the drilling, production, and processing of hydrocarbons are located on the topside itself (Graff 1981).

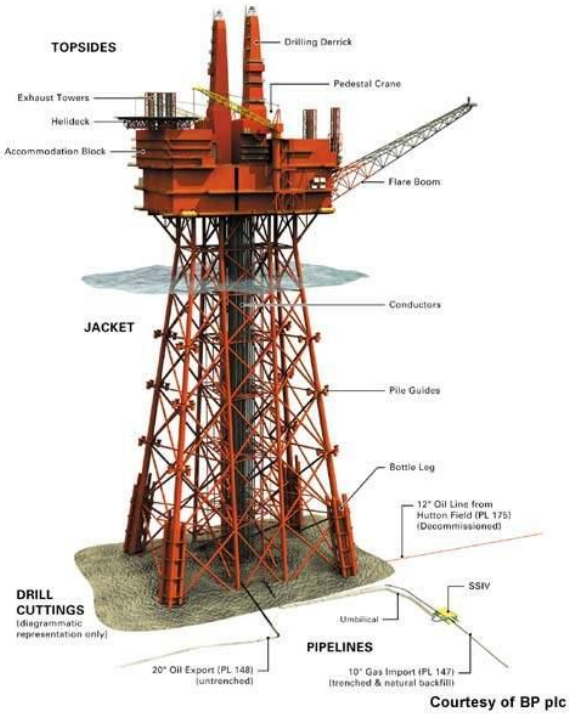

Figure 2-5 – Illustration of an Offshore Oil and Gas Platform (BP 2011)

As illustrated in **Figure 2-5** (above), the topside is located above the waterline and attached on top of the jacket or substructure. Topsides design can be divided into two different types: modularised topsides and integrated topsides (Kram, Kirkevik & Bosko 1990; Bøtker, Mo & Hannus 2005; Liu & Li 2017).

2.1.2.1 – Modularised Topsides

As the name suggests, modularised topsides means that components of the topsides are constructed in multiple different modules. **Figure 2-6** (below) shows an example of a modularised topside.

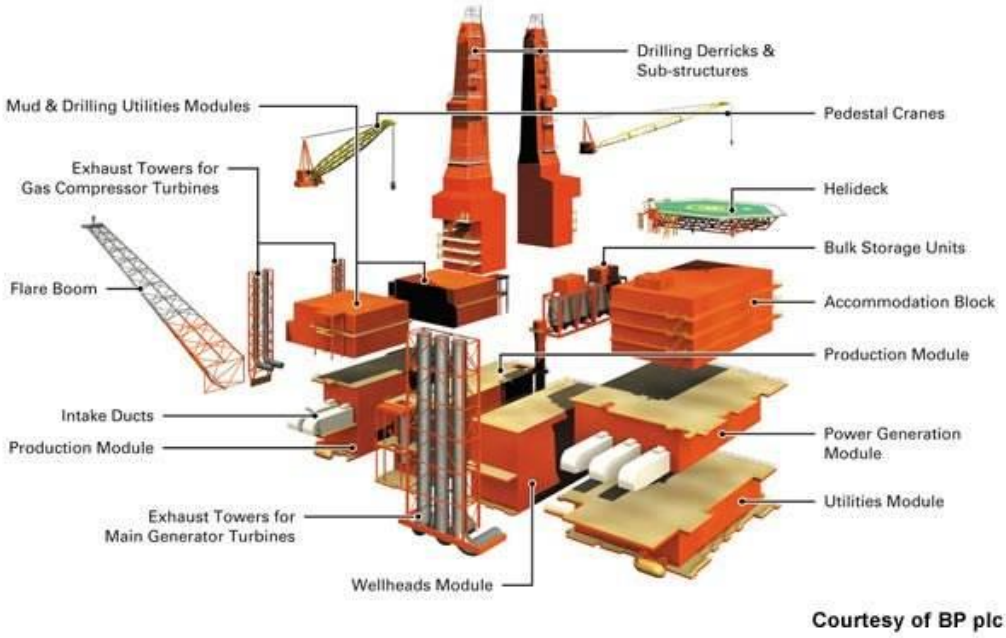

Figure 2-6 – Topside of the North-West Hutton Facility, an example of a Modularised Topside (BP 2011)

The main rationale for the modularised design is the lower manufacturing cost and the ease of construction, transportation, and decommissioning. There are more decommissioning options for modularised topsides than for integrated topsides (Liu & Li 2017). Modularised topsides can be more easily broken down into smaller pieces and hence can be decommissioned using piece-small or reverse installation methods. The piece-small method involves separating the topside into various smaller pieces for removal. In contrast, as the name suggests, the reverse installation method involves the dismantling of the topside in the reverse order to which it was installed. This means that smaller cranes, vessels, and barges, which are generally cheaper to hire than larger ones, may be enough to decommission modularised platforms.

However, multiple trips may be required if the modularised topsides are too large to be transported in one trip (Yimtae et al. 2018; Ahiaga-Dagbui et al. 2017; Cheng et al. 2017). Multiple trips extend the duration of the

decommissioning project, which may impact the overall cost, especially if the vessels are hired on a day-rate basis. This suggests that the type of lifting vessel used can also impact the overall duration and cost of the decommissioning project, indicating that there are initial uncertainties in the development of lifting solutions.

Figure 2-7 – The Decommissioning of the North-West Hutton Topside by Reverse Installation (Blacklaws, Johnston & Leask 2014)

2.1.2.2 – Integrated Topsides

Integrated topsides are designed to be lighter and cheaper to construct. This is achieved by removing the need for a modular support frame and reducing the duration of offshore installation activities. Integrated topsides are constructed as one single unit onshore rather than welded together in an offshore environment with limited space. This means that integrated topsides also tend to have improved integrity because the connections between the topside components are stronger than modularised topsides. It also means that integrated topsides are much safer for offshore workers during the operation and production period.

However, because integrated topsides are fabricated as a single piece, the options for removing them are limited. Breaking down an integrated topside is technically challenging and less safe because of the need to use more destructive tools and methods to overcome the stronger connections. This

means that integrated topsides are best removed as a single piece, an operation usually termed in the industry as the single-lift method. However, the issue with the single-lift method is that for heavier integrated topsides, there are currently a limited number of vessels in the world that can perform the work (Samudero, Capurso & Zoontjes 2019). This suggests that there is a need to consider the availability of vessels when planning decommissioning activities. The lack of supply of suitable vessels also suggests that contractors are impactful stakeholders when it comes to cost and schedule. It also indicates that there are plenty of opportunities for innovation in cutting tools and lifting technology.

Samudero, Capurso and Zoontjes (2019) also state that larger cranes and vessels such as Allseas's *Pioneering Spirit* and Heerema's *Sleipnir*, also cost more to hire than smaller cranes and vessels. In addition, lifting a heavier load also comes with its own set of safety and technical risks (Bernstein 2015; Kaiser, Pulsipher & Byrd 2003; Meenan 1998; Samudero, Capurso & Zoontjes 2019). Factors such as the amplitude and frequency of the ocean waves (Zhao 2019) and wind speed (Spence et al. 2019) are critical to the single-lift method's success. **Figure 2-8** (below) shows an example of a topside being decommissioned using a single-lift method:

Figure 2-8 – The Decommissioning of the Brent Delta Topside by Single Lift (Shell 2017c)

2.1.2.3 – Non-Conventional Topsides

In addition to conventional topsides, an increasing number of unconventional topsides are being installed. One of the most common non-conventional topsides, arising from the pursuit of renewable energy, is wind turbine (Topham & McMillan 2017). The Beatrice Oil Field in the Moray Firth contained[1] two demonstrator wind turbines which were installed to supply renewable energy to the other facilities (Repsol 2018).

Figure 2-9 – The Beatrice Oil Field, North Sea (McCulloch 2017)

Decommissioning wind turbines presents its own set of challenges considering the span of their propellers (Kaiser & Snyder 2012; Topham & McMillan 2017; Legorburu, Johnson & Kerr 2018). Engineering literature explicitly states that certain non-governmental organisations such as the Royal Society for the Protection of Birds (RSPB) are highly interested in the impact of decommissioning wind turbines on birds (Langston 2010). According to Langston (2010), wind turbines are large structures that can harm birds in three possible ways – disturbance, habitat loss, and collision. This suggests that the challenges involved in decommissioning offshore infrastructures are not only limited to the oil and gas industry but affect the renewables industry as well.

[1] The two demonstrator wind turbines were undergoing decommissioning when this thesis was submitted. The Beatrice Decommissioning Programme was approved by BEIS in January 2019.

2.1.3 – Substructure

The substructure of an oil and gas facility refers to the base of the platform. Kemp & Stephen (1998) state that there are two main types of substructure: jacket-based and concrete gravity-based. Jacket-based substructures are constructed from steel beams forming trusses that make up the jacket, while concrete gravity-based substructures are constructed from large concrete columns.

The engineering literature indicates that removing substructure is one of the most challenging decommissioning operations because current decommissioning technology has a limited operating depth (Meenan 1998; Tularak, Khan & Thungsuntonkhun 2007; Shell 2017a). This is because the deeper the water, the higher the pressure, which can impact the effectiveness of equipment and tools (Spence et al. 2019). Additionally, substructures are also secured tightly to the seabed during installation to prevent the structure from moving (Graff 1981). Steel-jacket structures are secured in place by installing construction piles, while concrete gravity-based substructures are secured by creating a vacuum between the concrete legs and the seabed (Graff 1981; Meenan 1998). This means that the precise decommissioning method for substructures is dependent on the height of the substructure.

Besides engineering issues, engineering literature also explicitly states that stakeholders have interests in the decommissioning decisions of substructures, largely due to environmental factors (e.g. marine biodiversity and pollution), and safety reasons (e.g. navigation hazards to other users of the sea) (Brown 1982; Meenan 1998; Forte 1998; Tularak, Khan & Thungsuntonkhun 2007; Chandler et al. 2017; IOGP 2018; Bills 2018). Bills (2018) even indicates that enhancing marine biodiversity has a further downstream effect, such as benefits to the tourism and fishing industries. This indicates that further review in the area of marine science, environmental science, and tourism are needed in order to develop a better understanding of decommissioning from the perspective of stakeholders. All these additional bodies of literature will be explored in more detail later on in this chapter.

2.1.3.1 – Steel-Jacket Substructures

Steel-jacket substructures are steel structures fixed on the seabed, as illustrated in **Figure 2-5** (above, page 20). Even today, jacket-based platforms are still a favourable offshore structure because, compared to concrete-based substructures, they are much cheaper and easier to manufacture and install (Nouban, French & Sadeghi 2016; Graff 1981). This also means that steel jacket substructures are much easier to remove than concrete-based substructures. Although steel-jacket substructures are the easier type of substructure to decommission, the precise decommissioning method is determined by the steel jacket substructure's height (OGUK 2012; Spence et al. According to (Dauterive 2000), there are three methods to decommission a steel-jacket substructure, as illustrated in **Figure 2-10** (below): Left-In-Place, Partial Removal, and Complete Removal:

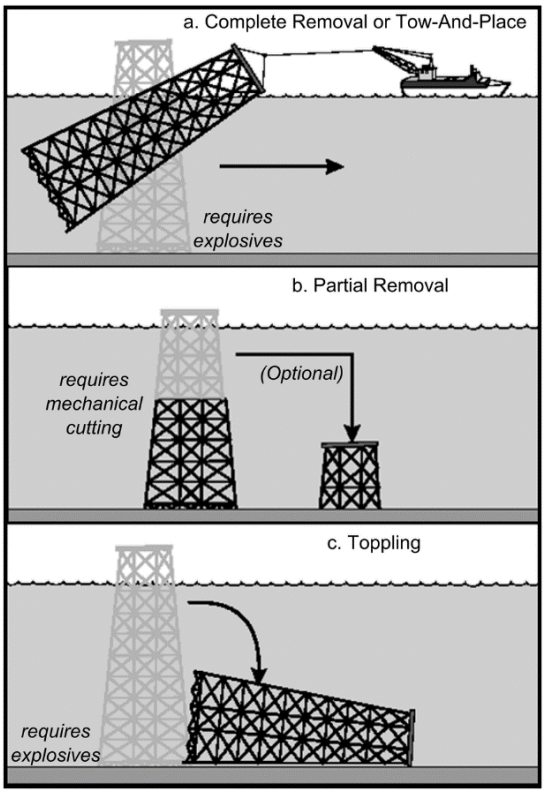

Figure 2-10 – Decommissioning Options for Steel-Jacket Substructures (Dauterive 2000)

Removing a steel-jacket substructure involves getting the tools underwater and cutting the steel, and then moving them with a crane vessel (OGUK 2012; Kim et al. 2017). As mentioned earlier, current tools and equipment can only reach a certain depth. This means it may not be technically feasible to

completely remove larger steel jackets. Many large steel-jackets in the North Sea, such as North-West Hutton, Miller, Murchison, and Ninian Northern were only partially removed (Blacklaws 2018; OGUK 2012). The current issue is that, over time, as oil and gas exploration technology has become more and more advanced, the size of steel-jacket substructures has increased to enable hydrocarbon production from deeper waters (Golafshani et al. 2011). This means that there is a knowledge gap in the development of decommissioning tools that can operate at greater depths.

2.1.3.2 – Concrete Gravity-Based Substructures

Concrete gravity-based substructures are created from large reinforced concrete columns. Such columns can weigh up to 1.2 million tonnes in air, about 100 times heavier than steel-jacket substructures, which weigh approximately 10,000 to 20,000 tonnes in air depending on its size. This means that leaving in place is a more feasible option in terms of technical issues, cost, and safety (Ekins, Vanner & Firebrace 2006). **Figure 2-11** (below) shows the different types of concrete gravity-based substructures around the world:

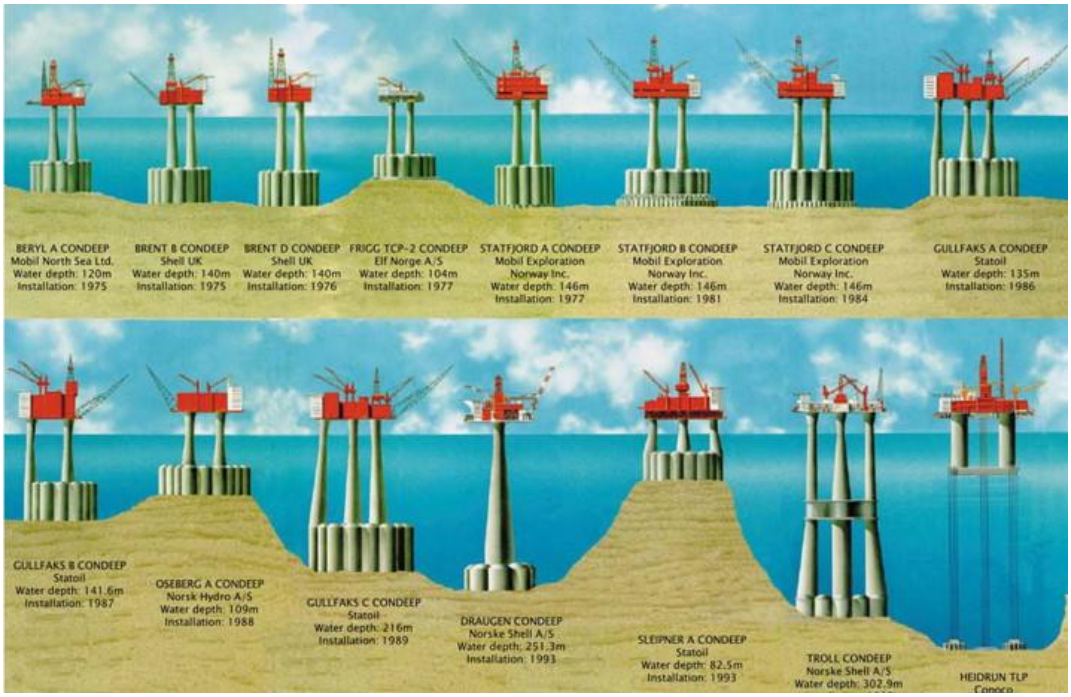

Figure 2-11 – Examples of Concrete Gravity-Based Substructures (Pérez Fernández & Lamas Pardo 2013)

The concept of concrete gravity-based structures was developed in the aftermath of the Piper Alpha incident, where the primary rationale for the design was to create a more stable substructure than steel jacket substructures to ensure the safety of offshore employees (Davenport III, Runge & Murff 2002). A stable foundation makes the structure less susceptible to structural damage in harsh weather conditions such as hurricanes (Yang & Kim 2011; Puskar et al. 2006; Kaiser & Chambers 2017). **Figure 2-12** (below) shows a steel-jacket platform damaged by a hurricane.

Figure 2-12 – Examples of a Steel Jacket Platform Damaged by Harsh Offshore Conditions (Kaiser & Chambers 2017)

Regarding modes of installation, most concrete gravity-based structures are installed on the seabed by vacuum suction (Pérez Fernández & Lamas Pardo 2013). This poses a lot of challenges for decommissioning as considerable force is required to remove concrete gravity-structures. The vacuum installation method also means that concrete gravity-based structures are highly pressurised, which means removing them can pose a high safety risk (IOGP 2018). Pre-decommissioning inspection of the Brent Bravo concrete gravity-based has cost the lives of two men (The Guardian, 2006). This suggests that decommissioning decisions for concrete gravity-based platforms will need to take into account the safety of the offshore personnel involved in decommissioning, as well as the environmental benefits of removing the platforms.

As seen in **Figure 2-11** (above, page 27), most concrete gravity-based structures have storage cells as part of the overall design. Storage cells can be easily identified by the cylindrical structure located at the very bottom of the concrete gravity-based structures, as illustrated in **Figure 2-11** (above, page 27) and **Figure 2-13** (below). Storage cells were designed for the purpose of storing hydrocarbons before transporting them by oil tankers to the processing facilities.

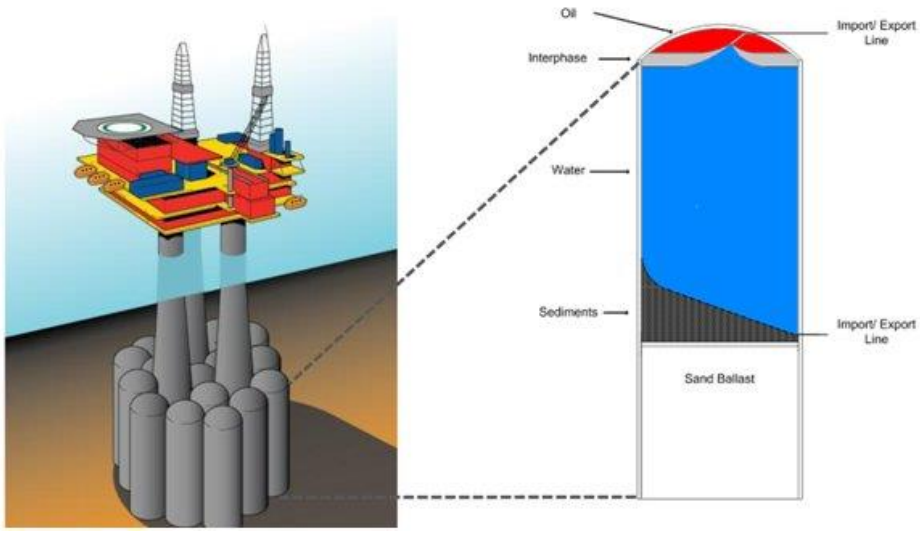

Figure 2-13 – Storage Cells of a Concrete Gravity-Based Substructure (Geoprober 2006)

As these storage cells are underwater, the main concern when decommissioning these storage cells is the potential release of hydrocarbons into the marine environment (Boyd 1983; IOGP 2018; Shepherd et al. 2017). Shell UK even set up a CMSTG (Cell Management Stakeholder Task Group) specifically to look at storage cells and the cell contents (Shell 2017b), which suggests that stakeholders could have higher interest in decommissioning storage cells compared with other parts of the facility.

Accessing and cleaning these storage cells is also difficult as it involves using tools to penetrate thick concrete walls (Pérez Fernández & Lamas Pardo 2013; IOGP 2018). (Shepherd et al. 2017) indicated that Shell UK even consulted NASA (the National Aeronautics and Space Administration) regarding accessing and cleaning the Brent platforms' storage cells, indicating that an extremely high level of technical and engineering expertise is required for decommissioning storage cells. Despite all the studies, (Shell 2017a)

concluded that leaving the storage cells in place (completely filled with hydrocarbons) is the best decommissioning option. This suggests that there is still a large knowledge gap when it comes to accessing and cleaning storage cells.

2.1.4 – Subsea Facilities

Subsea facilities are installed as extensions to the main platforms. When linked to a fixed platform, these subsea facilities are commonly known as subsea tiebacks. Subsea facilities can also be linked to mobile platforms such as semi-submersibles and FPSOs (floating production, storage, and offloading units). Subsea facilities are usually installed in deeper waters where fixed platforms cannot reach (Bai & Bai 2018). **Figure 2-14** (below) shows an example of a subsea facility:

Figure 2-14 – Example of a Subsea Facility (Aker Solutions 2017)

Subsea infrastructures can be small, such as a subsea Christmas tree, which is approximately the size of a small car. In the context of oil and gas, a Christmas tree is an assembly that is installed over a well, and it is used to controls the production rate of the well. Other types of subsea structures can be as large as an 18-wheeler truck, such as a subsea towhead. (Bean 2019) and (Zhao 2019) indicate that removing subsea towheads is the most challenging part of the Leadon decommissioning programme. This suggests that removing subsea infrastructures could be as technically challenging as removing topsides and substructures.

Most subsea facilities are installed in deep waters, and this poses a challenge during decommissioning as only particular cranes can reach the required depths to remove them (Anderson 2002; IOGP 2014; Philip et al. 2014; Ho 2018; Yap 2018; Zhao 2019). Furthermore, there have not been many decommissioning activities involving subsea facilities because subsea technology is still relatively new (Zhao 2019; Bai & Bai 2018). This suggests that there are a lot of opportunities for improving decommissioning solutions for subsea infrastructures.

2.1.5 – Pipelines

Offshore pipelines connect different offshore structures, and they also serve as means of transport to take hydrocarbons from the offshore environment to onshore processing facilities. There are various types of pipelines, including conventional pipelines, flexible pipelines, and pipeline bundles (OPRED 2019). Each of these types of pipeline weighs differently, and they also come in a variety of diameters to optimise the production flow of hydrocarbons. Pipelines also extend over long distances. The Brent Pipeline System is approximately 147 kilometres in length, while the Forties Pipeline System is 169 kilometres long.

This means that pipelines must be cut during decommissioning in order to remove them. While smaller pipelines can be easily cut, larger pipelines such as pipeline bundles are complicated to cut (IOGP 2014). With current technology, cutting pipeline bundles is still challenging and time-consuming (IOGP 2014). Furthermore, engineering literature also noted that cutting pipelines may also result in underwater vibration and noise, which may impact marine life (Baxter et al. 1982; Yelverton et al. 1973; Richmond et al, 1973; Klima et al, 1998). This suggests that marine science stakeholders may have an interest in pipeline decommissioning.

Much engineering literature in the context of Australian and Gulf of Mexico, such as Barrymore (2017), Cullinane & Gourvenec (2017), and Bills (2018), notes that there are a lot of marine growths around the pipelines, such as the one illustrated in **Figure 2-15** (below, page 32), courtesy of S2V Consulting, an Australian engineering consultancy company. This suggests that engineers

in the Australian oil and gas industry are aware of potential disruption to marine ecosystems around pipelines if they were to remove them.

Figure 2-15 – Example of a Pipeline with an Established Ecosystem (S2V Consulting, 2017)

However, other engineering literature, especially that of the North Sea environment (Goldie 1970; Rouse, Kafas, Catarino, et al. 2017; Murray 2019), indicated that there were more concerns regarding preventing commercial fishing equipment from snagging the pipelines (Rouse, Kafas, Catarino, et al. 2017; Bills 2018; Genter 2019; Thornton and Wiseman 2000). This suggests that stakeholder influence and impact could be partly dependent on location.

2.1.6 – Summary of Engineering Literature

From the literature review of offshore oil and gas structures, it is apparent that many facilities were designed and installed in the past without considering their decommissioning. Engineering literatures also explicitly indicate that there are many unknowns, which caused decommissioning to be highly technically challenging. This suggests that almost every engineering aspect of decommissioning is a potential avenue for future research. Regarding the procedure, there are also many different methods that can be used to decommission the same facility. A substructure, for example, as mentioned earlier, can be entirely removed, partially removed, or left in place. This means

that the critical path for decommissioning may vary depending on the precise method of decommissioning.

Stakeholders were also mentioned in some of the engineering literature, which suggests that engineers and project managers are aware of the influence and impact stakeholders can have on decommissioning activities. Further details regarding stakeholder management literature will be covered in ***Chapter 3: Managing Oil and Gas Decommissioning***.

Public stakeholders such as environmental non-governmental organisations (eNGOs) and commercial fishing stakeholders were only mentioned explicitly on certain infrastructure types, such as platforms, jackets, and pipelines. It is also interesting to note that there was no mention of any public stakeholders' concerns for well plugging and abandonment, in contrast to other offshore structures. This suggests that public stakeholders are perhaps only interested in certain aspects of the offshore facility. A list of stakeholders identified from engineering literature can be seen in **Table 2-1** (below).

Table 2-1 – List of Stakeholders Identified from Engineering Literature

Stakeholder	Engineering Literature Mentioned
Internal Stakeholders (Top Management Teams, Employees, etc.)	Prasthofer et al. 1987; Shaw 1994; Prasthofer 1997; Griffin 1998; Poremski 1998; Kirby 1999; Ferreira & Suslick 2000; Thornton & Wiseman 2000; Ruivo & Morooka 2001; Cavallo, Michelini & Molfino 2004; O'Connor et al. 2004; Kaiser 2006; Tularak, Khan & Thungsuntonkhun 2007; Wiegand 2011; Jais, Rashidi & Anis 2016; Ahiaga-Dagbui et al. 2017; Esson 2017; Goodwin, Muir & Piasentin 2017; Huijskes et al. 2017; Kaiser & Liu 2018)
Government (Legislative and Regulatory)	Prasthofer et al. 1987; Calvert & Smith 1994; Hustoft & Gamblin 1995; Mankabady 1997; Griffin 1998; Kirby 1999; Anthony, Ronalds & Fakas 2000; Ferreira & Suslick 2000; Shaw 2000; Abraham 2001; Ruivo & Morooka 2001; Anderson 2002; Hao & Yang 2004; Mount & Voskanian 2005; Kaiser 2006; Tularak, Khan & Thungsuntonkhun 2007; Smith 2010; Wiegand 2011; Moo 2014; Truchon et al. 2015; Aguilar et al. 2016; Jais, Rashidi & Anis 2016; Kanmkamnerd, Phanichtraiphop & Pornsakulsakdi 2016; McCann, Henrion

	and Bernstein 2016; Wilkinson et al. 2016; Ahiaga-Dagbui et al. 2017; Ars and Rios 2017; Barrymore 2017; Amelia et al. 2018; Bills 2018; Chandler et al. 2017; Fam et al. 2018; Laister & Jagerroos 2018; Palandro & Aziz 2018; Saraceni & Liddle 2018; Akbar Ali, Abdul Karim & Rusli 2019; Barrymore & Ballard 2019; Jagerroos & Kayleigh 2019; Rusman et al. 2019)
Environmental Conservative Stakeholders (eNGOs, etc.)	Hustoft & Gamblin 1995; Fields & Martin 1997; Side, Kerr & Gamblin 1997; Griffin 1998; Poremski 1998; Simpson 1998; Kerr, Side & Gamblin 1999; Kirby 1999; Anthony, Ronalds & Fakas 2000; Linzi, Harley & Picken 2000; Hao & Yang 2004; Mount & Voskanian 2005; Kaiser 2006; Tularak, Khan & Thungsuntonkhun 2007; Smith 2010; Truchon et al. 2015; Kanmkamnerd, Phanichtraiphop & Pornsakulsakdi 2016; McCann, Henrion & Bernstein 2016; Kim et al. 2017; Bills 2018; Palandro & Aziz 2018)
Marine Science Stakeholders (eNGOs, etc.)	Hakam & Thornton 2000; Abraham 2001; Ruivo & Morooka 2001; Mount & Voskanian 2005; Tularak, Khan & Thungsuntonkhun 2007; Wiegand 2011; Truchon et al. 2015; Kanmkamnerd, Phanichtraiphop & Pornsakulsakdi 2016; McCann, Henrion & Bernstein 2016; Barrymore 2017; Bills 2018; Palandro & Aziz 2018; Hughes & Jagerroos 2019)
Fishing Stakeholders (Commercial and Recreational)	Hustoft & Gamblin 1995; Hakam & Thornton 2000; Linzi, Harley & Picken 2000; Ruivo & Morooka 2001; Mount & Voskanian 2005; Tularak, Khan & Thungsuntonkhun 2007; Wiegand 2011; Truchon et al. 2015; Barrymore 2017; Bills 2018; Palandro & Aziz 2018; Zawawi, Liew, Shawn, et al. 2019)
Tourism Stakeholders	Barrymore 2017; Na et al. 2017; Bills 2018; Palandro & Aziz 2018; Zawawi, Liew, Shawn, et al. 2019)
Logistics and Transport Stakeholders	Hustoft & Gamblin 1995; Mankabady 1997; Tularak, Khan and Thungsuntonkhun 2007; Jais, Rashidi & Anis 2016; Amelia et al. 2018; Palandro & Aziz 2018)
Supply Chain Stakeholders	Boyd 1983; Shaw 1994; Prasthofer 1997; Griffin 1998; Kirby 1999; Thornton & Wiseman 2000; Cavallo, Michelini &

	Molfino 2004; O'Connor et al. 2004; Kaiser 2006; Parshall 2011; Siems 2016; Ars & Rios 2017; Cullinane & Gourvenec 2017; Goodwin, Muir & Piasentin 2017; Huijskes et al. 2017; Oudenot, Whittaker & Vasquez 2017; Bills 2018; Blacklaws 2018; Jean Christophe, Jimmy & Mohamed Izzat Mohamed 2018; Whittaker, Oudenot & Vasquez 2019)

From **Table 2-1** (above, page 33), it can be seen that decommissioning operations involve a large number of stakeholders. There are various stakeholder mapping techniques to prioritise, visualise, and analyse stakeholders, such as using power versus interest matrix (Ackermann & Eden 2011), a stakeholder-issue interrelationship diagram (Bryson 2004), or an ethical analysis grid (Lewis, 1991). Project stakeholder management literature will be discussed in more detail in ***Chapter 3: Managing Oil and Gas Decommissioning***. However, most literature regarding stakeholder management techniques lies in the field of construction. There is no literature that explicitly explores the prioritisation of stakeholders in the field of oil and gas decommissioning. This indicates that there is a need for some means of prioritising stakeholders for oil and gas decommissioning.

According to the data shown in **Table 2-1** (above, page 33), a review of engineering literature yielded the discovery that stakeholders groups could be prioritised by project managers in the following order, from most important to least important, according to the frequency of them being mentioned in engineering literature:

1. Governmental Stakeholders
2. Environmental Conservative Stakeholders
3. Internal Stakeholders
4. Supply Chain Stakeholders
5. Marine Science Stakeholders
6. Fishing Stakeholders
7. Logistics and Transport Stakeholders
8. Tourism Stakeholders

This suggests that governmental stakeholders could be the most impactful stakeholder in a decommissioning project, while tourism and logistics stakeholders are the least impactful ones. However, as mentioned earlier in this chapter, stakeholders' interests also depending on location. This means that a stakeholder's interest for a decommissioning project is neither fixed nor predetermined. Furthermore, the frequency of appearance in literature alone may not be an accurate reflection of actual decommissioning practices. Hence, it would be beneficial to explore the stakeholder landscape across different decommissioning regions in order to bridge this gap in knowledge.

Another unique finding that emerged from reviewing engineering literature is that much of the literature also refers to bodies of literature outside the field of engineering, including literature from environmental science, project management, and law. There is also a growing body of interdisciplinary research in the field of engineering. The Chandler et al. (2017) paper, published in an engineering journal, for example, discusses both the engineering and legal aspects of decommissioning. This suggests that decommissioning is interdisciplinary, and that there is an increasing awareness of the need for interdisciplinary research in the field.

2.2 – Environmental Science Literature

The main reason for exploring environmental science literature is that this body of knowledge is one of the most referenced in the field of oil and gas decommissioning other than engineering. The Greenpeace protest regarding the Brent Field was also due to environmental concerns. Additionally, stakeholder interest and concerns in oil and gas decommissioning in the Australian landscape were also explored first through the lens of environmental science literature (Advisian 2017; Shaw, Seares & Newman 2018). Environmental science literature can be divided into three main categories:

- Environmental Impact of Rigs-to-Reefs
- Social Impact of Rigs-to-Reefs
- Environmental Impact of Decommissioning Activities

2.2.1 – Environmental Impact of Rigs-to-Reefs

The idea of transforming decommissioned oil and gas infrastructures into artificial reefs, or Rigs-to-Reefs, as it is now more commonly known in the industry, can be traced back to early environmental science literature in the 1970s and 1980s. These early studies focus on assessing the benefits of small man-made structures on marine biodiversity and fish population (Luckhurst & Luckhurst 1978; Jessee, Carpenter & Carter 1985; Aprieto 1988; Polovina & Sakai 1989; Campos & Gamboa 1989; Bohnsack 1989). All these studies concluded that artificial reefs could improve marine biodiversity and increase fish population. These studies were also conducted in a variety of different locations, including the United States (Jessee, Carpenter & Carter 1985), Costa Rica (Campos & Gamboa 1989), the Netherlands (Luckhurst & Luckhurst 1978), Japan (Polovina & Sakai 1989), South Korea (Bohnsack 1989), and the Philippines (Aprieto 1988). These early groups of studies suggest that the concept of artificial reefs is applicable regardless of location.

The literature was then, in the early 1990s, expanded to cover oil and gas structures, where the findings of Szedlmayer & Shipp (1994) and Scarborough Bull & Kendall Jr (1994) suggested that the presence of offshore oil and gas platforms increased the red snapper population off the Californian coast and the Gulf of Mexico. Since then, as shown in **Figure 2-16** (below, page 38),

there has been an increasing number of studies commissioned to understand the impacts of oil and gas structures as artificial reefs. All of the studies recognise that Rigs-to-Reefs can be beneficial to the environment. The increase in studies commissioned also seems to align with the introduction of the United Kingdom's INSITE Programme in 2012 and Australia's NDRI (National Decommissioning Research Initiative) in 2019. Both of these programmes focus on studying the impact of oil and gas structures on the marine environment. An interesting finding is that both of these research programmes are sponsored by the oil and gas industry, suggesting that there is perhaps a preference by operators for Rigs-to-Reefs operations rather than removing the offshore facilities to shore.

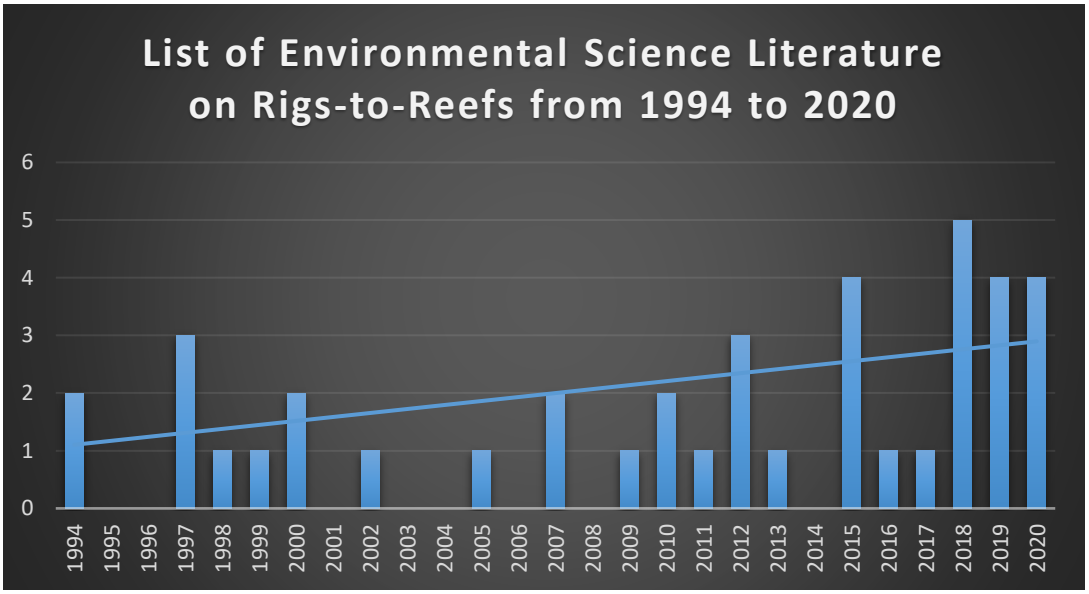

Figure 2-16 – List of Environmental Science Literature on Rigs-to-Reefs from 1994-2020[2]

An overview of the literature also showed more studies conducted into the impact of structures on marine animals than on marine plants, which suggests there is a prioritisation of the former over the latter. This also suggests that there are many opportunities for studying the impact of artificial reefs on corals and other marine plants.

[2] Data for 2020 only considered the literature up until 24 March 2020

In general, environmental science literature indicates that Rigs-to-Reefs is beneficial to the environment. Environmental science literature indicates that Rigs-to-Reefs can increase biodiversity, improve recruitment of fish and larvae, improve the connectivity of habitats, reduce pressure on natural reefs, prevent trawling, and create opportunities for dive tourism (Advisian 2017). **Figure 2-17** (below) illustrates the benefits of Rigs-to-Reefs.

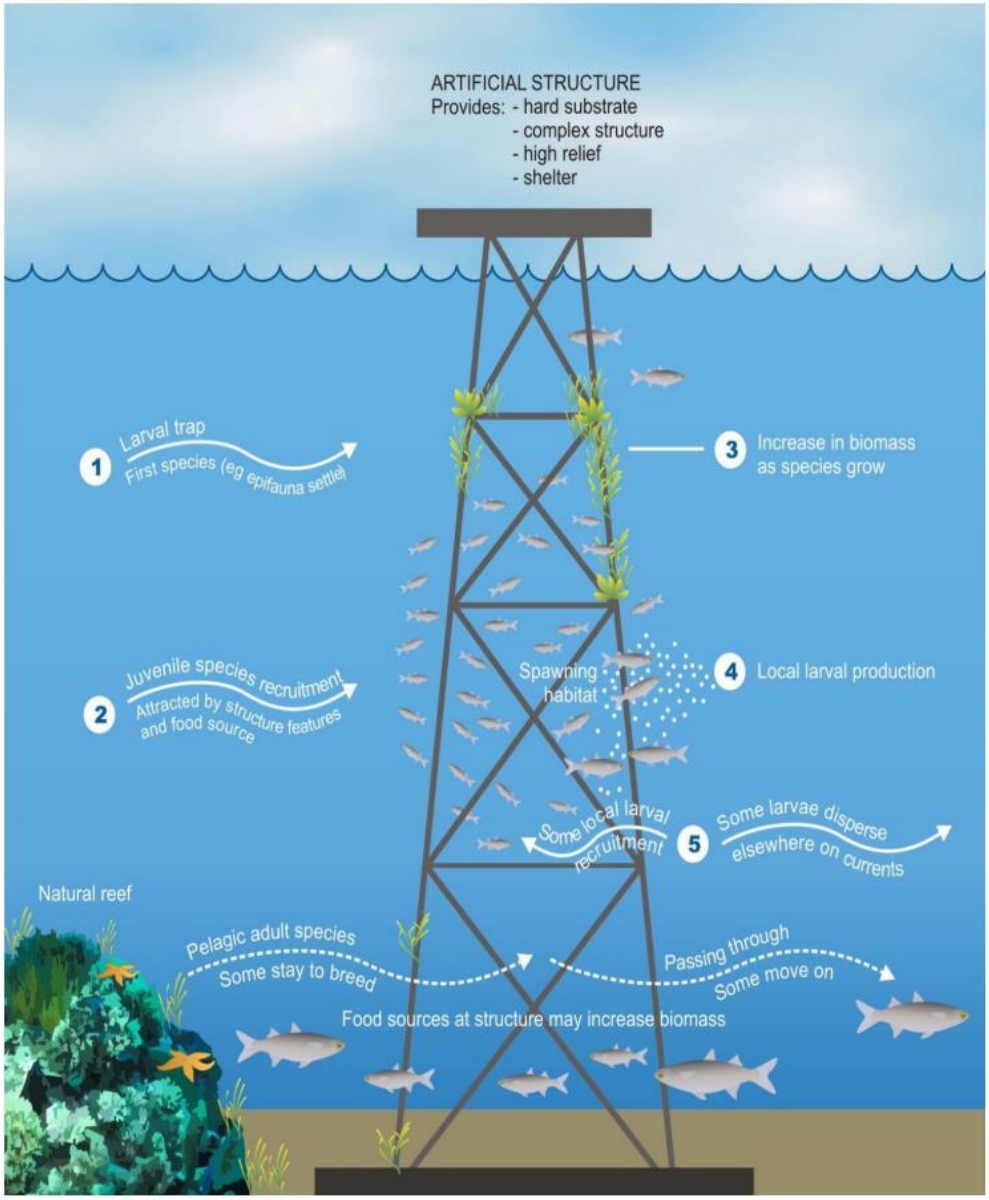

Figure 2-17 – Benefits of Rigs-to-Reefs (Advisian 2017)

Sammarco, Atchison and Boland (2004) demonstrate in their study that, on average, locations with oil and gas infrastructures have 11 more species than locations without oil and gas infrastructures. Fowler and Booth's (2012) study of an offshore oil and gas structure in the North-West Shelf of Australia was

shown to recruit and sustain a population of *red-belted anthias*. Santos and Monteiro's (1998) investigation demonstrates that artificial reefs could increase the fish population by a factor of 2.28. This suggests that in theory at least, Rigs-to-Reefs seems to be a better option than removing the offshore oil and gas structures to shore.

Figure 2-18 – Recruitment of Fish by Offshore Oil and Gas Infrastructures (US Bureau of Ocean Energy Management, 2016)

However, the literature also explicitly notes that the benefits of Rigs-to-Reefs is dependent on certain conditions. Watterson et al.'s (1998) study hypothesises that the close proximity of offshore platforms to the predator of red snappers drastically reduces the benefits of the platforms as an artificial reef. Ajemian et al.'s (2015) analysis of 12 offshore oil and gas platforms across the Gulf of Mexico concluded that not all of them had the same level of increase in red snapper population. This suggests that the benefit of Rigs-to-Reefs depends on location. This indicates that, for some cases, relocating the offshore infrastructures is necessary in order to maximise the environmental benefits of Rigs-to-Reefs.

Another study, by Atchison, Sammarco and Brazeau (2008), shows that there is a minimum distance of 65 kilometres between the oil and gas structure and the natural habitat of the targeted marine species for recruitment to occur. Jakšić, Stamenković and Đorđević (2013) also note that the introduction of an artificial reef can have an impact on nearby natural reefs through recruitment and migration of species. As the introduction of a reef can impact the

neighbouring marine environment, this also suggests that Rigs-to-Reefs projects must consider the holistic impact of the project on the region, not just on a specific location.

The two main types of offshore structure that are covered more extensively by environmental science literature are steel-jacket platforms and offshore pipelines (Love & York 2005; Rouse, Kafas, Catarino, et al. 2017; Rouse, Kafas, Hayes, et al. 2017; Molen et al. 2018; Bond et al. 2018; McLean et al. 2020). Love et al. (2007) note that structures with cross beams, which are characteristics of steel jackets, are more likely to increase fish population and diversity. The structure in **Figure 2-18** (above, page 40) illustrates an offshore structure with cross beams. McLean et al. (2018) and Bond et al. (2018) indicate that the hard surface of the Echo Yodel pipelines is one reason marine species seem to congregate at the structure. This suggests that the benefits of Rigs-to-Reefs also depend on the type and design of the offshore oil and gas structure.

Overall, a review of the literature pertaining to the environmental impact of Rigs-to-Reefs indicated that while there are potential environmental benefits for Rigs-to-Reefs, the extent of benefit depends on the location, type, and design of the offshore oil and gas infrastructure. This means that not all offshore oil and gas structures should be reefed and that Rigs-to-Reefs should be assessed on a case-by-case basis. Techera and Chandler (2015) also indicate clearly in the conclusion of their study that reefing all offshore oil and gas structures is not feasible. Furthermore, there is the need (noted earlier) to consider the environmental impact of reefing on the surrounding region rather than just at the location itself.

2.2.2 – Social Impact of Rigs-to-Reefs

Almost all the literature that focuses on the environmental impact of Rigs-to-Reefs does at least mention social impacts in their conclusion. The social impacts most mentioned in the environmental science literature are the impacts on recreational and commercial fishing; tourism; and shipping. This suggests that recreational fishermen, tourism stakeholders, and shipping companies are potentially impactful stakeholders on a decommissioning

project that is considering Rigs-to-Reefs. This also suggests connections and collaborations between different groups of stakeholders, which coincide with the findings of Voyer et al. (2017), which suggest that there is a cooperative relationship between recreational fishing stakeholders and tourism stakeholders in Australian coastal communities.

Rigs-to-Reefs has become an increasingly popular alternative to decommissioning by removal in certain jurisdictions worldwide, such as the Gulf of Mexico region, Australia, and Malaysia (Kaiser, Shively & Shipley 2020), a trend primarily driven by the demands of recreational and commercial fishermen in those regions. A study by Edwards (2012) indicates strong support by recreational fishermen for Rigs-to-Reefs programme in the United States. The Philippines government ordered the construction of 21,600 artificial reef structures to support the local fishing industry (Pears & Williams 2005). King Reef in Exmouth, Australia, was an artificial reef installed in 2018 due to pressure by the recreational fishermen body – RecFishWest (Florisson et al. 2020). Chevron is also currently actively engaging RecFishWest on the decommissioning of the Thevenard Island offshore facilities (Western Angler 2019). This suggests that recreational fishermen are a stakeholder group with significant influence on project managers when making oil and gas decommissioning decisions.

Figure 2-19 – An Artificial Reef Module Partially Made Out of Offshore Oil and Gas Structures (Western Angler 2018)

As mentioned earlier, Rigs-to-Reefs processes have been known to improve the population of commercial fish. McLean et al. (2018) and Bond et al. (2018) also indicate in their studies that the presence of offshore pipelines increased the population of fish with high commercial value in the North-West Shelf. However, Edwards (2012) notes that only commercial fishermen who fish with lines support Rigs-to-Reefs, while commercial fishermen who use trawls are strongly against it. A publication on “Offshore Oil and Gas Decommissioning Policy and Key Principles” by the SFF (Scottish Fishermen Federation), clearly states that they prefer “total removal to shore”, indicating a strong stand against Rigs-to-Reefs (SFF 2018). The publication states that their primary reason for this is reducing navigation hazards and preventing damage to fishing tools (Edwards 2012). (Edwards 2012) states that several legal claims were made against oil companies in California because of damage to fishing tools. In 1997, a trawler in the North Sea capsized after its fishing equipment was caught by underwater pipelines, resulting in the death of two men (SFF 1997). This shows that there is a conflict in interests between the goals of greater fish production, reducing navigation hazards, and the risk of damage to fishing equipment.

Environmental science literature also notes that there is a need to properly manage offshore oil and gas structure after its decommissioning by reefing to prevent adverse environmental and social impacts (Ajemian et al. 2015; Pears & Williams 2005; Grossman, Jones & Seaman Jr 1997; Ekins, Vanner & Firebrace 2006). Ekins, Vanner and Firebrace (2006) explicitly note that trawling by commercial fishermen is more environmentally damaging than leaving oil and gas platforms in the marine environment. Schroeder and Love 's (2004) study also found that the reefing benefits of offshore platforms off the coast of California were annulled by overfishing and poor habitat quality. This suggests there is also a need to consider the cost and maintenance of post-decommissioning. It also suggests that artificial reefs can be purposely placed in order to prevent environmentally damaging activities such as trawling and overfishing. Additionally, this indicates that there is also a conflict of interest between the prevention of overfishing and trawling, and the reduction of navigation hazards and risks of damage to fishing equipment.

Rigs-to-Reefs has also been stated in the literature to have the potential to benefit the tourism industry (Harriott 2002; Jakšić, Stamenković & Đorđević 2013; Voyer et al. 2017; Bills 2018). Jakšić, Stamenković and Đorđević (2013) state that recreational divers have a strong interest in wrecks and offshore structures. In Malaysia, a decommissioned oil rig was converted to a hotel called Seaventures Dive Rig[3] (see **Figure 2-20** below), which has attracted recreational divers worldwide. Zawawi, Liew and Na (2012) even suggest that offshore resorts and hotels can open up an entire new frontier in the tourism industry. However, leaving infrastructures in place can also have an impact on visual appeal (Advisian 2017). Bull and Love (2019) state that one reason the Rigs-to-Reefs programme was not implemented in California was because there is a perception by the locals that the visual appeal of the Californian coastline will be improved when it is clear of oil rigs.

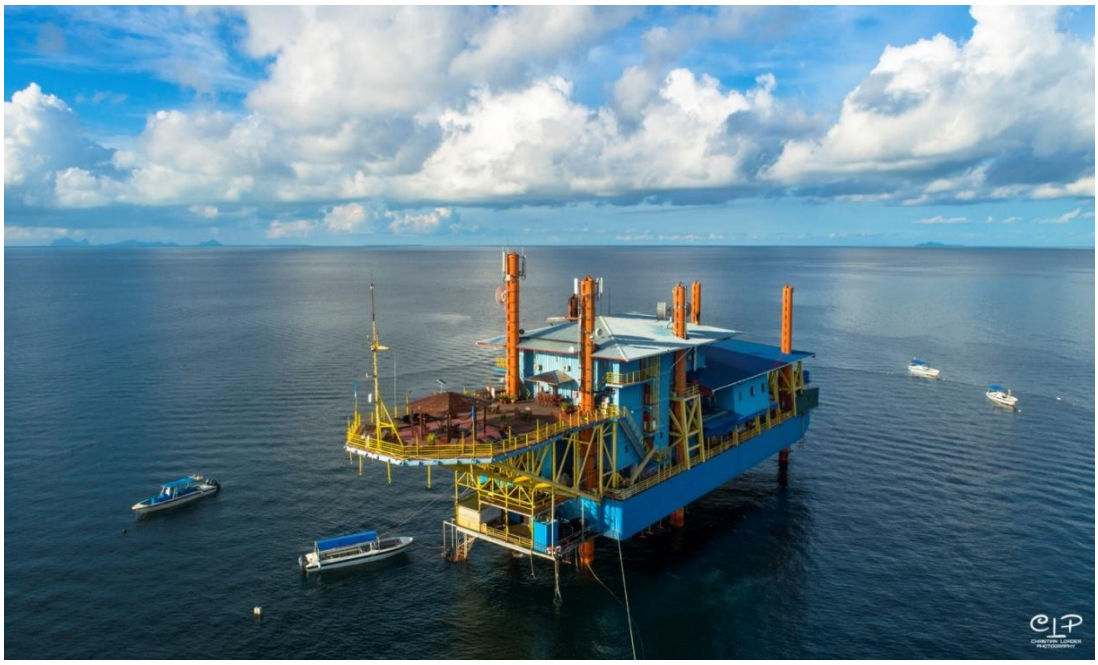

Figure 2-20 – An Offshore Structure Converted into an Offshore Resort (Seaventures 2020)

[3] Seaventures Dive Rig is a scuba diving platform and resort near Sipadan, Borneo, Malaysia. https://seaventuresdive.com/

The impact of Rigs-to-Reefs on logistics and shipping companies has been explicitly discussed in only a few studies within the environmental science literature, such as Schroeder and Love (2004), Amelia et al. (2018), and Advisian (2017); this is far less than the number of studies explicitly discussing fishing stakeholders and tourism stakeholders. This suggests less interest and concern by logistics and shipping companies than by fishing and tourism stakeholders. However, this also suggests opportunities to explicitly explore logistics and shipping companies' interests and concerns on the oil and gas structure decommissioning and Rigs-to-Reefs.

Another interesting finding is that much of the Rigs-to-Reefs literature also refers to legislation and regulations (Techera & Chandler 2015; Fowler, Macreadie & Booth 2015; Bills 2018; Bull & Love 2019; Kaiser, Shively & Shipley 2020), indicating that there is also a significant legal influence on decommissioning decisions. Techera and Chandler (2015) state that the current legislation and regulations in the United Kingdom are not fit for purpose to handle Rigs-to-Reefs issues. Therefore, a further literature review of international, regional, and national regulations will be conducted in more detail in ***Chapter 4: Regulating Oil and Gas Decommissioning***.

In terms of stakeholder influence and impact, environmental science literature that focuses on the social impact of Rigs-to-Reefs clearly indicates that there is strong interest by recreational and commercial fishing stakeholders. There are also indications of interests by tourism stakeholders and logistics and shipping companies, although these are suggested by environmental science literature to be less influential and impactful than recreational and commercial fishing stakeholders. There are also conflicts of interest among commercial fishing stakeholders. There is both a demand for more fish production, which favours Rigs-to-Reefs and a demand for reduced navigational hazards, which favours the complete removal of offshore infrastructures. This suggests that the same group of stakeholders can pull decommissioning decisions in multiple directions. **Figure 2-21** (below, page 46) illustrates the interests and concerns of recreational fishermen, commercial fishermen, tourism stakeholders, and logistics and shipping companies to illustrate the complexity in making decommissioning decisions.

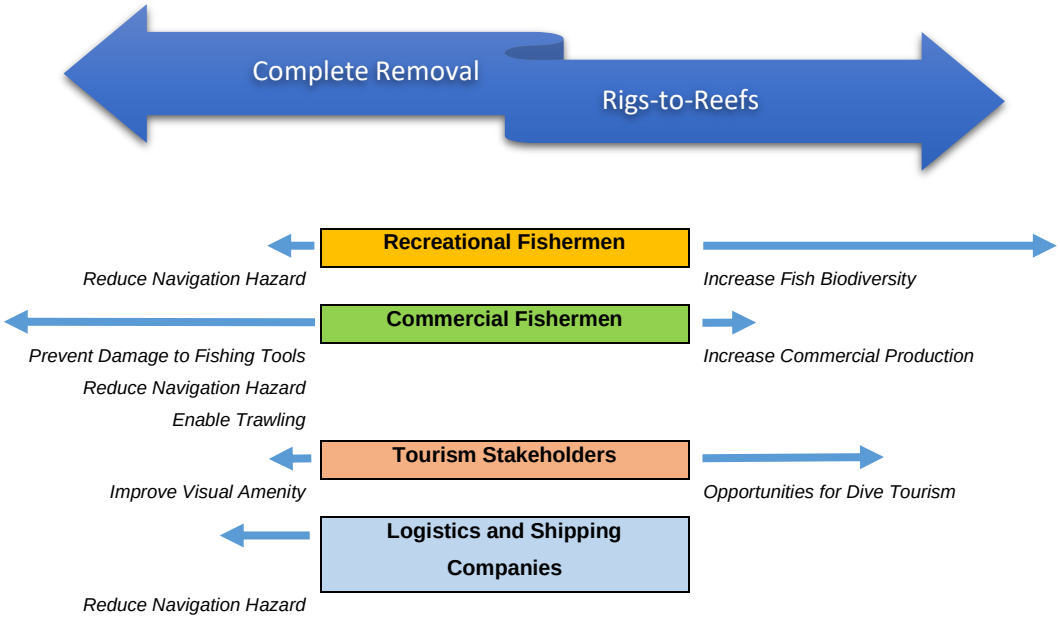

Figure 2-21 – Stakeholder Interests and Concerns (Based on Rigs-to-Reefs Literature)

Consequently, given the undoubted risks if decommissioning is not done properly, but equally the potential benefits from well-informed operations, it is important to engage the relevant stakeholders to ensure sustainable development and minimum impact on the marine ecosystem while also preventing any negative stakeholder impacts.

2.2.3 – Environmental Impact of Decommissioning Activities

As mentioned earlier when reviewing engineering literature, various methods can be used to decommission an offshore facility. A steel jacket structure, for example, can be removed as one piece, or it can also be removed by cutting it into smaller pieces and performing multiple lifts (Spence et al. 2019; Xu et al. 2019; Samudero, Capurso & Zoontjes 2019). Samudero, Capurso and Zoontjes (2019) note that removing an offshore structure using multiple lifts takes up more time and energy, leading to more carbon emissions than removing it in one go. This suggests that consideration should also be given to the environmental impact during the actual decommissioning operation.

There is a body of literature within environmental science literature that focuses on investigating the environmental impact of decommissioning activities, which include disruption to the ecosystem, discharges to the marine environment, underwater noise, and atmospheric emissions (Advisian 2017; Shaw, Seares and Newman 2018). However, significantly more environmental science literature focuses on Rigs-to-Reefs than focuses on assessing the environmental impact during decommissioning activity.

The number of stakeholders was also much fewer in this body of literature than in Rigs-to-Reefs literature. This suggests that decommissioning stakeholders are more interested in the decision concerning removing or leaving offshore infrastructures in the marine environment, than in the decisions as to how the reefing or removal is done. However, the stakeholders that were mentioned are eNGOs such as Greenpeace and the RSPB. As demonstrated by the events of Brent Field, eNGOs can potentially become the most impactful stakeholders in a decommissioning project if not managed properly (Dickson & McCulloch 1996; Grolin 1998; Jordan 2001; Zyglidopoulos 2002). This suggests that perhaps more emphasis should be placed by oil and gas operators on the environmental issues commonly mentioned in this body of literature (i.e. disruption to the ecosystem, discharges to the marine environment, underwater noise, and atmospheric emissions).

One of the arguments against removing an offshore infrastructure is that the activity may disrupt the existing ecosystem that had established itself around the offshore structure (Shaw, Seares and Newman 2018; Ajemian et al. 2015). As mentioned in the Rigs-to-Reefs sections of the literature review, the presence of offshore structures has been known to recruit flora and fauna, establishing a unique ecosystem (Caley et al. 1996; Emery et al. 2006). This suggests that removing an offshore infrastructure could be more damaging to the ecosystem than leaving it in place. Additionally, there are also studies such as Dunnet (1987) and Langston (2010) that indicate that offshore structures can also disturb and displace bird habitats. Langston (2010) reports that placing offshore structures close to shore elevates the risk of bird collision, leading to a change in the flight paths and breeding grounds of birds in the North Sea. This suggests that not only should oil and gas operators consider

the impact on the marine environment, but also that they should give consideration to the impact on the environment above mean sea level as well.

Literature regarding discharges of waste materials during decommissioning seems to centre on three main areas: drill cuttings (Nguyen & Rahman 1996; Breuer et al. 2004; Clyne & Jackson 2014; Grant & Briggs 2002), hazardous materials such as hydrocarbons and NORMs (Smith 2010; Peroni et al. 2012; McKay, Higgins & Baker 2020), and plastic (Pérez Fernández & Lamas Pardo 2013; Krause & Baquiran 2019). OSPAR's report (OSPAR Convention – Convention for the Protection of the Marine Environment of the North-East Atlantic 1992) on the impact of drill cuttings disturbance on the marine environment during decommissioning indicates that drill cuttings are toxic and may have detrimental effects if they enters the food chain, with the toxicity concentrating at higher trophic levels (OSPAR 2019). This indicates that decommissioning activities can have future downstream effects on fish stock and thus human health as well.

Regarding hazardous materials, Greenpeace's argument against the sinking of Brent Spar in the North Atlantic was based on the potential discharge of hazardous materials from the Spar unit (Elkington & Trisoglio 1996; Zyglidopoulos 2002). Greenpeace's argument against Shell UK's recommendation to leave the concrete gravity-based storage cells in the marine environment was also because of the potential discharge of hydrocarbons and other toxic chemicals from those cells (Shepherd et al. 2017; Shell 2017b). This suggests that eNGOs such as Greenpeace are most concerned about potential discharges of hazardous materials into the marine environment.

Studies on plastic in the context of offshore decommissioning only surfaced in recent studies (Pérez Fernández & Lamas Pardo 2013; Krause & Baquiran 2019). This suggests that there are opportunities to explicitly study the impact of plastic in the context of offshore decommissioning. Plastic is only present in certain types of offshore pipelines such as pipeline bundles in order to prevent corrosion and leakage of hazardous materials into the marine environment (Krause & Baquiran 2019). The issue with the decommissioning of pipeline

bundles, and their plastic components, as discussed earlier in (**Section 2.1.3.2**, see page 29), is that technically not all of them can be completely removed feasibly using current technology. The Oil and Gas Technology Centre (OGTC) and the National Decommissioning Centre in the United Kingdom are currently actively developing new technologies to decommission pipeline bundles (UKNDC, 2020). While the intention of using plastic in the pipeline design appears to be environmentally justified, the idea of leaving pipeline bundles with plastic materials in the marine environment after being decommissioned may not sit well with environmental NGOs (Krause & Baquiran 2019). This suggests that decommissioning decisions are sometimes limited by the technology available at the time, and that it may not be possible to address all stakeholder concerns.

There is also a section of the literature investigating the impact of decommissioning tools on marine life (Advisian 2017; Shaw, Seares and Newman 2018). Yverton et al. (1973) state explicitly that the use of destructive cutting tools such as explosives can cause damage to the internal organs of marine mammals in the vicinity. Zawawi, Liew, Alaloul, et al. (2019) also indicate that non-destructive techniques are much more environmentally friendly, although they may be less efficient than destructive techniques. This suggests that oil and gas operators should consider both the project's efficiency and its impact on the surrounding marine environment when selecting decommissioning tools.

As with any other engineering project, atmospheric emissions are also an important environmental consideration (Side, Kerr & Gamblin 1997; Kerr, Side & Gamblin 1999; Cantle & Bernstein 2015; Boothroyd et al. 2016; Baxter, Bebbington & Cutteridge 2002). Cantle and Bernstein (2015) indicate that as more activities and vessels are required, the level of carbon emissions produced by removing a platform is far higher than from leaving it in place. This suggests the atmospheric emissions produced from removing the offshore infrastructure removed could be more environmentally damaging than leaving it in place.

2.2.4 – Summary of Environmental Science Literature

Overall, a review of environmental science literature suggests that environmental considerations go beyond the debate around reefing or removal alone. There is also the need to consider the environmental and social impact of undertaking the actual decommissioning activities (cutting, lifting, transport, etc.). There also seems to be a variety of interests among different environmental NGOs. On the one hand, environmental NGOs who are more focused on reducing pollution of the marine environment, such as Greenpeace and Friends of the Earth, tend to prefer Complete Removal (Genter 2019; Jordan 2001). On the other hand, environmental NGOs who are more focused on protecting marine species, such as the Scottish Wildlife Trust, tend to prefer Rigs-to-Reefs (Scottish Wildlife Trust 2020). This indicates that not all environmental NGOs will be pulling decommissioning decisions in the same direction, making the decision-making and stakeholder engagement process challenging for project managers. **Figure 2-22** (below) factors environmental NGOs into the picture:

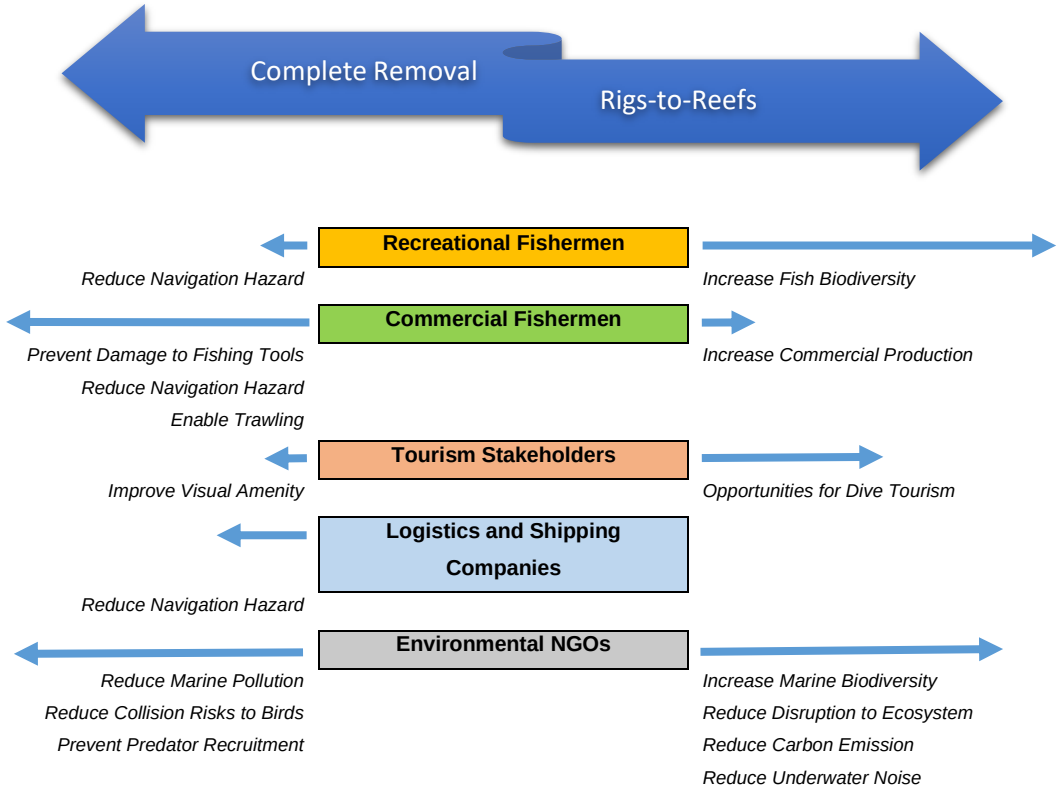

Figure 2-22 – Stakeholder Interests and Concerns (Based on Environmental Science Literature)

As illustrated in **Figure 2-22** (above, page 50), considering environmental science stakeholders alone, the different stakeholder interests and concerns are already pulling decommissioning decisions in multiple directions. This demonstrates that managing a decommissioning project and its stakeholders is highly challenging and complex. From **Figure 2-22** (above, page 50), it can also be seen that the number of areas of concern does not directly relate to how influential and how impactful the stakeholders are. This suggests it may be difficult to categorise and map out decommissioning stakeholders accurately without first engaging and understanding the stakeholders prior to the stakeholder mapping process.

2.3 – Conclusion

The review of engineering and environmental science literature indicated that oil and gas decommissioning is technically challenging and complex. The precise decommissioning option is dependent on the design of the oil and gas facility, location, regulations, and stakeholder interests and concerns. Oil and gas decommissioning also involves a wide range of stakeholders with competing views, interests, and concerns. Furthermore, stakeholder views are not predetermined. This makes the management of project schedules and risks extremely important. ***Chapter 3: Managing Oil and Gas Decommissioning*** will explore the literature to understand the evolution of project and stakeholder management and highlight gaps within the literature pertaining to oil and gas decommissioning projects.

Based on the literature review in this chapter, there are also an increasing number of interdisciplinary researches on the topic of oil and gas decommissioning, which suggests its interdisciplinary nature. It also suggests that an interdisciplinary approach to the research may be a better option. This finding will be taken into consideration when designing the research methodology. This methodology will be discussed in more detail in ***Chapter 5: Research Methodology.***

Chapter 3: Managing Oil and Gas Decommissioning

3.0 – Chapter Abstract

One of the conclusions of Chapter 2 is that oil and gas decommissioning projects are technically challenging and involve a wide range of stakeholders. Stakeholders' views were competing, pulling decommissioning decisions in multiple directions. These features indicate that oil and gas decommissioning projects are complex and that managing them can be challenging. This chapter reviews the literature from both project management and stakeholder management disciplines to understand their evolution and current considerations for managing complex projects and stakeholders. Gaps within the two bodies of literature pertaining to oil and gas decommissioning will also be highlighted and discussed.

This chapter begins by examining the definition and characteristics of projects, programmes, and portfolios. It then moves on to review the evolution of project management literature. Next the review explores key considerations regarding project management and current tools and techniques used in oil and gas decommissioning. The review then proceeds to explore the evolution of stakeholder management literature, key considerations of stakeholder management, and current tools and techniques used in oil and gas decommissioning.

The review of project management literature finds that there are many knowledge gaps in the context of oil and gas decommissioning. Firstly, there are not many studies in the field of oil and gas decommissioning project management. Most oil and gas decommissioning project management studies relate to cost modelling and cost estimation, while the management of schedule and scope of oil and gas decommissioning projects have not yet been explicitly explored. The review also finds that the terms "project" and "programme" seem to be used interchangeably within the literature, which suggests that is still a lack of understanding as to whether oil and gas decommissioning is a project or a program/programme.

Regarding the management of oil and gas decommissioning projects, the review also finds that many current project management tools and techniques have limitations in the context of oil and gas decommissioning, which indicates that there are opportunities to develop these tools and adapt them to the context of oil and gas decommissioning. The review of project management literature also finds that project management issues in oil and gas decommissioning, such as cost overruns, schedule overruns, and scope changes, are related to stakeholder impacts and influences, suggesting that perhaps more focus should be placed on stakeholder management.

In terms of stakeholder management, the review finds a strong emphasis on the use of multi-criteria decision-making tools, suggesting that using multi-criteria decision-making tools is considered to be current best practice in the industry. While many studies acknowledged that identifying and engaging stakeholders is still necessary in order to obtain sufficient information to be able to use those multi-criteria decision-making tools, the area of stakeholder identification and engagement in the context of oil and gas decommissioning has not yet been explicitly explored in stakeholder management literature. This indicates that there is still a knowledge gap in the area of stakeholder identification and engagement.

3.1 – Projects, Programmes, and Portfolios

3.1.1 – Definition of a Project

Different studies offer various definitions as to what a project is. Perhaps one of the most preferred definitions in the field of project management is the one offered by the Project Management Body of Knowledge (PMBoK), which defines a project as “a temporary endeavour undertaken to create a unique product, service, or result” (PMI 2017).

Despite being one of the most commonly used definitions, there is some uncertainty regarding the actual meaning of the words used. For example, the definition of the word “endeavour” differs depending on the study. Turner and Müller (2003) view “endeavour” as a temporary organisation created in order to achieve a set objective, while Wideman (2004) contextualises an “endeavour” as a management environment established to deliver one or more business products. There is a significant difference between an “organisation” and a “management environment”. An organisation can refer to the human infrastructure that facilitates and coordinates the implementation of project activities (PM4DEV 2016), while a management environment can be used to refer to both the organisational structure and the physical environment itself (PMI 2017).

Similarly, the word “unique” suggests that there is little similarity between any two projects. Shenhar and Wideman (1997) state that projects are unique because of the variation in objectives, complexity and technology. However, well-known industry project management practices such as PMP and PRINCE2 (PRojects IN Controlled Environments) suggested otherwise, believing that projects can be managed by using the same set of tools and techniques. Patterson (2015) also argues that building blocks of project works are not unique because the tools used to execute a project are similar. Ajam (2018) states that while projects are unique, the process of managing the project may not be. Overall, there is no clear definition of a project. For this research, a project be considered as Turner and Müller's (2003) definition: “a temporary organisation created in order to achieve a set goal or objective”.

3.1.2 – Definition of a Program / Programme

According to the Macquarie Dictionary, the difference between "programme" and "program" is spelling and they can be used interchangeably. "Programme" is considered to be the British spelling while "program" is the US spelling. However, within the context of project management, there is a difference between the definitions of "program" and "programme". According to PMBoK, a "program" is defined as "a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually" (PMI 2017). The Association for Project Management (APM) Body of Knowledge (APMBoK), however, defines a "programme" as "a unique and transient strategic endeavour undertaken to achieve a beneficial change and incorporating a group of related projects and business-as-usual activities" (APM 2016).

A comparison of both these definitions and the management techniques offered by both the Project Management Institute (PMI) and APM suggested that the difference between "program management" and "programme management" is far more than just spelling alone. The approach by PMI, a US professional association organisation, focuses more on controlling costs, risks, and schedule of the various projects within the "program". The approach by APM, a UK professional association, places more emphasis on achieving the overall "programme" objective. The difference in approaches and philosophy could perhaps influence the way "programs" or "programmes" are being managed by different organisations.

3.1.3 – Definition of a Portfolio

According to PMBoK, a portfolio is defined as "a collection of projects and programmes that are managed as a group to achieve strategic objectives" (PMI 2017). APMBoK's definition is similar, defining a portfolio as "a grouping of an organisations projects and programmes designed to maximise return on investment, maintain skills in the workforce, and to aid control of costs and benefits". While perhaps not entirely relevant from the perspective of a project manager, a portfolio management approach could be more beneficial for some stakeholders such as shareholders and governments (Blichfeldt & Eskerod 2008).

3.1.4 – Summary – Delivery Success Factors for Projects, Programmes, and Portfolios

Overall, as summarised in **Table 3-1** below, it was found, based on the literature review, that there are variations in terms of success factors between project, programme, and portfolio (Weaver 2010). This suggests that a better understanding of the descriptor of offshore oil and gas decommissioning activities could be critical in enhancing their management.

Table 3-1 – Definition and Success Factors of a Project, Programme, and Portfolio

Descriptor:	***Project***	***Programme/Program***	***Portfolio***
Definition:	A temporary endeavour undertaken to create a unique product, service, or result.	A group of related *projects* managed in a coordinated way to obtain benefits and control not available from managing them individually.	A collection of *projects* and *programmes* that are managed as a group to achieve strategic objectives.
Delivery Success Factors:	Success is measure by product and *project* quality, timeliness, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the *programme* satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of aggregate performance of *portfolio* components.

3.2 – The Evolution of Project Management

It can be argued that the introduction of modern project management tools and techniques surfaced in the early 1920s after the invention of the Gantt chart (Morris 2013). However, project management tools and techniques were not widely used by organisations until the 1950s after the formation of the American Association of Cost Engineers (AACE) (Morris 2013; Seymour & Hussein 2014). Since the inception of the AACE, there has been a rapid growth in the development of project management tools and techniques, such as the Critical Path Method in 1957, the Program Evaluation Review Technique (PERT) in 1958, the WBS (Work Breakdown Structure) in 1962, PROMPTII method in 1975, the PRINCE method in 1989, and the PRINCE2 method in 1996 (Seymour & Hussein 2014). Many of these tools and techniques have also been modernised and digitised by computer software packages in recent years such as Palisade's @RISK, Microsoft Project, and Primavera P6, assisting project managers when managing projects (Stellman & Greene 2005).

Various professional membership organisations have also been established over time to promote the project management profession such as the International Project Management Association (IPMA) in 1965, PMI in 1969, and APM in 1972 (Morris 2013; Seymour & Hussein 2014). PMI and APM also established bodies of knowledge (PMBoK and APMBoK), which provide an understanding of the project management discipline (Morris 2013; Seymour and Hussein 2014). However, there seems to be some inconsistency between PMBOK and APMBoK. For example, as mentioned earlier, when defining program/programme, there seem to be some differences regarding the definition and approach to program/programme management.

There are also professional certifications similar to engineering charterships, such as APM qualifications (Morris 2013), PRINCE2 certifications, and PMP certifications (Siegelaub 2017). It is interesting to note that certification preferences differ depending on location. PMP certifications are generally more preferred in the United States, while PRINCE2 certifications are generally more preferred in the United Kingdom (Siegelaub 2017). This suggests that oil and gas decommissioning could perhaps be managed differently depending on location.

The number of research studies in the field of project management also continues to increase through various forms of publication. Most studies in the field of project management can be found in internationally recognised journals such as:

- International Journal of Project Management
- Project Management Journal
- Harvard Business Review
- International Journal of Managing Projects in Business

Project management researches can also be found in some science and engineering type journals such as:

- Journal of Engineering, Project, and Production Management
- Journal of Engineering and Technology Management
- Journal of Construction Engineering and Management

Research published in these science and engineering-type journals typically uses engineering techniques such as lifecycle assessment and data mining. The topics also tend to be more industry-focused. This suggests that the field of project management is interdisciplinary, encompassing both business and engineering knowledge.

Despite the growing body of knowledge, however, the literature suggests that many projects that reportedly failed to have been effectively managed. One study (White & Fortune 2002) suggests that current project management tools have limitations because the performance of the tools differs in theoretical and practical settings. Walkup and Ligon (2006) also indicate that existing project management tools such as Stage-Gate Review Systems have limitations when applied it in the oil and gas industry. However, Walkup and Ligon's (2006) study only focuses on oil and gas exploration and development projects. This indicates there is a knowledge gap regarding how current project management tools perform in the context of oil and gas decommissioning.

Overall, the evolution of project management literature suggests that current project management tools and techniques have significant limitations and can be further improved. This idea will be kept in mind when conducting the research, as it may be one of the reasons for stakeholder interactions in oil and gas decommissioning.

3.3 – Managing Projects

The "Iron Triangle", also known as the triple constraints of project management, can be said to be derived from the definition of a project (Dobson 2004). The theory states that all of the three factors (Cost, Time, and Scope) need to be managed well for a project to be successful (Trojanowska & Dostatni 2017; Newbold 1998; Cox III & Schleier 2010).

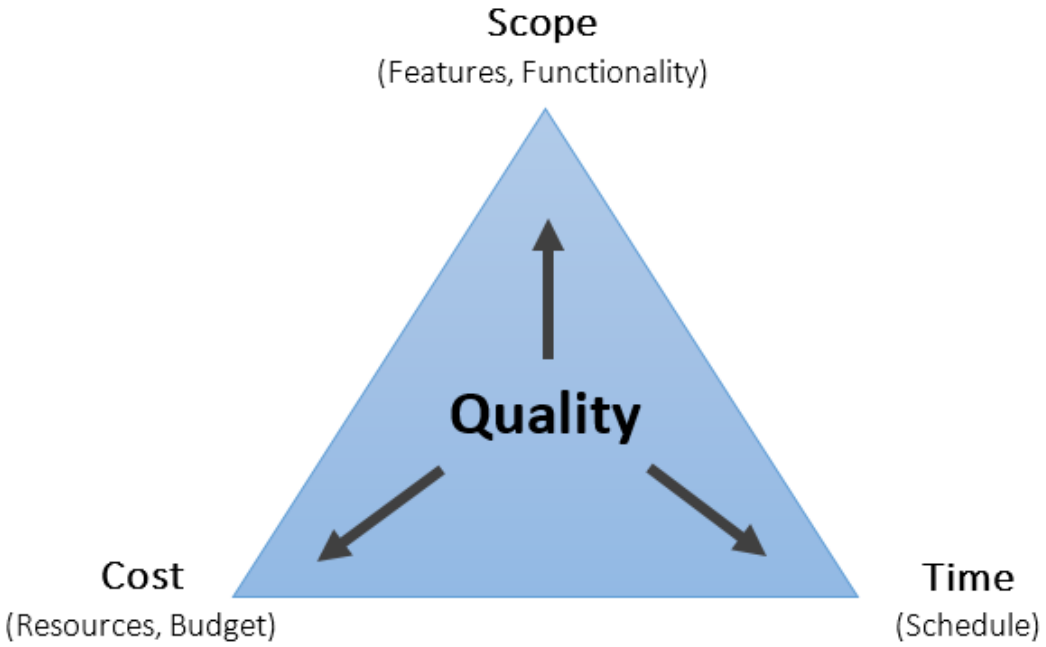

Figure 3-1 – The Iron Triangle of Project Management (Atkinson 1999)

3.3.1 – Cost Management

Findings from the literature suggest that many construction and information technology industry projects experience mismanagement of resources and budget. A survey by Standish Group in 2004 found that 71% of projects exceeded their budget (Rubinstein 2007). Another survey by Standish Group in 2014 found that 52.7% of projects will exceed their budget by a factor of 1.89 (Rubinstein 2007). Notable projects that experienced cost overruns include the Sydney Opera house, which exceeded its budget by a factor of 14 (Ahiaga-Dagbui & Smith 2014), and the Boeing Dreamliner programme, which exceeded its budget by a total of USD 26 billion (Fanthorpe et al. 2011).

The literature suggests that there are many reasons for poor cost management. Samarghandi et al. (2016) argue that the poor forecasting and budgeting skills are the main causes of cost management. Other literature such as Frimpong, Oluwoye and Crawford (2003) and Sambasivan and Soon (2007) argue that poor communication and poor site management are the main causes of poor cost management. This suggests that there are two main causes of poor cost management, one relating to the skills of cost management, the other to interactions between people. While cost management skills can be improved with better cost management tools and techniques (Anbari 2003), improving communication also requires better stakeholder management skills (Berman et al. 1999; Xue et al. 2018).

This suggests that an improvement in stakeholder management may improve the management of project cost. A recent study by Xue et al. (2018) indicates that improved stakeholder management can improve cost performance for construction projects.

3.3.1.2 – Cost Management in Oil and Gas Decommissioning

In terms of oil and gas decommissioning, the consequences of mismanagement of cost are more significant because unlike construction projects, there is no return on investment from the project to cover the cost of decommissioning (Kaiser 2015). According to an Oil and Gas Authority (OGA) report on oil and gas projects in the UK Continental Shelf from 2011 to 2016, oil and gas projects executed during the period were on average 35% over budget (OGA 2016a). A study by Ahiaga-Dagbui et al. (2017) also found that on average, oil and gas decommissioning projects in the North Sea exceed their budget by about 40%. This suggests that cost overruns are a prevalent issue in oil and gas decommissioning.

Cost estimation and modelling techniques have been explored extensively by Mark J. Kaiser in his numerous studies in the field of oil and gas decommissioning. **Table 3-1** (below, page 61) presents Kaiser's work in the oil and gas decommissioning field chronologically.

Table 3-1 – List of Project Cost Estimation and Modelling Literature in Oil and Gas Decommissioning

Author	Year	Title
Kaiser, Pulsipher, & Robert	2003	Decommissioning Cost Functions in the Gulf of Mexico
Kaiser	2006	Offshore Decommissioning Cost Estimation in the Gulf of Mexico
Kaiser, Yunke, & Brian	2010	Economic Feasibility of Using Offshore Oil and Gas Structures in the Gulf of Mexico for Platform Based Aquaculture
Kaiser & Liu	2014	Decommissioning Cost Estimation in Deepwater US Gulf of Mexico – Fixed Platforms and Compliant Towers
Kaiser	2015	A New Approach to Decommissioning Cost Estimation Using Settled Liability Data
Kaiser & Liu	2015	Decommissioning Cost Estimation for Deepwater Floating Structures in the US Gulf of Mexico
Kaiser & Liu	2015	Quantifying Decommissioning Risk in the Deepwater Gulf of Mexico
Kaiser & Liu	2018	A Scenario-Based Deepwater Decommissioning Forecast in the US Gulf of Mexico
Kaiser, et al.	2020	An Update on the Louisiana and Texas Rigs-to-Reefs Programs in the Gulf of Mexico

The relationship between the management of oil and gas decommissioning costs with communication and stakeholder management has, however, not yet been explicitly explored in an academic setting. This suggests a gap in the body of knowledge in this area which can fruitfully be explored in more detail.

3.3.2 – Time Management

Findings from the literature also suggest that many projects experience schedule delays. A questionnaire conducted by Faridi and El Sayegh (2006) found that more than 50% of construction projects experienced schedule delays in the United Arab Emirates. A study by Aibinu and Jagboro (2002) of 61 building projects in Nigeria, for example, found that all of them experienced

schedule delays. This suggests that schedule delays are a prevalent issue. The literature review also found that schedule delays are more common in construction projects, suggesting that construction projects are more prone to poor time management.

Cotton (2003) indicates that unexpected circumstances such as climate changes, wars, protests, and union strikes, are common causes of schedule delays. This suggests that some schedule delays are more difficult to predict and mitigate. In legal terms, these types of events are known as *force majeure*. In an event of a *force majeure*, depending on the terms of the contract, a contractor might be able escape from the usual consequences of falling behind schedule (Gordon, Paterson & Usenmez 2018b). This means that to a certain extent, cost related to schedule delays can be mitigated through legal means. For example, the COVID-19 pandemic was used by many contractors in Japan's construction industry to claim *force majeure* and escape the consequences of schedule delays (Mashishi 2020).

In terms of controllable factors, lack of communication is the most mentioned reason in the literature, suggesting that lack of communication is a major cause of poor time management for projects. Sambasivan and Soon's (2007) study found that miscommunication between client, consultant, and contractors is the primary cause of schedule delays for construction projects in Malaysia. Ren, Atout and Jones (2008) also state that poor communication between the parties involved was the main cause of schedule delays in construction projects in Dubai. Considering that consultants and contractors are stakeholders to a project. This also indicates that stakeholder management can have an influence on the schedule of a project.

According to Trauner (2009), one of the best ways to avoid schedule delays is to use schedule management tools such as Gantt charts and critical path analysis. This indicates that there are tools and techniques available for project managers to use to ensure that project schedules are well managed.

3.3.2.1 – Time Management in Oil and Gas Decommissioning

Regarding oil and gas decommissioning, schedule overruns can have a significant impact on the project cost. For example, schedule delays can result in consequential loss, liquidated damages, and multiple breaches of commercial contracts, increasing the overall cost of decommissioning (Gordon, Paterson & Usenmez 2018b). This suggests that a well-managed oil and gas decommissioning schedule can reduce the overall cost of decommissioning.

According to an OGA report on oil and gas projects in the UK Continental Shelf from 2011 to 2016, fewer than 25% of oil and gas projects were delivered on time. The decommissioning of the North-West Hutton facility, for example, was completed two years later than anticipated (Blacklaws, Johnston & Leask 2014). This indicates that schedule delays are still a prevalent issue in the oil and gas industry.

Executing oil and gas decommissioning at the right time is also important from an engineering point of view. For certain oil and gas decommissioning activities, such as the cleaning and flushing of pipelines, the timing of the execution of the activities is essential (Philip et al. 2014). For example, when shutting down an oil and gas facility, the conditions (such as temperature and pressure) of the equipment and pipelines begin to change over time. For example, the temperature and pressure inside a pipeline drops over time when the fluid stops flowing. This change in conditions can alter the fluid's physical and chemical behaviours within the pipelines, leading to environmental and safety issues such as formation of toxic chemicals, pressure build-ups, or pipeline corrosion. This means that project schedules must be managed meticulously to ensure that certain activities are executed at the right time. This also suggests that an oil and gas decommissioning project manager will need to be adept in engineering.

The review of industry literature suggests that that one key reason for schedule delay is contractual models. Whittaker, Oudenot and Vasquez (2019) suggest that an effective contractual model can improve project efficiency in terms of

both cost and schedule. One of the reasons the Miller decommissioning project was completed ahead of schedule was the unique contractual model between BP, Saipem, and Petrofac (Blacklaws 2018). According to Blacklaws (2018), the contractual arrangement placed emphasis on ensuring alignment of processes between BP, Siapem, and Petrofac during the decommissioning operation. Overall, this suggests that the management of operator-contractor and contractor-contractor interfaces, and by extension, the management of contractors as stakeholders during oil and gas decommissioning operations, can impact project schedules.

The literature review suggests that schedule management tools and techniques such as Gantt charts are commonly used for managing oil and gas decommissioning projects. **Figure 3-2** (below) shows an example of an oil and gas decommissioning project Gantt chart.

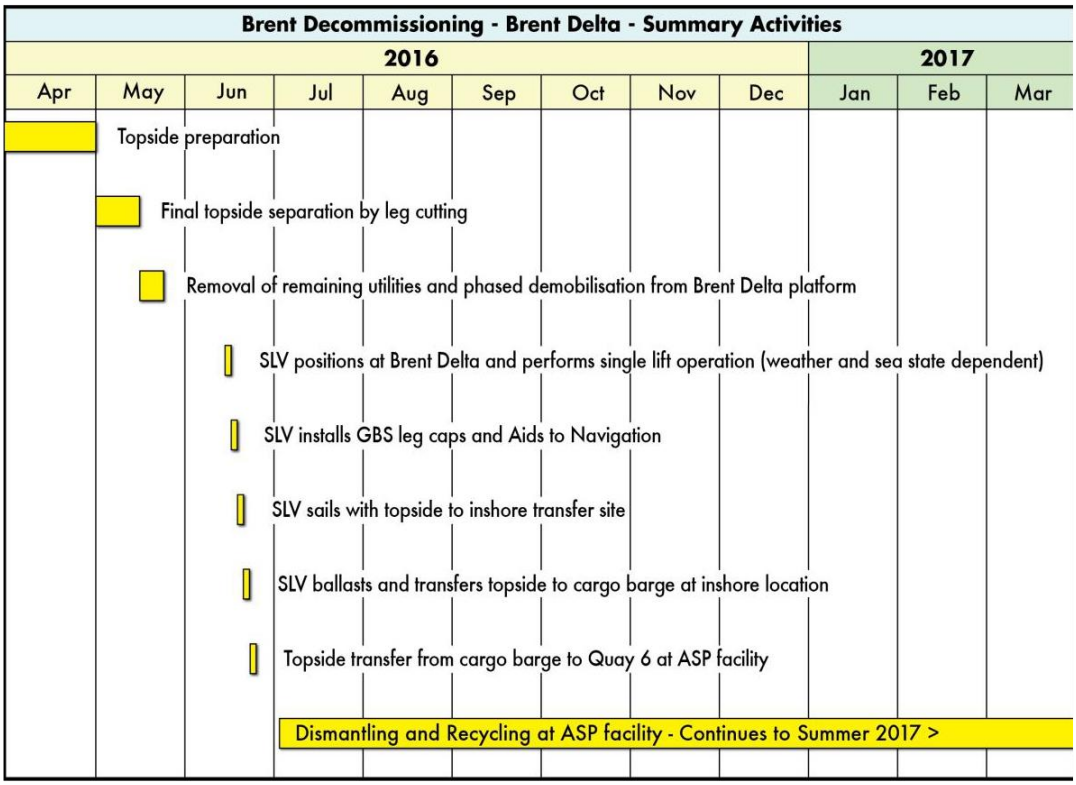

Figure 3-2 – An Example of a Gantt Chart for an Oil and Gas Decommissioning Project (Shell 2015)

While it is likely that the critical path method is also commonly used for managing oil and gas decommissioning projects, there has been no industry nor academic literature that explicitly explores its use. As mentioned earlier in

this chapter, and in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 33), oil and gas decommissioning projects involve a wide range of stakeholders. This suggests an opportunity to explicitly explore oil and gas decommissioning projects by developing and analysing stakeholder-oriented critical paths.

3.3.3 – Scope Management

In project management, "scope" refers to "the work that needs to be accomplished to deliver a product, service, or result with the specified features and functions" (PMI 2017). In addition to the cost and time, the scope is also an important factor to consider when managing projects (Trojanowska & Dostatni 2017). Findings from the literature suggested that many projects experience scope change or scope creep. A study conducted by Clancy (1995) shows that approximately two-thirds of IT projects fail because of poor project scope management.

The literature review also found that larger and more complex projects are more prone to poor scope management and control. Flyvbjerg, Bruzelius and Rothengatter (2003) show that the megaprojects such as Channel Tunnel the Denver International Airport, and Chek Lap Kok Airport experience more severe scope creep and cost overruns than other smaller-scale investment projects around the world. This suggests that larger-scale oil and gas decommissioning projects are more prone to scope creep and scope changes.

Regarding reasons for poor scope management, Fageha and Aibinu (2013) indicate that lack of stakeholder participation is one reason for the poor definition of project scope. Studies by Cheung, Yiu and Lam (2013) and Yang et al. (2011) suggest that effective stakeholder engagement can prevent scope creep and improve project performance. This suggests that engaging stakeholders is an effective way to improve the definition and management of project scopes. Patanakul, Iewwongcharoen and Milosevic (2010) indicate in their study that the use of project management tools and techniques throughout the lifecycle of a project can improve the management of project scopes. This suggests project tools and techniques available for project

managers to define and manage project scopes effectively. Examples of scope management tools are the WBS and the Stage-Gate Review System.

3.3.3.1 – Scope Management in Oil and Gas Decommissioning

The scope of an oil and gas decommissioning project can change significantly depending on a variety of factors. For example, a change in the precise decommissioning option can change the type of equipment and vessels required (Yimtae et al. 2018; Samudero, Capurso & Zoontjes 2019).

The literature review suggests that scope management tools such as WBS and stage gates are being used extensively for oil and gas decommissioning. The Oil and Gas UK Decommissioning Work Breakdown Structure, for example, was published by Oil and Gas UK to ensure that the scope of oil and gas decommissioning is thoroughly understood by the industry (OGUK 2019). The Oil and Gas Decommissioning Breakdown Structures (see page 607, ***Appendix H***)**,** detail the scopes of work involved in an oil and gas decommissioning project.

Scope Definition Using Multi-Criteria Decision-Making Tools

In addition to the WBS, the review of both academic and industry literature shows extensive use of various multi-criteria decision tools by oil and gas operators to consider stakeholder views during scope definitions for oil and gas projects. This suggests that multi-criteria decision tools are current best practices for managing stakeholders in oil and gas decommissioning projects.

Multi-criteria decision-making originates from the discipline of operations research. It is a decision-making technique that evaluates various criteria to inform decisions (McGinley 2012). The use of multi-criteria decision-making tools to consider stakeholder views regarding the evaluation decommissioning options for oil and gas facilities can be traced back to the late 1990s and early 2000s, when the Best Practicable Environmental Option (BPEO) method was used by oil and gas operators evaluate oil and gas decommissioning options, such as the Heather Field decommissioning project (Hustoft & Gamblin 1995), and the Balmoral Field decommissioning project (Linzi, Harley & Picken 2000).

Several other multi-criteria decision-making tools and techniques are being developed to evaluate oil and gas decommissioning options, such as the multi-

criteria framework by Fowler et al. (2014a), PLATFORM by Henrion, Bernstein and Swamy (2015), and many others. However, the review of industry literature suggests that in recent years there are three multi-criteria decision-making tools being used the most by oil and gas operators to consider stakeholder views when evaluating oil and gas decommissioning options; these are:

- CA (Comparative Assessment)
- BPEO (Best Practicable Environmental Option)
- NEBA (Nett Environmental Benefit Analysis)

These three multi-criteria decision-making tools are slightly different in terms of methods and techniques. The differences are summarised by Sommer et al. (2019) in their study, as shown in **Table 3-2** (below).

Table 3-2 – A Comparison of Different Multi-Criteria Decision-Making Tools Used for Evaluating Oil and Gas Decommissioning Options (Sommer et al. 2019)

Comparative Assessment (CA)	An approach used to evaluate decommissioning options based on a range of criteria typically including safety, technical, environmental, socio-economic and financial aspects (Oil and Gas UK, 2015).	Mostly Quantitative
Best Practicable Environmental Option (BPEO)	A systematic approach in which the practicality of all reasonable decommissioning options is examined, including technical feasibility, environmental, risk and safety, costs, and public acceptance (Linzi et al 2000, Laister & Jagerroos 2018).	Quantitative and Qualitative
Net Environmental Benefit Analysis (NEBA)	An approach that evaluates the net environmental performance of decommissioning options by weighing the potential environmental gains against the adverse environmental effects caused by the activities (Hughes & Jagerroos 2019).	Mostly Quantitative

The literature review found that the preference for the type of multi-criteria decision-making tools depends on location and regulations. For example, CA is being used most extensively by oil and gas operators the United Kingdom to consider stakeholder views when evaluating oil and gas decommissioning options (Gordon, Poot & O'Connor 2019; Marfatia 2019). NEBA is being used more extensively by oil and gas operators in Thailand (Kanmkamnerd, Phanichtraiphop & Pornsakulsakdi 2016; Kankamnerd et al. 2018; Tularak, Khan & Thungsuntonkhun 2007), while BPEO is the preferred multi-criteria decision-making tool for Malaysian oil and gas decommissioning regulators (Jagerroos & Kayleigh 2019). The variation in preferences of multi-criteria decision-making tools suggests that there is still a lack of understanding on how to best consider stakeholder views in oil and gas decommissioning decision-making and project scoping.

3.4 - The Critical Path Method

The critical path method was developed by Morgan Walker from the DuPont Corporation and James Kelley Jr. from the Remington Rand Corporation (Kelley Jr & Walker 1959). The critical path method was first used for the management of the Manhattan Project (Thayer 1996). The critical path method was also used for the construction of the former World Trade Centre in New York.

The critical path analysis process involves inputting the list of activities, the duration of each activity, the dependency between the activities, and project deliverables or milestones. These components are then used to develop an activity-on-node diagram, as illustrated in **Figure 3-3** (below).

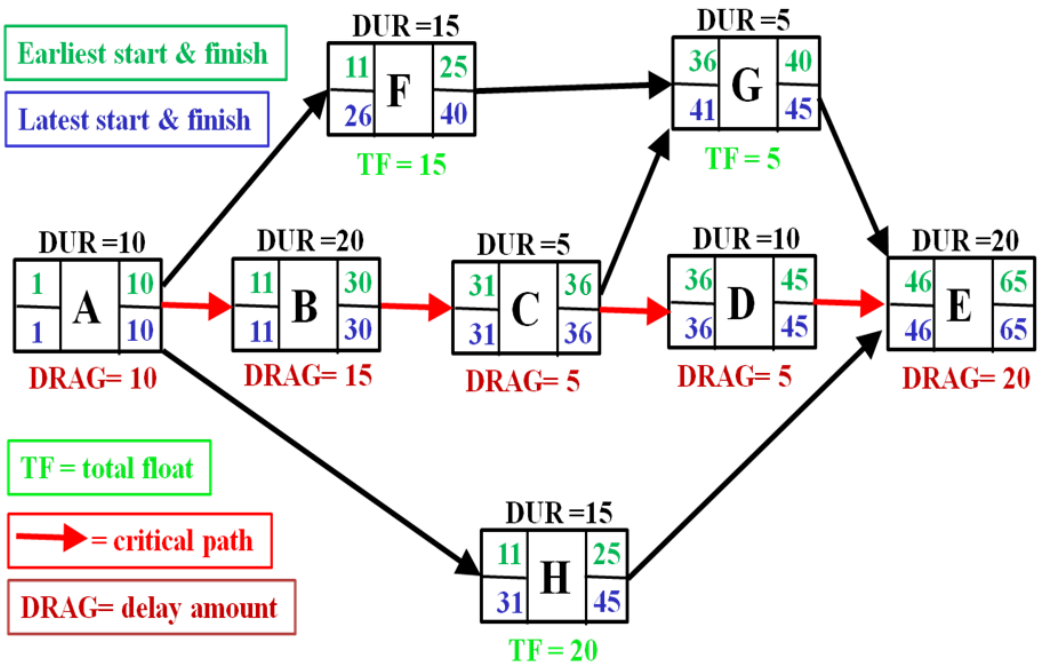

Figure 3-3 – An Example of Critical Path Analysis (Kundu 2014)

The critical path of the project is then determined by identifying the activity pathway with the longest total duration. An activity pathway is a path that can be taken to go from the first activity to the final activity in the activity-on-node diagram. For example, in the diagram in **Figure 3-3** (above), there are four activity pathways:

- Pathway 1 : Activity A → Activity F → Activity G → Activity E
- Pathway 2 : Activity A → Activity B → Activity C → Activity G → Activity E
- Pathway 3 : Activity A → Activity B → Activity C → Activity D → Activity E
- Pathway 4 : Activity A → Activity H → Activity E

The total duration for each pathway is then calculated. The total durations of the pathways are as follows:

- Pathway 1 : Total duration = 10 + 15 + 5 + 20 = 55 days
- Pathway 2 : Total duration = 10 + 20 + 5 + 5 + 20 = 60 days
- Pathway 3 : Total duration = 10 + 20 + 5 + 10 + 20 = 65 days
- Pathway 4 : Total duration = 10 + 15 + 20 = 45 days

Therefore, the critical path for the project illustrated in **Figure 3-3** (above, page 69) is Pathway 3. This means that project managers should prioritise their project management efforts on activities in Pathway 3 because they are more "critical" in terms of schedule. The critical path method is still being used today by many project managers (Sheibani 2020; Liu & Hu 2020). However, as projects become more complex and the list of activities becomes much longer, many project managers resort to using computer software packages such as Microsoft Project and Primavera P6 to determine the critical path rather than relying on traditional manual calculations (Cho & Eppinger 2005).

The use of the critical path method has also been stated in the literature to bring benefits to project management. A study conducted by Andawei (2014) shows that the use of the critical path method has improved both the management of schedule and the cost of construction projects in Nigeria. Another study by Braaksma and Shortreed (1971) shows that the critical path method improved the management of transport operations in airports. Hofmann (1993) also notes that the use of the critical path method was useful in coordinating clinical care operations as well. This shows that the critical path method can apply to a wide array of different industries.

However, the literature also shows that there are some limitations to the use of the traditional critical path method. Castro-Lacouture et al.'s (2009) study, for example, suggests that the critical path method did not consider factors such as unforeseen material shortages. This study also suggests that an activity not on the critical path, but with material shortage should be prioritised over an activity on a critical path but with a surplus of materials available. This suggests that other unforeseen activities such as stakeholder impacts and influence should also be considered when prioritising project management efforts.

3.4.1 – Uncertainties of the Critical Path Method

According to Williams (2017), uncertainties are natural features of projects. While the critical path method has been proven useful in enhancing the management of project schedules, the literature review suggests that the critical path method has limitations when applied to projects with a higher level of uncertainties (Williams 2017; Laslo & Gurevich 2001). For a project with considerable uncertainty, multiple critical paths may exist to consider the various possibilities (Mazlum & Güneri 2015; Laslo & Gurevich 2001)

To address critical path uncertainties, there have been numerous extensions of the critical path method proposed by scholars over the years (Mazlum & Güneri 2015). For example, Monte Carlo simulations and Fuzzy PERT (Mazlum & Güneri 2015; Laslo & Gurevich 2001). While these extensions have been proven useful in quantifying and predicting critical paths of projects with quantifiable uncertainties (for example, the duration of a project), it must be noted that there are some uncertainties that can be difficult to quantify (Williams 2017). One example is variations in the intensity of stakeholder interactions that occur during decommissioning projects, (discussed in **Chapter 2**) (Henrion & Bernstein 2015; Kaiser 2015; Ahiaga-Dagbui et. al. 2017). Another example, as expressed by a number of scholars, is the measure of regulatory uncertainties and its impact on projects (Atkinson, Crawford & Ward 2006; Zhong et al. 2018). Therefore, there is a need for a further extension of the critical path enabling consideration of uncertainties in stakeholder impacts.

3.4.2 – Stakeholder-Oriented Critical Path

As part of this research, the author proposed a stakeholder-oriented critical path as a novel extension of Kelley Jr & Walker's (1959) critical path method to consider the stakeholder impacts on projects. A stakeholder-oriented critical path is defined as a route through the network of project activities that is subjected to the highest volume of stakeholder interactions. As compared with the standard critical path, which is based on the duration of the project activity, a stakeholder-oriented critical path considers the volume of stakeholder interactions on each project activity. As such, stakeholder-oriented critical paths are not focused on activities per se, but recognise that stakeholder interactions may have an impact on project duration.

In this research, the volume of stakeholder interactions on project activities were identified by qualitatively analysing the semi-structured interviews. Examples of qualitative analysis techniques include considering the number of times the project activity was mentioned by interviewees and the description of the stakeholder interaction by the interviewees. Future research could therefore take a more quantitative approach in measuring the volume of stakeholder interactions and potential stakeholder impacts on project activities.

Using **Figure 3-3** (above, page 69) as an example, if the volume of stakeholder interactions is exceptionally high for Activity H, and there are no stakeholder interactions for Activity B, Activity C or Activity D, then the stakeholder-oriented critical path would be Pathway 4 rather than Pathway 3. As such, the pathway undertaken by the standard critical path and the stakeholder-oriented critical path may differ from one another. This means that stakeholder interactions can be higher in volume on project activities outside the standard critical path, demonstrating limitations with the standard critical path method when it comes to the prioritisation of stakeholder management resources.

Project managers can also overlay both the standard critical path and stakeholder-oriented critical path on top of one another, providing them with the ability to compare and contrast the standard and stakeholder-oriented critical paths. This would allow for better decision-making and more effective prioritisation of their stakeholder management efforts. The use of a

stakeholder-oriented critical path could, therefore, be a useful tool for the management of projects that involve a wide range of stakeholders, such as oil and gas decommissioning projects.

3.5 – Summary of Project Management Literature

While there are some project management studies, mostly from the industry, oil and gas decommissioning is a very new field, with many opportunities for contribution to knowledge. For example, the literature review also shows that current project management tools such as the Stage-Gate Review System and multi-criteria decision-making tools have plenty of room for improvement.

The literature review also shows that cost overruns, schedule overruns, scope creep, and other project management issues are still prevalent in oil and gas decommissioning. Project management issues were also found to be linked to stakeholder impacts and influences. This suggests the management of oil and gas decommissioning projects could be improved by improving the management of its stakeholders.

3.6 – The Evolution of Stakeholder Management

3.6.1 – Stakeholder Theory - Origins

The review of stakeholder management literature finds that many books and journal articles in the field refer to Freeman's (1984) work on stakeholder theory as the foundation for the body of knowledge. This has led to many works in the field of stakeholder management, crediting Freeman as the father of stakeholder theory (Eskerod 2020; Lehtinen 2021). While it is true that the American origin of stakeholder theory originates from the discipline of business ethics with the work of Freeman (1984) in his book "*Strategic Management: A Stakeholder Approach*", the ideas of stakeholder theory first surfaced decades earlier in the works of Rhenman (1964). It is not until recently that more scholars begin to explicitly acknowledge Rhenman's (1964) work, naming it as the Scandinavian origin of stakeholder theory. Overall, the literature review suggests that the Scandinavian view on stakeholder theory if often overlooked. Future work could consider the different origins of stakeholder theory (both American and Scandinavian) and explore how they influence project stakeholder management behaviours.

Regardless of the origins of stakeholder theory, the message behind stakeholder theory remained the same. Rhenman (1964) stated that stakeholders are individuals and groups whom the firm is depending for its existence Freeman's (1984) argues that organisations should also care about "those groups without whose support the organisation would cease to exist", rather than just the shareholders. Overall, the stakeholder theory challenges the shareholder theory of Friedman (1962), which, in contrast to the stakeholder theory, argues that shareholders are the only stakeholders an organisation should care about.

Following the formal introduction of stakeholder theory through the work of (Freeman 1984), the body of knowledge regarding stakeholder management has expanded steadily throughout the years through research and studies in the area of business ethics, strategic management, corporate social responsibility, and project management. However, there are still not many studies on stakeholder management, which suggests that the discipline is still in its infancy, and there are still many opportunities for extending the body of knowledge.

3.6.2 – Stakeholder Theory in Business Ethics

Business ethics is the study of the ethical dimensions of organisations and commercial activities (Donaldson & Walsh 2015). Stakeholder theory has been expanded upon by many different authors over the years, using several different lenses within business ethics (Parmar et al. 2010). Examples include Kantian Capitalism theory (Evan & Freeman 1998), Convergent Stakeholder Theory (Jones & Wicks 1999), Libertarian Stakeholder Theory (Freeman & Phillip 2002), and Feminist Theory (Wicks, Gilbert Jr & Freeman 1994).

One of the debates in the field of business ethics is the contention between different authors on how the different part of stakeholder theory complements one another. Donaldson and Preston (1995) suggest that stakeholder theory can be divided into four separate parts: Descriptive, Instrumental, Normative and Managerial. Donaldson and Preston (1995) also state that the Normative Section of stakeholder theory has a larger role than the others. However, there are others such as Jones and Wicks (1999) and Freeman (1999) that explicitly

argue against the claim of Donaldson and Preston (1995). Freeman (1999) argues that all parts of stakeholder theory (Descriptive, Instrumental, Normative and Managerial) are equally important, and there are strong links between them.

Based on the review of Freeman and various works since 1984, research in the field of business ethics has centred more on addressing the problem of the ethics of capitalism than addressing other ethical issues such as the problem of value creation and trade the problem of managerial mindset (Parmar et al. 2010).

3.6.3 – Stakeholder Theory in Strategic Management

In contrast to the literature in the field of ethics, the problem of value creation and trade and the problem of managerial mindset, as noted by Parmar et al. (2010), has been explored more by strategic management literature.

The application of stakeholder theory in strategic management has been argued to be beneficial to the organisation. Stakeholder influence can improve the robustness of business strategies (Ackermann & Eden 2011), increase the competitive advantage of the organisation (Priem & Butler 2001), and improve the economic performance of the organisation (Harrison, Bosse & Phillips 2010). However, there are also some literature, such as (Bryson (2004), who argue that there is insufficient evidence to prove that stakeholder analysis can help organisations produce desirable outcomes.

This suggests that the benefits of stakeholder influence on strategic management could differ depending on various factors, such as the influencing power the stakeholders can bring to the firm (Ackermann & Eden 2011).

3.6.4 – Stakeholder Theory in Corporate Social Responsibility

Corporate social responsibility has been defined by McWilliams and Siegel (2001) as “actions that appear to further some social good, beyond the interests of the firm and that which is required by law”. The concept of corporate social responsibility has some parallels with stakeholder theory in the sense that they both involve “value creation”. However, the concept of corporate social responsibility has been criticised by stakeholder theory

ethicists for distinctly dividing business operations and societal interests rather than seeing them together as one (Parmar et al. 2010).

Introducing stakeholder theory into the concept of corporate social responsibility has helped researchers in the field to conceptualise the linkages between financial responsibilities and societal responsibilities (Parmar et al. 2010; Frederick 1998). The application of stakeholder theory has also been explored in various concepts in the field, such as corporate social responsiveness, corporate governance, corporate citizenship, and sustainability (Parmar et al. 2010). For example, the works of Ackerman and Bauer (1976) and Sethi (1975) identify empirical links between corporate social responsibility and financial benefits.

3.6.5 – Stakeholder Theory in Project Management

Stakeholder theory has also been explored in the context of project management. The application of stakeholder theory in the field of project management can arguably be traced back 35 years to the works of Cleland (1985), which incorporate the stakeholder theory idea into the context of project management. Cleland (1985) argued that in addition to delivering a project on time and on budget, projects are required to meet all stakeholder expectations.

Over the years since the introduction of stakeholder theory into the management of projects by earlier works such as Cleland (195), the linkages between the various sub-disciplines of project management, and stakeholder theory have gradually strengthened over time (Achterkamp & Vos 2008; Jepsen & Eskerod 2009; Yang et al. 2011). For example, the categorisation of stakeholders is now recognise by many scholars as an integral part of the project risk management process (Mitchell et al. 1997; Bourne & Walker 2008; Ackermann & Eden 2011; Xia et al. 2018). Similarly, as noted in various works such as Olander (2007), and Atkin and Skitmore (2008), the engagement of stakeholders has become embedded as part of the quality control process for construction projects around the world. In 2013, stakeholder management was officially recognised as a knowledge area in the Project Management Body of Knowledge (PMI 2017). Overall, the review of the literature suggests that

various aspects of project management can be improved through the use of stakeholder theory.

Between the 1990s to early 2000s, many project stakeholder management research focuses on enhancing the identification and classification of stakeholders (Olander & Landin 2005; Bourne and Walker 2007; Eskerod & Huemann 2013; Aaltonen & Kujala 2016). The stakeholder categorising method proposed by Mitchel et al. (1997), for example, divides stakeholders based on the influencing power, legitimacy, and urgency of the respective stakeholders. Fletcher et al. (2003) argued that stakeholders should be mapped based on key performance indicators. Bourne and Walker (2007) proposed their Stakeholder Circle™ methodology to enhance visualisation of stakeholder potential impacts on projects. Overall while there are various methodologies to classify stakeholders, there is common consensus among all the works, which is that different stakeholders should be engaged and managed differently (Olander & Landin 2005; Eskerod & Huemann 2013; Aaltonen & Kujala 2016).

A review of recent stakeholder management literature finds that over the years, the focus of project stakeholder management research began to shift from stakeholder classification towards relationship building and exploring organisation-stakeholder interactions in a project setting (Karlsen, Græe & Massaoud 2008; Aaltonen & Kujala 2016; Eskerod & Vaagaasar 2014; Oppong, Chan & Dansoh 2017; Winch & Cha 2020). Works such as (Karlsen, Græe & Massaoud 2008), (Eskerod & Vaagaasar 2014), and (Oppong, Chan & Dansoh 2017), for example, finds that the extent of trust between the organisation and its stakeholders have a direct relationship with the successful delivery of projects. Other works such as (Box & Platts 2005) and (Davis 2014) finds that the extent of alignment in goals between the organisation and its stakeholders can have an influence on their relationship.

Overall, the review of the project stakeholder management literature finds while mechanisms to enhance the relationship between organisations and stakeholders (trust, alignment in goals, etc.) were identified, there is still a knowledge gap on identifying key actions to enhance relationship building and

organisation-stakeholder interactions in a project setting. As such, this presents an opportunity to explore when during a project is the best time to engage and manage each project stakeholders, respectively.

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3.7 – Defining Stakeholders

Miles (2012) states that there are hundreds of different definitions for the word "stakeholder" in stakeholder management literature. Even today, the contention over what the term "stakeholder" means in the business context remains unresolved (Eskerod & Huemann 2013; Littau, Jujagiri & Adlbrecht 2010; Miles 2012; Eden & Ackermann 1998). The term "stakeholder" can also have other meanings in other disciplines. For example, in the context of property law, a stakeholder can be defined as an escrow agent (Kendall 1964).

Littau, Jujagiri and Adlbrecht (2010) argue that there are two main definitions of the word "stakeholder" in academic literature, one by Freeman (1984), and the other by Cleland (1985), with other definitions being similar to either one or both of these definitions. Freeman (1984) defines stakeholders as "any group of individuals who can affect or is affected by the achievement of the organisation's objectives". Cleland (1985) defines stakeholder as those "who have a vested interest in the outcome of the project". As Freeman (1984) is viewing stakeholders from a business ethics point of view while Cleland (1985) is viewing stakeholders from a project management point of view, this shows that the variation in definitions in the literature is dependent on context.

3.7.1 – Project Stakeholder

From a project management point of view, there have been many definitions of "stakeholder" proposed by academic literature over the years. There is also a contention between different literature on what constitutes a "project stakeholder" (Achterkamp &d Vos 2008; Eskerod, Huemann & Savage 2015). For example, Dinsmore (1990) defines stakeholders as any people "who have a stake in project outcome". Bourne and Walker (2005) define stakeholders as "individuals or groups who have an interest or some aspect of rights or ownership in the project, can contribute in the form of knowledge or support, or can impact or be impacted, by the project". Couillard, Garon and Riznic

(2009) define stakeholders as “entities or persons who are or will be influenced by or exert an influence directly or indirectly on the project”.

PMBoK also has its own definition of stakeholder. PMBoK defines stakeholders as "an individual, group, or organisation, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project" (PMI 2017). The PMBoK definition is perhaps the most developed definition to date as it considers a broader range of stakeholders than the definitions found in other academic literature. The definition states that stakeholders can be affected “by a decision, activity, or outcome of the project”, which considers the impacts on stakeholders due to actions throughout the lifecycle of a project, not just the outcome of the project as suggested by older definitions such as that of Dinsmore (1990).

As this research lies in the area of project management, the research will adopt a variation of the PMBoK definition, where a “project” is defined “a temporary organisation created in order to achieve a set goal or objective” (Turner & Müller 2003).

3.8 – Managing Project Stakeholders

3.8.1 – Classifying Project Stakeholders – Internal and External

In terms of project stakeholder classification, the review of existing academic works finds that most scholars draw clear distinctions between internal and external stakeholders. Internal project stakeholders are those situated within the organisation undertaking the project (Eskerod 2020; Lehtinen 2021; Leung & Olomolaiye 2010; Berringer, Jonas & Knock 2013). The top management team is an example of an internal stakeholder (Ackermann & Eden 2011). External project stakeholders, on the other hand, are those who are situated outside the organisation undertaking the project. As discussed in Chapter 2, environmental NGOs and recreational fishermen are examples of external project stakeholders (Shaw et al. 2018).

The literature review suggests that internal and external project stakeholders need to be attended to using different methodologies (Atkin & Skitmore 2008; Chinyio & Akintoye 2008; Leung & Olomolaiye 2010). For example, according to Atkin & Skitmore (2008), less effort is required to manage internal

stakeholders because of higher similarities in perception between the organisation and internal stakeholders on the idea of effective project management.

Another possibility for the separation between internal and external stakeholders is that both groups should be attended to at different times through the course of a project. For example, according to Chinyio and Akintoye (2008), internal stakeholders are more critical to the successful delivery of the project, and thus should be dealt with before dealing with external stakeholders.

Another interesting observation is that the majority of existing academic works in project stakeholder management focus on external project stakeholders. Recent works such as Lehtinen & Aaltonen (2020), Oppong (2020), and Xia et al. (2018) all focus on external project stakeholder management. This observation suggests that there are opportunities to further explore internal stakeholder management.

3.8.2 – Classifying Project Stakeholders – Variation in Interests and Influencing Power

Another common way in which scholars classify project stakeholders is according to interests and influencing power. Regardless of whether the project stakeholder is internal or external, each project stakeholder will have their own stance, which can vary from supportive to antagonising (McElroy & Mills 2000). McElroy and Mills (2000) proposed that stakeholder positions on a project can be divided into five categories: Active Support, Passive Support, Not Committed, Passive Opposition, and Active Opposition. This means that stakeholders can have either a positive or a negative impact (Ackermann & Eden 2011). A more experienced contractor, for example, may be able to propose a more cost-effective solution, hence bring about a positive impact to the project. On the flip side, environmental NGOs may organise protests, potentially causing schedule delays.

A project stakeholder can also vary in terms of level of interests and level of influencing power (Ackermann & Eden 2011; Eskerod & Huemann 2013). Ackermann and Eden (2011) build on the power-interest grid developed by

Mitchell, Agle and Wood (1997) and demonstrate in practice, how stakeholders can be managed by categorising them into four different groups depending on the level of interests and level of influencing power. Ackermann and Eden's (2011) version of the power-interest grid is illustrated below in **Figure 3-4**.

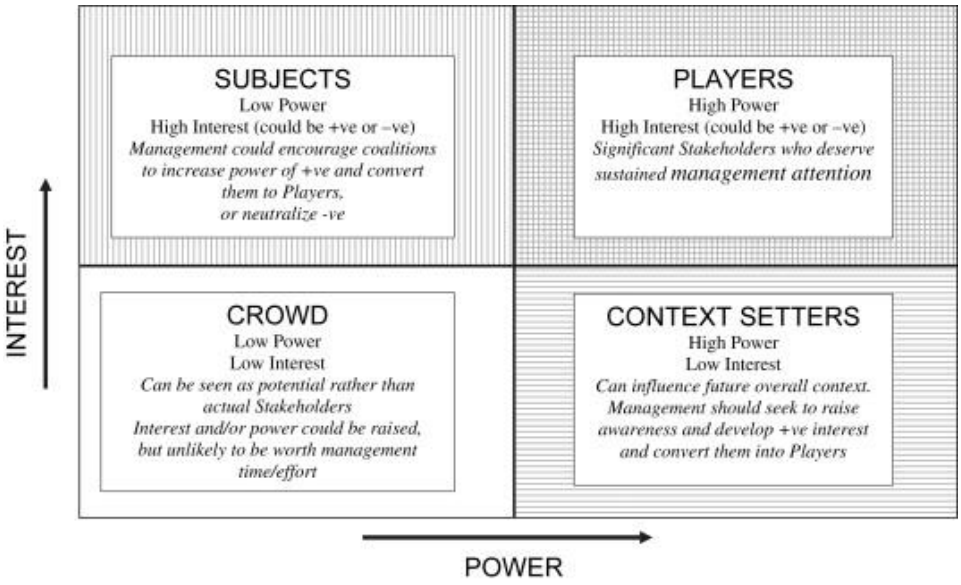


Figure 3-4 – Stakeholder Power-Interest Grid (Ackermann & Eden, 2011)

As seen in **Figure 3-4** (above), a stakeholder can have a high level of interest and a high influencing power, and is thus “player”. For example, in the context of offshore oil and gas decommissioning, a “player” could be a business partner, as they would have the monetary and voting power to impact the project, and a business partner would also have a high level of interest because the performance of the project can have an impact on their business performance. According to Ackermann and Eden (2011), more effort should be placed in managing these “players” than other categories of stakeholder.

A stakeholder can also have a high level of interest, but low power, and is thus a “subject”. For example, in the context of offshore oil and gas decommissioning, a “subject” could be a contractor. A contractor has a high level of interest in the project because the performance of the project can impact their business performance. However, a contractor can be said to have a low influencing power because they are usually bound by the requirements of the client.

A stakeholder can also have a low interest, but high power, and is thus a "context setters". For example, in the context of offshore oil and gas decommissioning, a "context setter" could be the offshore personnel transport company. The offshore personnel transport company may have a low interest on how the project is accomplished, but they have the power to prevent the transportation of workers to the offshore facility to do the decommissioning work.

A stakeholder can also have both a low interest and low power, and is thus a "crowd". For example, in the context of offshore oil and gas decommissioning, a "crowd" could be the general public. The general public is likely to have a low interest in the project, especially if it takes place in an offshore environment, far away from them. The public, in general, also have a lower influencing power on determining how the project is executed than other stakeholders such as regulators and contractors. According to Ackermann and Eden (2011), it is unlikely to be worth the effort to manage stakeholders in this category.

However, Ackermann and Eden (2011) also note that a stakeholder can move from one category to another. As illustrated in **Figure 3-4** (above, page 81), "context setters" can become "players" through an increase in awareness and interests. For example, in the context of oil and gas decommissioning, an environmental NGO might grow in level of interest when becoming increasingly aware of the decommissioning project. This kind of event can make it difficult for project managers to use the interest-power grid to accurately categorise the various stakeholders.

Furthermore, the actions of one stakeholder can Influence the level of interest and level of power of other stakeholders. For example, the publicising of the project's progress by a news agency can influence the level of interest of the general public. A news agency can be considered as a stakeholder as it has an interest in the project's progress. This suggests that project managers should also not only consider the impact of stakeholder management actions on the targeted stakeholder, but also the impact of those actions on other stakeholders.

Furthermore, the conflict of interests on the project does not only exists between the project management team and its stakeholders, but it also exists among the different project stakeholders (Jepsen & Eskerod 2009). This means that it is possible for certain stakeholder groups, to form some sort of an alliance (Ackermann & Eden 2011). This suggests that for projects with a larger number of stakeholders, it may be possible to group multiple stakeholders together and manage them as a group rather than as individuals.

3.8.3 – Industry Practices on Classifying Project Stakeholders

The stakeholder power-interest grid is also found in the handbooks of project management methods such as PRINCE2 and PMP (Murray-Webster & Simon 2006; Hinde 2018). The literature review also found that the stakeholder power-interests grid has been used by project managers to identify, analyse, and prioritise project stakeholder management efforts. Examples of its use can be found in various academic and industry literatures, including in the field of construction (Cheung, Yiu & Lam 2013; Yu & Leung 2018; Lin, Ho & Shen 2018; Dansoh, Frimpong & Oppong 2020), in the field of mining (Dong, Burritt & Qian 2014; Moffat & Zhang 2014), and in the field of oil and gas (Mimmi et al. 2017; Genter 2019). This suggests that using the stakeholder power-interest grid could be a form of industry best practice to manage project stakeholders.

3.8.4 – Project Stakeholder Engagement

Stakeholder engagement is how organisations interact with stakeholders to manage stakeholder relationships (Greenwood 2007). According to Kujala & Sachs (2019), stakeholder engagement is how organisations apply stakeholder theory in practice. A review of the literature in project stakeholder engagement finds that the literature can be divided into two bodies – one focusing on strategic engagement and the other focusing on moral engagement (Noland & Phillips 2010).

Strategic engagement, also termed as amoral engagement, primarily focuses on value creation for the organisation (Donaldson & Preston 1995; Noland & Phillips 2010). While strategic engagement may maximise value creation for the organisation, for some researchers there is concern about the ethical and

moral implications of the approach (Freeman 1999). Overall, this suggests that there is a need to move beyond Friedman's (1962) view of the world and consider a wealth of other stakeholders rather than just prioritising shareholders.

Moral engagement, on the other hand, is primarily driven by ethical behaviours, building on the idea that benefits are derived from the establishment of positive long-term relationships between the organisation and its stakeholders (Noland & Phillip 2010; Freeman et al. 2010).

Overall, according to Kujala & Sachs (2019), stakeholder engagement should be both strategic and moral in practice. This suggests that project managers should strive to achieve an appropriate balance between being strategic and ethical when developing stakeholder engagement strategies. As such, it is possible that the intention of engagement could influence the effectiveness of stakeholder engagement for oil and gas decommissioning activities.

3.8.5 – The Focus on Trust

Trust is described in the context of stakeholder engagement as the willingness to be vulnerable (Rousseau et al. 1998; Eskerod & Vaagaasar 2014; de Oliveira & Rabechini Jr. 2019). Among the various factors identified by various scholars, the literature review finds that academic works seem to converge on the main theme of "Trust". Pinto et al. (2009) indicated that trust can reduce project schedule and cost by improving the working relationship among stakeholders and project competency. According to Karlsen et al. (2008), trust facilitates the exchange of information, enabling better decision making. Eskerod and Vaagaasar's (2014) research suggests that the greater the extent of trust, the better the relationship between the organisation and stakeholders, facilitating more effective management of conflict and issues that may arise in projects. Overall, the literature review suggests that there is a strong integration between the concepts of trust and stakeholder engagement. The literature review also suggests that trust can improve various aspects of project management.

With regard to recommended actions for building trust, the literature review also found various conceptual models in the field of stakeholder management.

These ideas and recommended actions introduced in these conceptual frameworks could be woven into the stakeholder-oriented critical paths developed in this research. These existing conceptual models may also be useful when developing the overall conceptual framework when summarising the research findings. For example, Cheung, Yiu and Lam's (2013) model, as seen in **Figure 3-5** (below), suggests that improving the level of trust influences project performance by influencing the quality of communication among project stakeholders.

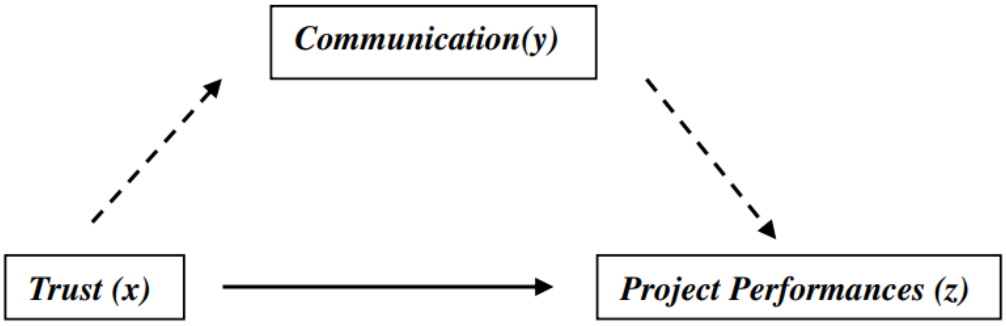


Figure 3-5 – Factors Impacting Project Performance (Cheung et al., 2013)

Perhaps one of the most relevant and recent works on stakeholder engagement is the conceptual framework developed by (Moffat & Zhang 2014). The work of Moffat and Zhang (2014) is particularly relevant because it has been recently referenced in oil and gas decommissioning literature, notably in the work of Genter (2019). **Figure 3-6** (below) illustrates the conceptual framework developed by Moffat and Zhang (2014).

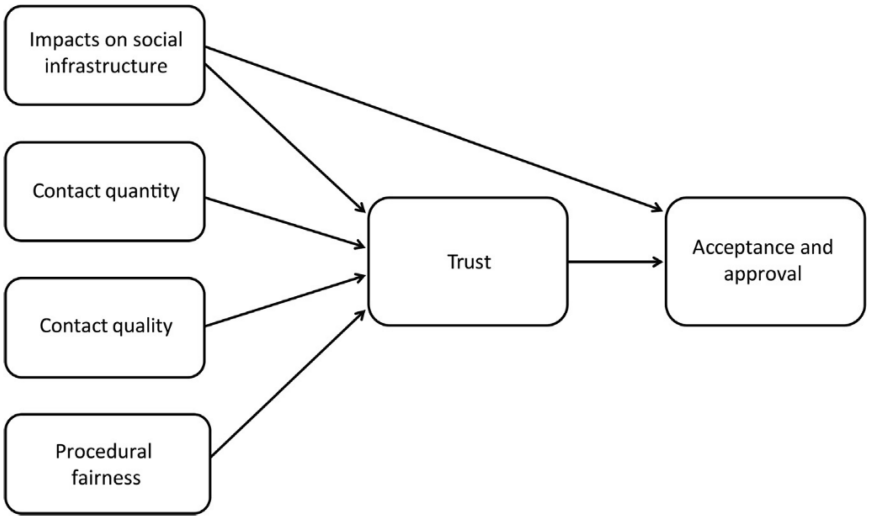


Figure 3-6 – Conceptual Framework for Managing Stakeholders for Mining Decommissioning Projects (Moffat & Zhang 2014)

According to Moffat and Zhang (2014), the extent of trust between the organisation and its stakeholders is key to the acceptance and approval of the mining decommissioning. Additionally, among the four factors identified by Moffat and Zhang (2014) that influence the extent of trust, contact quality was identified as the most significant factor in building the extent of trust. This suggests that stakeholder engagement methods should be more focused on building trust.

It must also be noted that there is another group of literature linking co-creation of knowledge with the effectiveness of stakeholder engagement, which includes works such as Keeys and Huemann (2017), Kazadi, Lievens and Mahr (2016), and Jull, Giles and Graham (2017). There is also another group of studies on the influence of procedural rationale and procedural fairness on stakeholder acceptance - Simon (1976), Dean Jr and Sharfman (1993), Kim and Mauborgne (1998), and Moffat and Zhang (2014). This suggests that co-creation of knowledge and procedural fairness could be useful stakeholder engagement techniques that can be used to build trust.

Some of these studies also moves deeper into the discipline of behavioural science, political science, and mass psychology, which is beyond the scope of this thesis. However, the literature review does suggest that works on oil and gas decommissioning and stakeholder management could move in that direction.

3.9 – Managing Project Stakeholders in Oil and Gas Decommissioning

As mentioned earlier (in **Section 3.3.3**, see page 65) when discussing the management of project scopes, multi-criteria decision-making tools such as the CA, NEBA, and BPEO are currently being used extensively by oil and gas operators to incorporate stakeholder views into the evaluation and selection of decommissioning options (Gordon, Poot & O'Connor 2019; Marfatia 2019; Hughes & Jagerroos 2019). This suggests that the use of multi-criteria decision-making frameworks is currently being deemed as best practice by oil and gas operators to manage stakeholders for oil and gas decommissioning projects.

The review of oil and gas decommissioning literature related to stakeholder management supports the findings mentioned in the project scope management (see **Section 3.3.3**). The literature review finds that there is a high reliance on the use of multi-criteria decision-making tools by oil and gas operators to manage its stakeholders. For example, Gordon, Poot and O'Connor (2019) stated that multi-criteria decision-making tools such as CA are used by oil and gas operators to improve the confidence of stakeholders in decommissioning decisions.

However, the review of oil and gas decommissioning literature related to stakeholder management finds that the emphasis on stakeholder management in the context of oil and gas decommissioning has only been placed on the management of stakeholders during the evaluation and selection of decommissioning options (Complete Removal, Rigs-to-Reefs, etc.). However, as suggested by the work of Eskerod and Vaagaasar (2014), stakeholder interactions can take place throughout the entire course of a project. This indicates that there is an opportunity to explicitly explore other stakeholder interactions that occur at other points of an oil and gas decommissioning project lifecycle and identify the best practices to manage those interactions.

The review of oil and gas decommissioning literature related to stakeholder management also finds that the emphasis has been placed solely on managing public stakeholders. This indicates that there is also an opportunity

to explicitly explore the interactions between operators and other stakeholder groups, such as internal stakeholders, regulators, and contractors.

The review of industry literature also indicated that the regulations of some countries, such as the United Kingdom, Thailand, and Malaysia, require the use of multi-criteria decision-making tools to consider stakeholder views (OPRED 2013; OGA 2016a; Tularak, Khan & Thungsuntonkhun 2007; Jagerroos & Kayleigh 2019). This suggests that the ways in which stakeholders are being managed for oil and gas decommissioning could also be influenced by regulations. The regulatory aspect of oil and gas decommissioning will be explored in more detail in ***Chapter 4: Regulating Oil and Gas Decommissioning***.

3.9.1 – Project Stakeholder Analysis

Regarding prioritisation of stakeholders, some investigation has been done through the works of Advisian (2017) and Shaw, Seares and Newman (2018). Based on the work of Shaw, Seares and Newman (2018), most of the stakeholders identified have environmentally related concerns, which suggests that environmental stakeholders are perhaps the most important. However, while environmental stakeholders may be important, there is still a gap in the knowledge regarding how and when to best engage and manage these stakeholders during an oil and gas decommissioning project.

In terms of stakeholder mapping, it is likely that oil and gas operators adopt the stakeholder management tools and techniques of PMP and PRINCE2 because some oil and gas decommissioning industry literature mentions them in their work (Sommer et al. 2015; Zulkipli & Saw 2019; Ahiaga-Dagbui et al. 2017). However, there are some limitations to current stakeholder management tools and techniques (Eskerod & Huemann 2013). This suggests that stakeholder impacts on oil and gas decommissioning projects could be due to the limitations of stakeholder management tools and techniques. It also indicates that there is an opportunity to explicitly explore the effectiveness of current stakeholder mapping tools and techniques to improve existing stakeholder management tools and techniques

3.9.2 – Project Stakeholder Engagement

In terms of engaging stakeholders, there is no academic literature that explicitly explores this area in the context of oil and gas decommissioning. However, the review of the industry literature finds that there is one related study conducted by Genter (2019). Genter's (2019) paper hypothesises that the framework developed by Moffat and Zhang (2014) for the management of stakeholders in the mining industry is applicable for oil and gas decommissioning as well.

As mentioned earlier, Moffat and Zhang (2014) state that contact quality was is more important than other factors (impacts on social infrastructure, contact quantity, contact quality, and procedural fairness) in terms of building the extent of trust. This suggests that the effectiveness of stakeholder engagement

for oil and gas decommissioning is perhaps more dependent on the quality of the engagement (contact quality) rather than the robustness of the multi-criteria decision-making tool used (procedural fairness).

However, Genter (2019) did not explicitly study the determinants for effective stakeholder engagement in oil and gas decommissioning. The paper merely suggests that there are similarities and parallels between mining decommissioning and oil and gas decommissioning and attempts to fit the model of Moffat and Zhang (2014) into the context of oil and gas decommissioning. This indicates an opportunity to explicitly explore the determinants for effective stakeholder engagement in an actual context of oil and gas decommissioning.

3.10 – Summary of Stakeholder Management Literature

In summary, the review of stakeholder management literature finds that the discipline is still in its infancy, which suggests that there are many opportunities for expanding the body of knowledge. In terms of managing project stakeholders, the literature review also found that more focus has been placed on managing external stakeholders (e.g. contractors, public stakeholders) as oppose to internal stakeholders (e.g. employees, managers). The literature review also found that more focus has been placed on developing stakeholder analysis tools as opposed to improving the actual stakeholder engagement methods. In the literature that highlights stakeholder engagement, extent of trust and quality of communication seem to be recurring themes linking the effectiveness of stakeholder engagement to project performances, as seen through the work of Eskerod and Vaagaasar (2014), Cheung, Yiu and Lam (2013), Moffat and Zhang (2014), and Genter (2019).

In terms of managing stakeholders for oil and gas decommissioning projects, the literature has been primarily focused on the application and improvement of multi-criteria decision-making frameworks to consider stakeholder views. The focus has also been placed primarily on managing public stakeholders. This suggests that there is a gap in knowledge regarding the interactions between the project manager with other project stakeholders such as the regulators, contractors and employees. There is also yet to be any literature that explicitly explores the best times to engage stakeholders throughout an oil

and gas decommissioning project. This research will therefore seek to explore this front through the design and analysis of stakeholder-oriented critical paths. Further details regarding the research method can be found in ***Chapter 5: Research Methodology***.

The review of stakeholder management literature also suggests that regulatory procedures can have an influence on the methods project managers can use to manage stakeholders. This further suggests that regulations could possibly influence procedural fairness. The following chapter, ***Chapter 4: Regulating Oil and Gas Decommissioning*** will review the literature in the discipline of law, in order to identify any gaps within the literature.

Chapter 4: Regulating Oil and Gas Decommissioning

4.0 – Chapter Abstract

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning***, regulations can influence the precise decommissioning method. In ***Chapter 3: Managing Oil and Gas Decommissioning***, it was mentioned that regulations have some degree of influence on project scoping and stakeholder management. Overall, the literature suggests that the role of regulations is significant in oil and gas decommissioning. This chapter will explore the regulatory aspect of oil and gas decommissioning in order to highlight features and challenges of managing and regulating oil and gas decommissioning.

The chapter will begin by showing the evolution of international and regional regulatory regimes and demonstrate how they impact oil and gas decommissioning. This will cover key international regulations including the Convention on the Continental Shelf 1958, the London Convention 1972, the United Nations Convention on the Law on the Sea (UNCLOS) 1982, and the International Maritime Organization (IMO) Guidelines 1989. The chapter will then proceed to explore regional regimes such as the OSPAR Convention 1992, OSPAR Decision 98/3, and the ASEAN Council on Petroleum (ASCOPE) Decommissioning Guidelines 2015.

The chapter will then move on to explore and compare the main features of four domestic oil and gas decommissioning regulation regime (United Kingdom, Australia, United States and Thailand) and highlight the challenges and complexity domestic regulations add to oil and gas decommissioning.

It must be noted that the scope of this research is only limited to the context of the United Kingdom and Australia. However, reviewing the regulations of other jurisdictions (United States and Thailand) is necessary in order to illustrate the variation in regulatory approaches across different jurisdictions and demonstrate how regulations add to the challenges and complexity of managing and regulating oil and gas decommissioning.

4.1 – The Evolution of International and Regional Regimes

4.1.1 – United Nations Convention on the Continental Shelf 1958

The literature review finds that the starting point for discussing the development of oil and gas decommissioning regimes is the United Nations Convention on the Continental Shelf 1958 (Gordon, Paterson & Usenmez 2018a; Paterson 2015; Chandler et al. 2017; Igiehon & Park 2001). In other words, this means that oil and gas decommissioning regulations have been developing for over 62 years, which suggests many issues and challenges faced by governments today are not actually entirely new.

The purpose of the United Nations Convention on the Continental Shelf 1958, more commonly known as the Geneva Convention 1958, was to regulate activities taking place outside territorial waters which were subject to a degree of coastal state jurisdiction, including oil and gas activities. It states that:

> *Any installation which is abandoned or disused must be entirely removed.*
>
> *– Article 5(5), Geneva Convention on the Continental Shelf, 1958*

"*Must be entirely removed*" suggests that Complete Removal is the only acceptable decommissioning option. While this was reasonable in 1958, as most oil and gas facilities at that time were located in shallow waters, the complete removal of certain types of oil and gas structures today in the year 2020 may not be technically feasible. For example, as mentioned earlier in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 32), it is costly and technically challenging to completely remove concrete gravity-based substructures and pipeline bundles in deep water conditions. This means that that the strict enforcement of Article 5(5) of the 1958 Geneva Convention is perhaps unrealistic in today's context.

Additionally, Article 5(5) of the 1958 Geneva Convention can also be subjected to a purposive interpretation (Gordon, Paterson & Usenmez 2018a; Paterson 2015; Roberts 1994; Daintith 2012). In 1987, the United Kingdom challenged Article 5(5) of the 1958 Geneva Convention, stating the purpose of Article 5(5) was defined in Article 5(1), which states that:

…the exploitation of natural resources must not result in any unjustifiable interference with navigation, fishing or the conservation of the living resources of the sea

– Article 5(1), Geneva Convention on the Continental Shelf, 1958

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 37)**,** particularly in the Rigs-to-Reefs literature, and also mentioned in the works of Paterson (2015) and Daintith (2012), the complete removal of an oil and gas facility may result in more "*interference to fishing and the conservation of the living resources of the sea*" than other options such as Partial Removal and Rigs-to-Reefs. For example, as mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 37), removing an oil and gas facility can disrupt the existing marine ecosystem and threaten marine life. This suggests that more flexible regulations are needed to allow alternatives to Complete Removal.

4.1.2 – UNCLOS (UN Law of the Sea Convention) 1982

Considering the uncertainties of the 1958 Geneva Convention, and the advancement in oil and gas technology to exploit oil and gas in deeper waters, a new regime was introduced in the form of UNCLOS 1982. UNCLOS 1982 has since been widely regarded as the most wide-ranging convention on the marine environment, covering areas such as sea travel, overflight, exploitation of resources, conservation of marine resources, and shipping.

The section of UNCLOS 1982 that is most related to oil and gas decommissioning is Article 60(3), which states that:

Any installations or structures which are abandoned or disused shall be removed to ensure the safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organisation. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of the other States. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed.

- Article 60(3), United Nations Convention on the Law of the Sea, 1982

Article 60(3) starts off by stating that all oil and gas facilities "*shall be removed*". This suggests that Complete Removal remains as the preferred decommissioning option. However, the reference to the overall purpose and objective which follows, suggests that UNCLOS 1982 is also accepting of other decommissioning options such as Partial Removal and Rigs-to-Reefs.

Article 60(3) also states that oil and gas decommissioning activities should consider the "*generally accepted international standards established by the competent international organisation*". However, this raises questions regarding the identity of the "*competent international organisation*". This also suggests that both the "*competent international organisation*" and the "*generally accepted international standards*" can change at any time, creating uncertainties for oil and gas decommissioning.

The literature review finds that all the authors recognise that the "*competent international organisation*" Article 60(3) refers to is the IMO, specifically the Maritime Safety Committee, and the "*generally accepted international guidelines*" Article 60(3) refers to is the IMO Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone (IMO Guidelines) (Hamzah 2003; Gordon, Paterson & Usenmez 2018a; Paterson 2015; Trevisanut 2020; Chandler et al. 2017). Much emerging domestic legislation, such as that of Malaysia, Thailand, Indonesia, and Brunei, are based on IMO Guidelines (Fam et al. 2018; Jagerroos & Kayleigh 2019). This suggests that IMO Guidelines are currently the most widely accepted international standards on oil and gas decommissioning.

4.1.3 – IMO (International Maritime Organisation) Guidelines 1989

The IMO Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone were released in 1989. The IMO Guidelines can reasonably be said to be the most detailed and comprehensive international oil and gas decommissioning regulations to date (Hamzah 2003; Gordon, Paterson and Usenmez 2018a; Paterson 2015; Trevisanut 2020; Saraceni and Liddle 2018; Chandler et al. 2017). However, the IMO Guidelines are not legally binding. The IMO assembly resolution states that it only "*recommends that member governments take into account the aforesaid guidelines and standards when making decisions regarding the removal of abandoned or disused installations or structures*". This means that it is not a must for signatories to UNCLOS to adopt the IMO Guidelines into their domestic legislation. (Hamzah 2003; Gordon, Paterson & Usenmez 2018a; Paterson 2015; Trevisanut 2020; Chandler et al. 2017).

Paragraph 1.1 of the IMO Guidelines states that:

> *Parties are obliged to remove all abandoned and disused offshore installations on any continental shelf or in any exclusive economic zone except where non-removal or partial removal is consistent with the guidelines.*
>
> *– Paragraph 1.1, the International Maritime Organisation Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989*

Similar to Article 60(3) of UNCLOS 1982, Paragraph 1.1 of the IMO Guidelines begins by stating that *"parties are obliged to remove all abandoned and disused offshore installations"*, suggesting that Complete Removal is still the preferred decommissioning option. In the case of *"non-removal"* or *"partial removal"*, Paragraph 1.1 states that it must be *"consistent with the guidelines"*. This suggests that a case-by-case approach to decommissioning should be adopted, assessing each case based on consistency with the other subsections of the guidelines: navigation, cost and technical feasibility, health and safety, and reasonable justification for a new use of the decommissioned platform (Gordon, Paterson & Usenmez 2018a; Paterson 2015).

Conditions for 'Non-Removal' or 'Partial Removal

The IMO Guidelines also specify certain conditions in which *"non-removal"* or *"partial-removal"* can be considered. For example, Paragraph 3.1 of the IMO Guidelines states that:

> *All installations standing in less than 75 m of water and weighing less than 4000 tonnes in air (excluding deck and superstructure), and all installations placed on the seabed after 1998 standing in less than 100 m of water and weighing less than 4000 tonnes must be removed.*
>
> *– Paragraph 3.1, the International Maritime Organization Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989*

Paragraph 3.1 distinctly separates oil and gas infrastructures' water depth, weight, and time of installation. However, by categorising oil and gas infrastructures, it can make assessing decommissioning on a case-by-case basis a more complicated process. For example, should an oil and gas installation that is standing in less than 75 m of water and weighing less than 4000 tonnes in air be removed if its removal means disrupting the existing marine ecosystem?

Paragraph 3.13 follows up on Paragraph 3.1 stating that:

> *As of 1 January 1998, no installation should be placed on the continental shelf or in the exclusive economic zone unless the design and construction are such that it makes it feasible to remove the installation in its entirety.*
>
> *– Paragraph 3.13, the International Maritime Organization Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989*

Paragraph 3.13 suggests that the precise decommissioning option of oil and gas facilities is dependent on the *"design and construction"* of the oil and gas facilities, which supports the findings from the review of engineering literature in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 32).

There are also various other sections of the IMO Guidelines that shows that there are exceptions to the conditions stated in Paragraph 3.1 and Paragraph 3.13. For example, Paragraph 3.7 states that:

> *Installations or structures which no longer serve the primary purpose for which they were originally designed or installed and are located in approaches to or in straits used for international navigation or routes used for international through archipelagic waters should be entirely removed and should not be subject to any exception*
>
> *– Paragraph 3.7, the International Maritime Organization Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989*

This suggests that stakeholder interests and concerns and hence the precise decommissioning option are dependent on the location of the oil and gas facility as well. This supports the findings from the review of environmental science literature in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 41).

In addition to the decommissioning of the oil and gas facility, the IMO Guidelines recognise Rigs-to-Reefs as a possible decommissioning alternative. Paragraph 3.12 states that:

> *Where living of resources can be enhanced by the placement on the sea-bed of material from removed installations or structures (e.g. to create an artificial reef), such material should be located well away from customary traffic lanes, taking into account these guidelines and standards and other relevant standards for the maintenance of maritime safety.*
>
> *– Paragraph 3.2, the International Maritime Organization Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989*

Paragraph 3.2 suggests that the IMO recognises that Rigs-to-Reefs can benefit marine life. Paragraph 3.2 also suggests that the impact of Rigs-to-Reefs is dependent on the location. However, Paragraph 3.2 clearly states that there is a need to consider both the IMO Guidelines and *"other relevant standards"*. This means that oil and gas decommissioning operations need to consider not only the compliance of the activity with oil and gas regulations,

but also other relevant regulations (e.g. environmental regulations, fishing regulations).

The need to consider compliance with regulations beyond oil and gas suggests the interdisciplinary nature of the activity of oil and gas decommissioning itself. From a regulatory law standpoint, this also raises the question of whether the *"other relevant standards"* considered their applicability to oil and gas decommissioning activities when they were drafted.

4.1.4 – London Dumping Convention 1972

Examples of *"other relevant standards"* mentioned in the IMO Guidelines are the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, more commonly known as the London Dumping Convention 1972, and the London Protocol 1996.

The London Dumping Convention details a list of materials that may or may not be dumped. The list of materials can be divided into three categories:

> *Annex I includes items such as hydrocarbon and radioactive waste. Items in Annex I cannot be dumped under any circumstances.*
>
> *Annex II include items such as metals, copper, zinc, etc. Prior special permit is required for the dumping of items in Annex II*
>
> *For other items not listed in Annex I and Annex III, prior general permit is required for the dumping.*
>
> *– The London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972*

A comparison of the list of materials from the Annexes of the London Dumping Convention 1972 with findings from the review of engineering literature in ***Chapter 2: Exploring Oil and Gas Decommissioning*** suggests that oil and gas facilities may contain items from all three categories. Storage cells, for example, may contain residual hydrocarbons, and hence they may be classified as an Annex I item. A steel jacket, for example, is made of metal, and hence it may be classified as an Annex II item. This means that different parts of the facility, and different decommissioning activities, are subjected to

different rules and regulations, which adds further complexity to the management of oil and gas decommissioning projects.

4.1.5 – OSPAR Convention 1992

The Convention for the Protection of the Marine Environment of the North-East Atlantic 1992, more commonly known as the OSPAR Convention 1992, is a regional agreement on dumping for the North-East Atlantic region. The convention amalgamated and brought up to date the 1972 Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft and the 1974 Paris Convention for the Prevention of Marine Pollution from Land-based Sources. The name OSPAR, is a combination of the terms “Oslo” and “Paris”.

The OSPAR Convention of 1992 places an obligation on contracting parties *“to prevent and eliminate pollution and take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected”.* Contracting parties must also apply the precautionary principle when meeting obligations (Gordon, Paterson and Usenmez 2018a; Paterson 2015).

According to Article 1(f) of the OSPAR Convention 1992, “dumping” is defined in the convention as:

> *(i) Any deliberate disposal in the maritime area of wastes or other matter (1) from vessels or aircraft; (2) from offshore installations.*
>
> *(ii) Any deliberate disposal in the maritime area of (1) vessels or aircraft; (2) offshore installations and offshore pipelines.*
>
> *– Article 1(f), the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992*

Following Article 1(f), Article 1(g) of the OSPAR Convention 1992 states that "dumping" does not constitute:

> *(i) The disposal in accordance with the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, or other applicable international law, of wastes or other matter incidental to, or derived from, the normal operations of vessels or aircraft or offshore installations other than wastes or other matter transported by or to vessels or aircraft or offshore installations for the purpose of disposal of such wastes or other matter or derived from the treatment of such wastes or other matter on such vessels or aircraft or offshore installations.*
>
> *(ii) Placement of matter for a purpose other than the mere disposal thereof, provided that, if the placement is for a purpose other than that for which the matter was originally designed or constructed, it is in accordance with the relevant provisions of the Convention.*
>
> *(iii) For the purposes of Annex III, the leaving wholly or partly in place of a disused offshore installation or disused offshore pipeline, provided that any such operation takes place in accordance with any relevant provision of the Convention and with other relevant international law.*
>
> *– Article 1(g), the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992*

Articles 6, 8 and 10 also note that Partial Removal and Non-Removal are allowed for certain circumstances, such as in the case of *force majeure*, or *"for a purpose other than that for which it was originally designed or constructed"*. This suggests that not all oil and gas facilities can and should be removed, which agrees with the findings from ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 51).

Regarding oil and gas decommissioning, Article 5 states that *"contracting parties shall take, individually and jointly, all possible steps to prevent and eliminate pollution from offshore sources in accordance with the provisions of the Convention, in particular as provided for in Annex III".*

Article 2(1) of Annex III states that:

> *When adopting programmes and measures for the purpose of this Annex, the Contracting Parties shall require, either individually or jointly, the use of:*
>
> *(i) Best available techniques*
>
> *(ii) Best environmental practice including, where appropriate, clean technology*
>
> *Article 2, Annex III, the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992*

This suggests that there is a need to consider the advancement in technology over time when making oil and gas decommissioning decisions. However, this can be challenging as new and more advance technology, as mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 51), can be costly, impacting on the overall cost.

Article 5(1) of Annex III further states that:

> *No disused offshore installation or disused offshore pipeline shall be dumped and no disused offshore installation shall be left wholly or partly in place in the maritime area without a permit issued by the competent authority of the relevant Contracting Party on a case-by-case basis.*
>
> *- Article 5(1), Annex III, the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992*

Article 5(1) of Annex III suggests that the power for approving oil and gas decommissioning proposals rest with the *"competent authority of the relevant Contracting Party"*. However, Article 5(3) states that:

> *Any Contracting Party which intends to take the decision to issue a permit for the dumping of a disused offshore installation or a disused offshore pipeline placed in the maritime area after 1st January 1998 shall, through the medium of the Commission, inform the other Contracting Parties of its reasons for accepting such dumping, in order to make consultation possible.*
>
> *- Article 5(3), Annex III, the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992*

Article 5(3) of Annex III indicates that the OSPAR Commission and other contracting parties are also stakeholders of oil and gas decommissioning

projects in the North-East Atlantic region. This means that for oil and gas decommissioning projects, stakeholders are not confined to the location where the project takes place. Oil and gas decommissioning stakeholders can be regional or international.

4.1.6 – The Brent Spar Incident

International, regional, and domestic oil and gas decommissioning regimes after 1995 were highly influenced and impacted by the Brent Spar Incident (Hamzah 2003; Gordon, Paterson & Usenmez 2018a; Paterson 2015; Trevisanut 2020; Chandler et al. 2017). Understanding the legal treatment of the Brent Spar incident is therefore necessary in order to understand the further evolution of international and regional oil and gas decommissioning regimes beyond 1995.

4.1.6.1 – The Original Decommissioning Plan

The Brent Spar, or Brent Echo, was a spar unit located in the Brent Field. A spar is a floating offshore oil and gas structure acting as a storage and offloading unit. Prior to the completion of the Brent pipelines, the Brent Spar stored the hydrocarbons produced by the four Brent platforms (Brent Alpha, Brent Bravo, Brent Charlie, and Brent Delta) prior to their being loading onto tankers for transport to shore. The Brent Spar weighed 14,500 tonnes in air and was declared to have no further value in 1991 following the completion of the Brent pipelines.

In February 1994, Shell submitted an Abandonment Plan to the DTI (Department of Trade and Industry). The plan was to tow the Brent Spar to the North Feni Ridge in the North Atlantic and sink it in deep water. The Abandonment Plan was a result of years of discussions between Shell and the DTI, and a multi-criteria decision-making tool, BPEO (Best Practicable Environmental Option), was also used to determine the decommissioning option, which suggests that a lot of considerations were taken into account when making the decision.

In December 1994, the Abandonment Plan was approved by the DTI. There were also no objections raised by any other contracting parties of the Oslo Convention regarding the Brent Spar decommissioning when they were

notified by the DTI in February 1995. The reason for not selecting the Complete Removal option was that sinking the Brent Spar at North Feni Ridge was six times safer and four times cheaper. It must be noted that at that time, the original proposed plan for the decommissioning of Brent Spar did comply with all international and regional regimes at that time including UNCLOS 1982, the IMO Guidelines 1989, the London Dumping Convention 1972, and the Oslo Convention 1972. However, the plan to sink the Brent Spar in the North Atlantic did not sit well with Greenpeace.

4.1.6.2 – The Brent Spar Protest

In April 1995, four Greenpeace activists boarded the Brent Spar and collected samples of Brent Spar's contents. However, because the samples were collected wrongly, Greenpeace's report claimed that there were more than 5,500 tonnes of oil on Brent Spar, 110 times more than Shell's original estimate. This action by Greenpeace suggests a lack of trust between Greenpeace and Shell regarding the amount of oil on Brent Spar. It must be noted that as mentioned earlier in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 84), building trust is key for effective stakeholder management.

Following the interactions between Shell and Greenpeace in April 1995, Greenpeace began mounting an extensive media campaign across Europe. Greenpeace's campaign began to attract more media attention and influence public opinion on the issue (Dickson & McCulloch 1996; Elkington & Trisoglio 1996; Grolin 1998; Zyglidopoulos 2002). This means that stakeholders can have the power to influence the interests and opinions of other stakeholders. This suggests that there is a need to consider the interactions among stakeholders themselves in addition to the interactions between organisations and stakeholders.

The Brent Spar protest reached its climax in June 1995. On 11 June, a confrontation took place between Greenpeace and Shell on the Brent Spar. Greenpeace activists were sprayed with water cannons for 20 minutes. Greenpeace activists also sabotaged, in Aberdeen Harbour, a vessel which was meant to tow the Brent Spar to North Feni Ridge. The confrontation

between Greenpeace and Shell went on for days, until 16 June when the Greenpeace activists were evicted from the Brent Spar (Dickson &McCulloch 1996; Elkington & Trisoglio 1996; Grolin 1998; Zyglidopoulos 2002).

Figure 4-1 – Greenpeace's Occupation of the Brent Spar (The Times, 1995)

At the same time, there was a boycott of Shell products and services across Europe, resulting in a loss of sales that amounted to millions of dollars. There were also reports of arson and shootings at Shell service stations in Germany (Dickson & McCulloch 1996; Elkington & Trisoglio 1996; Grolin 1998; Zyglidopoulos 2002). This shows that stakeholders can have a significant impact on the financial performance of an organisation, which supports Freeman's (1984) stakeholder theory. This also suggests that the impacts of project stakeholders are not confined to a specific project, but the impacts can also be felt by other projects and programmes within the business portfolio.

Finally, on 20 June, Shell abandoned its original decommissioning plan and had to come up with a new plan for decommissioning the Brent Spar onshore (Dickson & McCulloch 1996; Elkington & Trisoglio 1996; Grolin 1998; Zyglidopoulos 2002). Considering that the decommissioning of Brent Spar was supposed to be executed on 11 June, this also demonstrates that stakeholders can significantly impact project schedules. This also demonstrates that stakeholders can significantly impact the scope of a project.

It is also worth noting that not only did Shell have to change its approach, but the UK government was unable to persuade Shell to do what it had been

licensed to do. It can be persuasively argued that Shell ultimately ran an alternative regulatory process, which the UK government simply had to accept, though it strongly disagreed (Gordon, Paterson & Usenmez 2018a; Paterson 2015). The Brent Spar was eventually dismantled in Norway and the materials from the unit were reused for the construction of a harbour in Stavanger (Dickson & McCulloch 1996; Elkington & Trisoglio 1996; Grolin 1998; Zyglidopoulos 2002).

By reviewing the events of the Brent Spar protests, it can be seen that for oil and gas decommissioning, complying with regulations alone is insufficient to satisfy stakeholders. The review of the events of the Brent Spar protests also finds that it was the result of a chain of events from April 1995 to June 1995, and that Greenpeace became more and more impactful over time. This suggests that it is perhaps more effective to engage stakeholders earlier on in the project in order to prevent stakeholder impacts from escalating further.

4.1.6.3 – The Impact of the Brent Spar Incident

From an organisational management standpoint, the Brent Spar incident resulted in a change in the stakeholder management approach for oil and gas decommissioning projects. Shell, for example, developed and implemented a Stakeholder Dialogue Process, to engage stakeholders and consider their views for the re-planning of the Brent Spar decommissioning (Gordon, Paterson and Usenmez 2018a; Paterson 2015). The idea of engaging stakeholders has also been adopted by several oil and gas organisations into their decommissioning planning approaches (Palandro and Aziz 2018; Bills 2018; Gordon, Poot and O'Connor 2019; Hughes and Jagerroos 2019).

On the legal front, the Brent Spar incident resulted in significant changes in international, regional, and domestic oil and gas decommissioning regimes (Hamzah 2003; Gordon, Paterson & Usenmez 2018a; Paterson 2015; Trevisanut 2020; Chandler et al. 2017). The rules set out in the international and regional regimes post-Brent Spar, for example, appear much more stringent than its predecessors (Gordon, Paterson & Usenmez 2018a; Paterson 2015; Chandler et al. 2017). **Sections 4.1.7**, **4.1.8**, and **4.1.9** (below,

pages 106 to 112) will detail the evolution of oil and gas decommissioning regimes post-Brent Spar.

4.1.6.4 – Recent Developments

In 2017, the proposal for the decommissioning of the remaining offshore structures in the Brent Field was submitted to BEIS (the Department for Business, Energy, and Industrial Strategy) (Shell 2017d). However, in 2019, there was another protest organised by Greenpeace, this time regarding the decision to leave in place concrete-gravity based storage cells in the North Sea (Thomas 2019). This suggests that the issue of stakeholder impacts on oil and gas decommissioning projects is still prevalent and relevant today.

Figure 4-2 – Greenpeace's Occupation of the Brent Bravo (Bloomberg, 2019)

One key concern raised by Greenpeace was that a total of three samples were collected and used as evidence to justify the decision to leave in place 64 concrete-gravity-based storage cells in the North Sea (Shell 2017b; Shepherd et al. 2017). However, Shell argued that accessing the concrete-gravity-based storage cells to collect more samples was technically and environmentally risky. Shell also argued that it was technically and environmentally difficult to remove the concrete-gravity-based storage cells and bring them to shore (Shepherd et al. 2017; Shell 2017d). Discussions regarding the decommissioning of the concrete-gravity-based storage cells are still ongoing at the time this thesis was submitted.

The review of the Brent Spar incident and the recent Brent Field protests suggests that the evidence and the way the evidence is collected and analysed (i.e. procedural justice) are essential to gaining the approval and acceptance of environmental NGOs such as Greenpeace. This finding seems to support the findings of Moffat and Zhang (2014), which suggest that procedural justice can influence the extent of trust between organisations and stakeholders, and the approval and acceptance of stakeholders on project decisions.

4.1.7 – London Protocol 1996

One of the changes to international regimes post-Brent Spar came in the form of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Protocol 1996), which came into force in 2007, with the intention ultimately of replacing the London Dumping Convention of 1972.

The key change in the London Protocol 1996 is that the default position has shifted. The position of the London Protocol 1996 is that dumping is now prohibited, and hence a reverse list is adopted in this new document (Gordon, Paterson & Usenmez 2018a; Paterson 2015; Chandler et al. 2017). The 2006 amendment of the London Protocol 1996 also made clearer references to oil and gas facilities (e.g. platforms, cables, pipelines) as seen in Article I (4).

Article I (4) of the London Protocol 1996, amended 2006, states that “dumping” means:

> *(i) Any deliberate disposal into the sea of vessels, aircraft, platforms or other man-made structures at sea.*
>
> *(ii) Any deliberate disposal into the sea of vessels, aircraft, platforms or other man-made structures at sea.*
>
> *(iii) Any storage of wastes or other matter in the seabed and the subsoil thereof from vessels, aircraft, platforms or other man-made structures at sea.*
>
> *(iv) Any abandonment or toppling at site of platforms or other man-made structures at sea, for the sole purpose of deliberate disposal*
>
> *– Article I (4), London Protocol 1996, amended 2006*

Article I (4) also clearly states that "dumping" does not include:

> *(i) The disposal into the sea of wastes or other matter incidental to, or derived from the normal operations of vessels, aircraft, platforms or other man-made structures at sea and their equipment.*
>
> *(i) Placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this protocol.*
>
> *(iii) Abandonment in the sea of matter (e.g., cables, pipelines and marine research devices) placed for a purpose other than the mere disposal thereof.*
>
> *– Article I (4), London Protocol 1996, amended 2006*

Looking at the definitions of "dumping" according to the 2006 amendment of the London Protocol 1996, there is frequent use of the word "*deliberate*". The use of the word *"deliberate"* suggests there is also a need to consider the intention of the oil and gas operators when they are proposing their decommissioning plans. This can create issues for project managers when justifying their decisions to stakeholders as direct evidence of non-deliberate behaviour may be difficult to obtain.

4.1.8 – OSPAR Decision 98/3

In July 1998, a Ministerial Meeting was held in Sintra, Portugal, that made several changes to the OSPAR Convention of 1992, including OSPAR Decision 98/3 on the Disposal of Disused Offshore Installation. In the preamble, it states clearly that the *"reuse, recycling of final disposal on land will generally be the preferred option for the decommissioning of offshore installations in the maritime area"*. Paragraph 2 of OSPAR Decision 98/3 further states that:

> *The dumping, and the leaving wholly or partly in place, of disused offshore installations within the maritime area is prohibited.*
>
> *– Paragraph 2, OSPAR Decision 98/3*

While Paragraph 2 of Annex III appears to mean that Complete Removal of the oil and gas facility is the only allowable decommissioning option, Paragraph 3 states that there are three circumstances in which Partial Removal or Non-Removal are still allowed in the North-East Atlantic region:

By way of derogation from paragraph 2, if the competent authority of the relevant Contracting Party is satisfied that an assessment in accordance with Annex 2 shows that there are significant reasons why an alternative disposal mentioned below is preferable to reuse or recycling or final disposal on land, it may issue a permit for:

(i) All or part of the footings of a steel installation weighing more than 10,000 tonnes in air emplaced before 9 February 1999.

(ii) A concrete installation (including a gravity based concrete installation, a floating installation and any concrete anchor-base which results, or is likely to result, in interference with other legitimate uses of the sea).

(iii) Any other disused offshore installation when exceptional or unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties can be demonstrated.

– Paragraph 3, OSPAR Decision 98/3

The conditions stated in Paragraph 3 are much more stringent than what was recommended in the earlier international and regional regimes. For example, the IMO Guidelines recommend that Partial Removal or Non-Removal of oil and gas facilities can be considered for *"all installations standing in less than 75 m of water and weighing less than 4,000 tonnes",* whereas in OSPAR Decision 98/3, the limit has been raised to 10,000 tonnes in air.

OSPAR Decision 98/3's approach to defining the conditions in which Partial Removal or Non-Removal of oil and gas facilities means that anything outside the three derogation categories must be removed without question. This means that decommissioning alternatives, such as Rigs-to-Reefs, are no longer an option in the North-East Atlantic region under the rules of OSPAR Decision 98/3, unless the oil and gas facility fulfils one of the three derogation conditions as stated in Paragraph 3. It is also important to stress that from the point of view of OSPAR, the remaining infrastructure would not be regarded as an artificial reef. This is simply not a consideration that figures in the context of Decision 98/3 (Gordon, Paterson & Usenmez 2018a).

What this suggests is that the precise decommissioning option differs depending on regulatory arrangements, meaning that the scope of an oil and gas decommissioning project is influenced by regulations. Later sections in

this chapter will attempt to demonstrate how regulations influenced the precise decommissioning method by comparing the main features of four different domestic regulatory arrangements (United Kingdom, Australia, United States and Thailand).

There are a lot of details provided in OSPAR Decision 98/3, which indicates that OSPAR Decision 98/3 is one of the most prescriptive oil and gas decommissioning regulations to date. Paragraph 7 of OSPAR Decision 98/3 indicated that the OSPAR Commission will review the derogation conditions every five years in order to consider the increase in decommissioning experiences and advancement in decommissioning technology over time, making modifications to the derogation conditions if necessary. However, the literature review found that there were no modifications made after the 2003, 2008, 2013, and the recent 2018 reviews. It is also important to note that the review can only result in a further narrowing of the derogation cases. There is no scope for a widening to encompass, for example, an ecosystem considerations review (Gordon, Paterson & Usenmez 2018a).

Annex 2 of OSPAR Decision 98/3 details the Framework for the Assessment of Proposals for the Disposal at Sea of Disused Offshore Installations. Annex 2 states that an assessment is required for the justification of a proposed decommissioning option that is not Complete Removal. In addition, Annex 4 states that an *"independent verification that the condition of the installation before the disposal operation starts is consistent both with the terms of the permit and with the information upon which the assessment of the proposed disposal was based"*.

The requirement of an "assessment" and an "independent verification" suggests that the OSPAR Commission and other contracting parities of OSPAR, and perhaps stakeholders in general, are concerned about procedural fairness. In addition, by considering this finding in light of the findings from ***Chapter 3: Managing Oil and Gas Decommissioning***, this also suggests that regulations can have an influence on the effectiveness of stakeholder engagement as they can affect procedural fairness. This also suggests that procedural fairness could perhaps be the most important factor

affecting the effectiveness of stakeholder engagement for oil and gas decommissioning projects.

4.1.9 – Ongoing Evolution of International and Regional Regimes

The literature review found that there were numerous other regional oil and gas decommissioning frameworks that were developed after OSPAR Decision 98/3 (IOGP 2017b, 2017a). However, the regulations of many of these newer regional frameworks are similar to those of the "main" international and regional frameworks (i.e. UNCLOS 1982, IMO Guidelines 1989, the London Dumping Convention 1972, the London Protocol 1996, OSPAR Convention 1992, and OSPAR Decision 98/3).

For example, the 2014 Abidjan Protocol, developed in the Western Africa region, is highly influenced by OSPAR Convention 1992. Another example is the 2012 ASCOPE Decommissioning Guideline for Oil and Gas Facilities, developed in the South East Asian region, which merely reiterated the regulations of UNCLOS 1982 and IMO Guidelines 1989 (IOGP 2017b, 2017a). This suggests that the evolution of international and regional regimes has relatively stabilised following OSPAR Decision 98/3. However, none of the other regional instruments went as far as OSPAR Decision 98/3 in terms of prescriptiveness.

In summary, while each of the international and regional regimes has evolved in one way or another over the years, it can be argued that each iteration of them is still in force today depending on location. For example, there are still member states, such as Egypt and Sudan, that have yet to ratify the most recent version of UNCLOS. In another example, newer regional iterations such as OSPAR Decision 98/3 merely added more prescriptive rules to the existing 1992 OSPAR Convention.

There might be an argument that insofar as UNCLOS 1982 is understood to reflect customary international law, a state that is a signatory to the 1958 Convention but not to UNCLOS might nevertheless find an operator arguing that a demand for complete removal is at odds with the more modern permissive approach – and customary international law. A detailed examination of this argument is beyond the scope of this thesis, but it can

nevertheless be observed that UNCLOS 1982 does not rule out the possibility that a state could impose more demanding requirements in pursuit of environmental protection. In other words, an operator seeking to avoid complying with the demands of a coastal state applying the 1958 Convention might find it difficult to make its case.

4.2 – The Evolution of Four Domestic Regimes

This section of the chapter will first show the evolution of four domestic regimes:

- United Kingdom
- Australia
- United States
- Thailand

This research will only be conducted in the United Kingdom and Australian landscape. The reason for reviewing two additional domestic regimes is to enable a better comparison across multiple regulatory landscapes, and to better demonstrate how regulations add to the complexity of managing oil and gas decommissioning projects and their stakeholders.

The United States was selected as it adopts a federal system similar to that of Australia (Boyd Pollett 2017). Additionally, the Gulf of Mexico is a much older hydrocarbon region than the United Kingdom. Many states around the Gulf of Mexico such as Texas, Louisiana, Mississippi, and Alabama also implemented Rigs-to-Reefs programs, encouraging reefing oil and gas infrastructures as opposed to removing them completely (Dauterive 2000; Kaiser, Shively & Shipley 2020). Hence, it would be useful to compare the UK and Australian regimes with that of the United States. Thailand was selected as, like Australia, the Thai oil and gas decommissioning sector is still in its infancy (Beckstead 2018; Barrymore & Ballard 2019; Jagerroos & Kayleigh 2019). However, Thailand has recently adopted new oil and gas decommissioning legislation and regulations whereas Australia is still developing them (Beckstead 2018; Barrymore & Ballard 2019; Jagerroos & Kayleigh 2019). It would also be useful to compare the regulatory approaches between different emerging decommissioning landscapes

This section of the chapter will first present the evolution of each of the four domestic regimes. It will then move on to compare and contrast the main features of the four domestic regimes. The comparison will demonstrate explicitly the variation in regulatory approaches to oil and gas decommissioning across the world and highlight the implications for the management of oil and gas decommissioning projects and their stakeholders. Gaps within the regulatory law literature will also be highlighted.

4.2.1 – Adoption of International and Regional Regimes

The literature review found that there is a variation in regulatory approaches (Techera & Chandler 2015; Chandler et al. 2017; IOGP 2017b, 2017a). **Figure 4.3** (below) illustrates the variation in decommissioning approaches across the world.

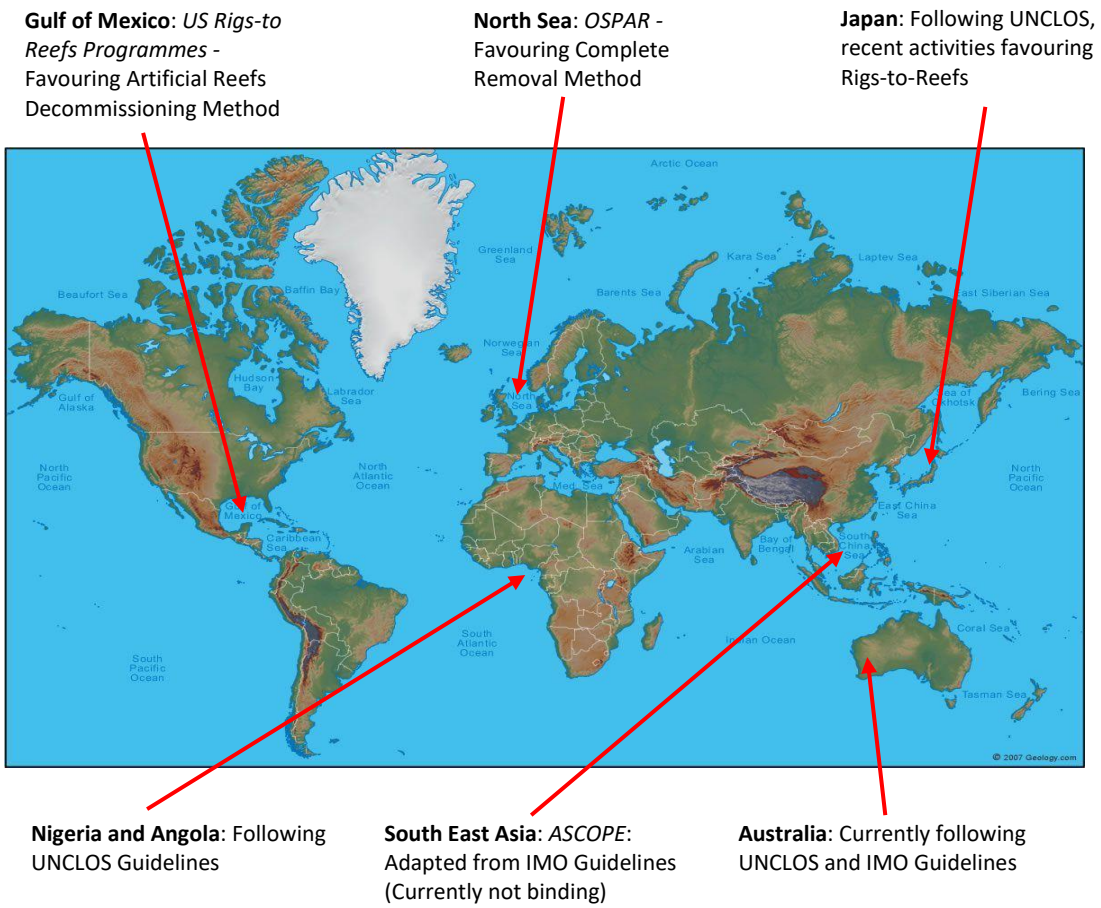


Figure 4-3 – Variation in Oil and Gas Decommissioning Legal Landscapes (IOGP 2017b, 2017a)

The literature review also found that to a large extent, the domestic oil and gas decommissioning regulations are influenced by the international and regional instruments to which the country is bounded to. **Table 4-1** (below) details the international and regional instruments followed by those of the United Kingdom, Australia, United States, and Thailand respectively (IOGP 2017b, 2017a):

Table 4-1 – International and Regional Instruments (IOGP 2017b, 2017a)

Country	International Instruments	Regional Instruments
United Kingdom	Geneva Convention 1958 (Ratified) UNCLOS III 1982 (Ratified) London Convention 1972 (Party) London Protocol 1996 (Party) IMO Guidelines and Standards 1989	OSPAR Convention 1992
Australia	Geneva Convention 1958 (Ratified) UNCLOS III 1982 (Ratified) London Convention 1972 (Party) London Protocol 1996 (Party) IMO Guidelines and Standards 1989	COBSEA Action Plan 1981 Nouméa Convention 1986
United States	Geneva Convention 1958 (Ratified) UNCLOS III 1982 (Signatory Only) London Convention 1972 (Party) IMO Guidelines and Standards 1989	AEPS Cartagena Convention 1983
Thailand	Geneva Convention 1958 (Ratified) UNCLOS III 1982 (Ratified) IMO Guidelines and Standards 1989	COBSEA Action Plan 1981 ASCOPE Guidelines 2012

As seen from **Table 4-1** (above), different countries are bound by different international and regional frameworks. For example, the United States did not ratify UNCLOS 1982. In addition, some international and regional frameworks such as the IMO Guidelines and ASCOPE Guidelines are not enforceable. This suggests that variations in domestic oil and gas decommissioning regimes are due to variations in international and regional obligations of different countries.

4.2.2 – United Kingdom

The domestic legislation that currently governs oil and gas decommissioning activities in the United Kingdom is the Petroleum Act 1998, as amended by the Energy Acts 2008 and 2016 (Gordon, Paterson & Usenmez 2018a).

4.2.2.1 – The Petroleum Act 1998

The Petroleum Act 1998 (United Kingdom) combined and updated various older legislation including the Petroleum Act 1987 (Gordon, Paterson & Usenmez 2018a). Provisions specific to oil and gas decommissioning can be found in Part IV of the Petroleum Act 1998.

The review of the Petroleum Act 1998 found that the legislation focusses on allocating power to the Secretary of State in order to regulate oil and gas decommissioning activities. The Petroleum Act 1998 gave the Secretary of State the power to approve decommissioning proposals, issue penalties in the event that operators fail to comply with notices, and make regulations related to oil and gas decommissioning. From a stakeholder management perspective, this suggests that the Secretary of State has a very high influencing power on oil and gas decommissioning.

Perhaps the most important provision of the Petroleum Act 1998 in this regard is Section 29(1), which gives power to the Secretary of State to issue a notice to the relevant parties involved, placing the liability on them to decommission the oil and gas facility. With regard to the relevant parties, Section 30(1) specifies that “persons who may be required to submit programmes” include:

(a) The person having the management of the installation or of its main structure;

(b) A person to whom subsection (5) applies in relation to the installation;

(c) A person outside paragraphs (a) and (b) who is a party to a joint operating agreement or similar agreement relating to rights by virtue of which a person is within paragraph (b);

(d) A person outside paragraphs (a) to (c) who owns any interest in the installation otherwise than as security for a loan;

(e) A company which is outside paragraphs (a) to (d) but is associated with a company within any of those paragraphs.

– Section 30(1), the Petroleum Act 1998

This indicates that an oil and gas facility may have multiple owners, which suggests that the number of stakeholders of an oil and gas decommissioning project differs depending on the contractual arrangements relating to the oil and gas facility itself. It must also be noted that depending on the contractual arrangement, the level of interest and influence may also differ (Gordon, Paterson & Usenmez 2018a).

4.2.2.2 – The Energy Act 2008

The Energy Act 2008 made amendments to Part IV of the Petroleum Act 1998. The purpose of the amendment was to consider the increased number of assets being transferred from one organisation to another, and the fact that organisations might be unable to fulfil their decommissioning liabilities (Gordon, Paterson & Usenmez 2018a). The amendment expanded Section 30(1), which now includes:

(b) A person to whom subsection (5)(a) and (b) applied in relation to the installation, but who (i) transferred the right mentioned in that subsection to another person, and (ii) has not obtained a consent required under the licence in relation to the transfer.

- Section 30(1), the Petroleum Act 1998 (United Kingdom), amended 2008

The Energy Act 2008 also added new supplementary provisions in Section 31, which gave power to the Secretary of State to demand that *"adequate arrangements (including financial arrangements)"* for decommissioning be made by oil and gas operators.

Another notable change made by the Energy Act 2008 is the word substitution of *"company"* with *"body corporate"*. Category (e) in Section 30(10) now reads:

> *(e) A body corporate which is outside paragraphs (a) to (d) but is associated with a body corporate within any of those paragraphs.*
>
> *– Section 30(1), the Petroleum Act 1998 (United Kingdom), amended 2008*

The substitution was to consider limited liability partnerships (Gordon, Paterson & Usenmez 2018a). Gordon, Paterson & Usenmez (2018a) also noted that the substitution of wording is representative of the changing stakeholder landscape in the United Kingdom. This suggests that the stakeholder landscape can change over time, perhaps even through the lifecycle of the oil and gas decommissioning project.

4.2.2.3 – The Energy Act 2016

The Energy Act 2016 created the OGA (Oil and Gas Authority) and sets out the functions of the OGA. One amendment made by the Energy Act 2016 is the addition of Section 29(2A). Section 29(2A) of the Petroleum Act 1998, amended 2016, states that:

> *A person to whom a notice under subsection (1) is given*
>
> *(a) Must consult the OGA before submitting the abandonment programme to the Secretary of State, and*
>
> *(b) Must frame the programme so as to ensure (whether by means of the timing of the measures proposed, the inclusion of provision for collaboration with other persons, or otherwise) that the cost of carrying it out is kept to the minimum that is reasonably practicable in the circumstances.*
>
> *– Section 29(2A), The Petroleum Act 1998 (United Kingdom), amended 2016*

Following on from Section 29(2A), Section 29 (2B) states that:

> *When consulted under paragraph (a) of subsection (2A) the OGA must (in particular) consider and advise on —*
>
> *(a) Alternatives to abandoning or decommissioning the installation or pipeline, such as re-using or preserving it, and*
>
> *(b) How to comply with paragraph (b) of that subsection.*
>
> *– Section 29(2B), the Petroleum Act 1998 (United Kingdom), amended 2016*

Section 29(2A) and Section 29(2B) indicate that interactions with the OGA are a requirement. In addition, oil and gas operators are also required to fulfil the obligations of the MER (Maximising Economic Recovery) Strategy for the United Kingdom, such as collaborating with other oil and gas operators and seeking out cost reduction opportunities (Gordon, Paterson & Usenmez 2018a). This suggests that regulations can influence stakeholder engagement strategies and activities.

Section 29(2A) and Section 29(2B) also indicate that the OGA has the power to influence the management of oil and gas decommissioning projects. Section 29(2A) places an obligation on oil and gas operators to keep the cost of decommissioning as low as is reasonably practicable, while Section 29(2B) suggests that the re-use and preservation of oil and gas facilities are prioritised over their abandonment or decommissioning. Overall, this indicates that regulations can influence the management of oil and gas decommissioning projects and their stakeholders.

4.2.2.4 – Offshore Oil and Gas Decommissioning Guidance Notes

The Offshore Oil and Gas Decommissioning Guidance Notes were first published in August 2000 (Gordon, Paterson & Usenmez 2018a) and the most recent version was published in November 2018 (OPRED 2019). The guidance notes were published by the OPRED (Offshore Petroleum Regulator for Environment and Decommissioning), which currently sits within BEIS, formerly the Department of Energy and Climate Change (DECC). The purpose of the guidance notes is to *"provide a framework for the planning and compilation of decommissioning programmes, as such they are not intended to be prescriptive but rather outline a process for operators to follow to enable them to deliver their decommissioning obligations"* (OPRED 2019).

Sections 7 and 8 of the guidance notes detail relevant domestic, regional, and international instruments in the context of the United Kingdom, including OSPAR Decision 98/3, and the IMO Guidelines. This suggests that there is an expectation by the UK regulator that oil and gas decommissioning activities in the United Kingdom will follow these regional and international obligations.

Perhaps the most striking feature in the guidance notes is the outline of the Decommissioning Programme Process, as illustrated in **Table 4-2** (below, page 120).

Table 4-2 – The Decommissioning Programme Process in the United Kingdom (OPRED 2019)

Stage 1 Early discussions	Stage 2 Planning & producing the Decommissioning programme	Stage 3 Submit the programme	Stage 4 Execution of the programme	Stage 5 Close out
Preliminary discussions with OPRED Possible option screening for pipelines Data & evidence collection & surveys	Detailed discussions with OPRED Assessment of options - Comparative Assessment or similar including assessment of risk Development & submission of consultation DP and Environmental Appraisal to OPRED and through consultation to other interested parties /public for consideration Derogation case - OSPAR consultation prior to final submission	Draft DP following comment resolution with OPRED Formal submission of the DP and approval under the 1998 Act	Commence main works Regular DP progress reports to OPRED Identify and discuss potential DP revisions	Close Out report & detail of all post DP surveys, within one year of full completion. Update OPRED with amendments to post DP monitoring plan Monitoring of site & site remediation as required Management plan for any infrastructure remaining in situ

As seen in **Table 4-2** (above), the Decommissioning Programme Process in the United Kingdom can be divided into five stages. At first glance, there is a requirement for interactions between the operator and OPRED throughout the entire process. This suggests that stakeholder engagement takes place throughout the entire lifecycle of an oil and gas decommissioning project. Furthermore, the need to update OPRED with regard to site remediation post decommissioning, as stated in Step 5, suggests that stakeholder interactions continue even after the oil and gas decommissioning project is completed.

Planning and Producing the Decommissioning Programme

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 66), the literature review found that there is extensive use of multi-criteria decision-making tools, including CA (Comparative Assessment), to consider stakeholder views when defining the scope of the project. Interestingly, the review of the guidance notes found that there is a strong promotion of the use of CA as part of the Decommissioning Programme Process. This suggests that

the extensive use of multi-criteria decision-making tools could be the result of regulatory influence.

The review of the guidance notes also found that the guidance notes are quite prescriptive regarding the way stakeholders should be managed throughout the oil and gas decommissioning project. For example, Paragraph 5.5 of the guidance notes states that:

> *Discussions should commence well ahead of forecast cessation of operations (guidance on cessation of production should be sought from the Oil and Gas Authority). In the case of a large field with multiple facilities this may be 2-3 years or more in advance. In the case of a potential OSPAR derogation case it may be up to 5 years in advance.*
>
> *– Paragraph 5.5, the Offshore Oil and Gas Decommissioning Guidance Notes, 2018*

This shows clearly that there is a prescriptive expectation of when during the oil and gas decommissioning project interactions between the operator and the OGA should take place. This suggests that the timing of stakeholder interaction could have an impact on the effectiveness of stakeholder engagement.

Similar to Paragraph 5.5, Paragraph 6.12 hints that the timing of stakeholder interaction can influence the effectiveness of stakeholder engagement. Paragraph 6.12 states that:

> *Operators will need to develop and manage a wide-ranging public consultation process proportionate to the level of interest from stakeholders. The form and timing of this process should be discussed with OPRED. As a guide, such a process may take up to 12 months and should commence at an early stage.*
>
> *– Paragraph 6.12, the Offshore Oil and Gas Decommissioning Guidance Notes, 2018*

Additionally, Paragraph 6.12 indicates that the level of stakeholder interactions should be *"proportionate to the level of interest from stakeholders"*. This suggests that the level of stakeholder interests can vary from one oil and gas decommissioning project to another.

Another interesting part of Paragraph 6.12 is that it explicitly states that "*the form and timing of the "wide-ranging public consultation" process should be discussed with OPRED"*. This clearly demonstrates that OPRED can have an influence on the management of stakeholders in an oil and gas decommissioning project.

4.2.2.5 – Oil and Gas UK Guidelines

An interesting discovery from the Offshore Oil and Gas Decommissioning Guidance Notes published by OPRED is that the document makes several references to Oil and Gas UK Guidelines. For example, in Paragraph 6.11, the guidance notes state:

> *Decommissioning programmes must include a statement about costs, preferably in the form of the Oil and Gas UK Work breakdown structure.*
>
> *– Paragraph 6.11, the Offshore Oil and Gas Decommissioning Guidance Notes, 2018*

Oil and Gas UK is an industry representative body and a not-for-profit organisation (OGUK 2019). The literature review found that there is a suite of guidelines published by Oil and Gas UK on decommissioning, as illustrated in **Figure 4-4** (below).

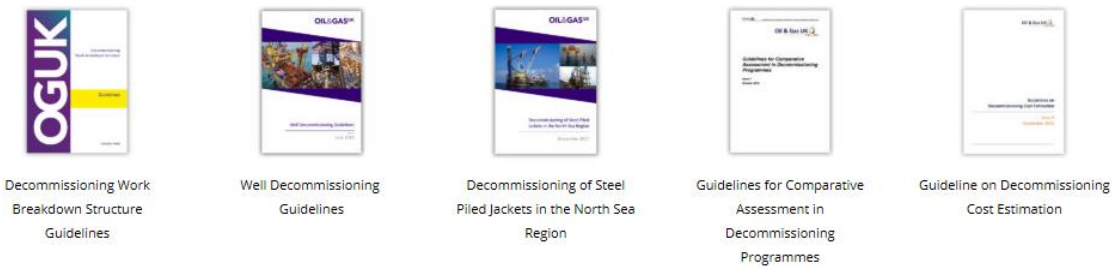


Figure 4-4 – Suite of Oil and Gas UK Guidelines on Oil and Gas Decommissioning (OGUK 2019)

The review found that the suite of guidelines focuses on management tools and techniques, such as WBS (Work Breakdown Structure), and cost estimation. The fact that there is a preference by OPRED for the use of the project management tools and techniques created by Oil and Gas UK, as evident in Paragraph 6.11 of OPRED's Guidance Notes, suggests that there is some degree of interest by OPRED on the management of oil and gas decommissioning projects.

4.2.3 – Australia

4.2.3.1 – Commonwealth and State Waters

The Australian Constitution of 1901 created a federal jurisdiction, in which legislative and regulatory powers are distributed between the Commonwealth government and the respective state and territory governments (Chandler et al. 2017; Techera & Chandler 2015). In addition, the Coastal Waters (State Powers) Act 1980 gave legislative power to the respective states and territories in and in relation to coastal waters.

This means that oil and gas decommissioning activities that take place in the marine area governed by the state or territory government, (i.e. State waters), are subject to the legislation and regulations of the individual state or territory government. On the other hand, oil and gas decommissioning activities that take place in the marine area governed by the Commonwealth government, (i.e. Commonwealth waters), are subjected to the legislation and regulations of the Commonwealth government. **Figure 4-5** (below) illustrates the division between Commonwealth and state waters in Australia:

Figure 4-5 – Commonwealth Waters and State Waters in Australia (NOPSEMA 2020)

As illustrated in **Figure 4-5** (above, page 123), the grey marine areas are Commonwealth waters, governed by Commonwealth legislation, while the coloured areas are the respective state and territory waters, governed by the local state or territory legislation. This indicates that even within the same country, oil and gas decommissioning regulations can differ depending on location. This suggests that the regulatory uncertainties of managing an oil and gas decommissioning project are higher in countries under a federal system. Examples of countries with a federal system include the United States, Brazil, India, Mexico, Russia, and Canada.

The following section will explore and highlight the difference between the Australian Commonwealth regime and the state regime of Western Australia. The reason for selecting Western Australia as a representative example of a state regime is because the bulk of oil and gas activities in Australia takes place in the North-West Shelf, which is located in Western Australia (Advisian 2017; Shaw, Seares & Newman 2018). It must be noted that there are also oil and gas activities taking place in other regions of Australia such as the Bass Strait in Victoria and the Timor Sea in the Northern Territory (NERA 2019).

4.2.3.2 – Commonwealth Waters – Offshore Petroleum and Greenhouse Gas Storage Act 2006

It must be noted that at the time this thesis was written, in 2020, oil and gas decommissioning legislation is still being revised. The Department of Industry, Innovation and Science (DIIS) estimated that the proposed oil and gas decommissioning policy will only be implemented after 2020 (DIIS 2018a).

At the time this thesis was written, on a federal level, or Commonwealth level, oil and gas decommissioning activities in Australia are governed by the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGSA) 2006 (Chandler et al. 2017), which was recently amended in October 2019 (NOPSEMA 2019). In terms of regulating oil and gas decommissioning, the Environment Protection and Biodiversity Conservation Act 1999, amended 2019, granted the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) the power to regulate oil and gas activities in Commonwealth waters, including oil and gas decommissioning.

The position on the treatment of oil and gas facilities after cessation of production (CoP) in Commonwealth waters is made clear in Section 572(3) of OPGGSA 2006, amended 2019, which states that:

> *A titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations:*
>
> *(i) In which the titleholder is or will be engaged; and*
>
> *(ii) That are authorised by the permit, lease, licence, or authority.*
>
> *Section 572(3), Offshore Petroleum and Greenhouse Gas Storage Act 2006, amended 2019*

However, Section 586(2) states that:

> *The NOPSEMA may, by written notice given to the registered holder of the permit, lease or licence, direct the holder to do any or all of the following things on or before the applicable date:*
>
> *1. to:*
>
> *(a) Remove, or cause to be removed, from the title area all property brought into that area by any person engaged or concerned in the operations authorised by the permit, lease or licence; or*
>
> *(b) Make arrangements that are satisfactory to NOPSEMA in relation to that property;*
>
> *– Section 586(2), Offshore Petroleum and Greenhouse Gas Storage Act 2006, amended 2019.*

Many journal authors suggest that Section 586(2)(a)(ii) means that arrangements to leave infrastructure wholly or partially in place is a possibility, subject to the satisfaction of NOPSEMA (Pears & Williams 2005; Advisian 2017; Chandler et al. 2017; Shaw, Seares & Newman 2018; Barrymore & Ballard 2019). However, what these “arrangements” constitute is not made clear in OPGGSA 2006. This suggests that currently, there are still regulatory uncertainties in Australia, which adds to the complexity of managing oil and gas decommissioning projects in Australia.

While Section 586(2) clearly states that oil and gas decommissioning activities must be undertaken to the *"satisfactory of NOPSEMA"*, Section 270(3) of OPGGSA 2006 states that:

> *The Joint Authority may consent to the surrender sought by the application only if the registered holder of the permit, lease or licence:*
>
> *(c) (i) to the satisfaction of NOPSEMA, removed or caused to be removed from the surrender area (defined by subsection (7)) all property brought into the surrender area by any person engaged or concerned in the operations authorised by the permit, lease or licence; or*
>
> *(ii) Make arrangements that are satisfactory to NOPSEMA in relation to that property*
>
> *– Section 270(3), Offshore Petroleum and Greenhouse Gas Storage Act 2006, amended 2019*

The use of the word *"may"* suggests that there is also a need for oil and gas decommissioning activities to satisfy the Joint Authority even after satisfying NOPSEMA. This indicates that there are multiple regulatory stakeholders that are required to be satisfied, which can create complexity for the management of oil and gas decommissioning projects and its stakeholders.

Regarding the definition of the Joint Authority, Section 56(2) of OPGGSA 2006 states that:

> *The Joint Authority for an offshore area of a State (other than Tasmania) is constituted by:*
>
> *(a) The responsible State Minister; and*
>
> *(b) The responsible Commonwealth Minister.*
>
> *and is to be known as the Commonwealth - [Name of State] Offshore Petroleum Joint Authority*
>
> *The responsible Commonwealth Minister is the Joint Authority for the offshore area of Tasmania. That Joint Authority is to be known as the Commonwealth-Tasmania Offshore Petroleum Joint Authority."*
>
> *– Section 56(2), Offshore Petroleum and Greenhouse Gas Storage Act 2006, amended 2019*

The establishment of a Joint Authority and a joint decision-making procedure between the state and Commonwealth governments regarding the surrender of titles suggests that the state and Commonwealth governments may have different interests regarding oil and gas decommissioning. As such, this means that, there are uncertainties regarding the management of oil and gas decommissioning projects in Australia.

4.2.3.3 – Commonwealth Waters – Environment Protection (Sea Dumping) Act 1981

When planning Rigs-to-Reefs operations, there is a need to consider the legislation in the Environment Protection (Sea Dumping) Act 1981, amended 2016. This Act is guided by and share many similarities in standards with the London Protocol 1996 (Advisian 2017; Chandler et al. 2017; Shaw, Seares & Newman 2018).

According to Section 4(1) of the Environment Protection (Sea Dumping) Act 1981, amended 2016, the construction and placement of artificial reefs is possible for:

> *(a) The purpose of increasing or concentrating populations of marine plants and animals; or*
>
> *(b) The purpose of being used in human recreational activities.*
>
> *– Section 4(1), Environment Protection (Sea Dumping) Act 1981, amended 2016*

This means that Rigs-to-Reefs is a possible option in Commonwealth waters as long as there is a valid purpose for its use.

4.2.3.4 – Commonwealth Waters –

DIIS Offshore Petroleum Decommissioning Guidelines 2018

Recognising that there are uncertainties with the legislation in OPGGSA 2006, the purpose of the DIIS Offshore Petroleum Decommissioning Guidelines 2018 is to *"clarify the components of the Commonwealth regime"* (DIIS 2018b).

Regarding oil and gas decommissioning obligations prior to the surrender of the license/title, Paragraph 2.3 makes it clear that:

> *…options other than complete removal may be considered, however the titleholder must demonstrate that the alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal, and that the approach complies with all other legislative and regulatory requirements – including requirements under other Commonwealth law.*
>
> *– Paragraph 2.3, DIIS Offshore Petroleum Decommissioning Guidelines 2018*

This means that there is a recognition by legislative governmental stakeholders that Complete Removal of the oil and gas facility may not be the most environmentally friendly option. Regarding regulating the oil and gas decommissioning activities themselves, Paragraph 3.1 of the DIIS Offshore Petroleum Decommissioning Guidelines 2018 states that:

> *A titleholder may demonstrate through an environment plan that arrangements other than complete removal of equipment and property provide outcomes that reduce environmental impacts and risks to both acceptable levels and as low as reasonably practicable (ALARP). If NOPSEMA accepts an environment plan that demonstrates these outcomes and meets all other criteria for acceptance under the regulations, and demonstrates compliance with all other legislative and regulatory requirements, this would constitute arrangements that are satisfactory to NOPSEMA in relation to the equipment and property covered under the environment plan. The titleholder would therefore not be required to remove the property under subsection 572(3).*
>
> *– Paragraph 3.1, DIIS Offshore Petroleum Decommissioning Guidelines 2018*

Overall, the review of the DISS Offshore Petroleum Decommissioning Guidelines 2018 suggests that legislative governmental stakeholders in

Australia are viewing oil and gas decommissioning as more of an environmental issue rather than an economic issue. It must be noted that the estimated bill for decommissioning from 2018 to 2068 is USD 21 billion (Barrymore & Ballard 2019).

4.2.3.5 – Commonwealth Waters –
NOPSEMA Environment Plan Decision Making Guidelines

Unlike the departmental guidelines provided by the UK regulator, the review of the NOPSEMA Environment Plan Decision Making Guidelines indicates that there is no obligation for oil and gas operators to use multi-criteria decision-making tools to determine the precise decommissioning option for oil and gas facilities in Commonwealth waters. Paragraph 1.2 of the NOPSEMA Environment Plan Decision Making Guidelines states that:

> *The regulatory construct that a NOPSEMA decision maker be 'reasonably satisfied' gives NOPSEMA a level of discretion in making administrative decisions on EPs. Specifically, a NOPSEMA decision maker will be reasonably satisfied where they:*
>
> - *Have a subjective satisfaction that the criteria in reg 10A (Nature and Scale, ALARP, Acceptable Levels, Environmental Performance, Implementation Strategy, World Heritage Properties, Consultation) are met; and*
> - *There is an objectively reasonable basis for that satisfaction; based on the available evidence – primarily presented by the titleholder in the EP submission.*
>
> — *Paragraph 1.2, NOPSEMA Environment Plan Decision Making Guidelines*

In addition, Paragraph 3.3 of NOPSEMA Section 572 Maintenance and Removal of Property Draft Policy states that:

> *NOPSEMA considers that a comparative assessment may be used in an EP as a method to evaluate feasible alternatives to removal of property. A comparative assessment may support but does not replace the requirement for the EP to meet the criteria for acceptance of an EP under the Environment Regulations.*
>
> *– Paragraph 3.3, NOPSEMA Section 572 Maintenance and Removal of Property Draft Policy, 2020*

This suggests that using multi-criteria decision-making tools may not be the best way to define the scope of an oil and gas decommissioning project.

With regard to stakeholder management, Appendix 2 lists four factors under the consultation criteria that influence the outcome of the Environment Plan approval process, which are:

> *The consultation process used, information sought from relevant persons to inform the evaluation of impacts and risk, the transparency and completeness of the report on consultations, and the consultation report.*
>
> *– Appendix 2, NOPSEMA Environment Plan Decision Making Guidelines*

The guidelines, however, do not specify further on when, where, or how stakeholders should be engaged during an oil and gas decommissioning project. This suggests that there could be a lot of uncertainties when it comes to the management of project stakeholders.

4.2.3.6 – Western Australian State Waters – Petroleum (Submerged Lands) Act 1982

Oil and gas decommissioning activities in Western Australia state waters are subject to the legislation of the Petroleum (Submerged Lands) Act 1982 (Advisian 2017; Chandler et al. 2017; Shaw, Seares and Newman 2018; Barrymore and Ballard 2019). Regarding oil and gas decommissioning, Section 98(3) of the Petroleum (Submerged Lands) Act 1982, amended 2018, states that:

> *An operator shall remove from the operations area all structures, equipment and other property that are not either used or to be used in connection with the operations in which he is engaged.*
>
> *– Section 98(3), the Petroleum (Submerged Lands) Act 1982, amended 2018*

However, Section 104(2) of the Petroleum (Submerged Lands) Act 1982, amended 2018, suggests that *"arrangements"* alternative to Complete Removal are also possible, subject to the satisfaction of the Minister:

Subject to subsection (3), the Minister shall not give his consent to a surrender of an instrument under subsection (1) unless the registered holder…

2. Has to the satisfaction of the Minister, removed or caused to be removed from the area to which the surrender relates all property brought into that area by any person engaged or concerned in the operations authorised by the instrument, or has made arrangements that are satisfactory to the Minister with respect to that property.

– Section 98(3), the Petroleum (Submerged Lands) Act 1982, amended 2018

The review also finds that the position on oil and gas decommissioning according to the legislation of the Petroleum (Submerged Lands) Act 1982, amended 2018, is similar to that of OPGGSA 2006, amended 2019. This means that despite having a federal system, there is some degree of consistency between Commonwealth and state legislation regarding oil and gas decommissioning.

4.2.3.7 – Western Australia State Waters – DMIRS Petroleum Decommissioning Guideline 2017

In October 2017, the Department of Mines, Industry Regulation and Safety Petroleum (DMIRS) Petroleum Decommissioning Guideline was published. The purpose of the Guideline is to provide guidance to oil and gas operators on the decommissioning obligations in the legislations.

The review of the Guideline found that there is variation in position regarding the use of multi-criteria decision-making tools to define the scope of the oil and gas decommissioning project. In contrast to NOPSEMA's position on CA (Comparative Assessment), Paragraph 5.5 of the DMIRS Petroleum Decommissioning Guideline 2017 states that:

A comparative assessment approach should be used to identify the best decommissioning options for specific assets.

– *Paragraph 5.5, DMIRS Petroleum Decommissioning Guideline 2017*

This suggests that different stakeholders have different views on the fairness and robustness of multi-criteria decision-making tools, making the justification of the scope definition procedure challenging for oil and gas project managers.

Regarding of the approval process, Paragraph 3.5 of the DMIRS Petroleum Decommissioning Guideline 2017 states that:

> *A 'petroleum activity' is any works or operations carried out under a petroleum instrument, including decommissioning, dismantling or removing a facility or pipeline. A petroleum activity cannot commence until the Environment Plan for the activity has been approved by DMIRS.*

– *Paragraph 5.5, DMIRS Petroleum Decommissioning Guideline 2017*

This shows that the approval process for oil and gas decommissioning in Western Australian state waters is similar to that of Commonwealth waters, as both of them require the submission of an Environmental Plan. However, when comparing the DMIRS Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia, with the NOPSEMA Environment Plan Decision Making Guidelines, it was found that there are differences in regulatory expectations.

4.2.3.8 – Western Australian State Waters – DMIRS Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia 2016

The literature review found that the DMIRS Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia is much more detailed and prescriptive than the NOPSEMA Environment Plan Decision Making Guidelines. For example, the DMIRS Guideline states clearly that there is a preference for the use of a risk matrix in assessment of project risks (DMIRS 2016), while the NOPSEMA Guidelines do not specify any methodology, leaving the precise risk assessment methodology up to the oil and gas operators (NOPSEMA 2019). Similarly, for stakeholder engagement, there is a recommended DMIRS stakeholder engagement model, as shown in **Table 4-3** (below).

Table 4-3 – Department of Mines, Industry Regulation and Safety Petroleum Stakeholder Engagement Model (DMIRS 2016)

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
STAKEHOLDER ENGAGEMENT GOAL	To provide the stakeholder with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.	To obtain stakeholder feedback on analysis alternatives, and/or decision.	To work directly with the stakeholder throughout the process to ensure that stakeholder issues and concerns are consistently understood and considered.	To partner with the stakeholder in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the stakeholder.
PROMISE TO STAKEHOLDER	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how stakeholder input influenced the decision.	We will work with you to ensure that your concerns and issues are directly reflected in the alternatives developed and provide feedback on how stakeholder input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
EXAMPLE TOOLS	• Fact sheets • Websites • Open houses	• Public comment • Focus groups • Surveys • Public meetings	• Workshops • Deliberate polling	• Citizen advisory committees • Consensus-building • Participatory decision-making	• Citizen juries • Ballots • Delegated decisions

This shows that DMIRS has a much clearer expectation on how an oil and gas decommissioning project and its stakeholders should be managed than NOPSEMA, which suggests that perhaps DMIRS has much more expertise in project and stakeholder management than NOPSEMA.

4.2.3.8 – Special Arrangement – Decommissioning in the Timor Sea

A very interesting finding in the field of regulatory law is the existence of joint-development areas. Joint development areas are provisional arrangements made between countries in an event of a maritime boundary dispute (Keyuan 2006; Lundahl & Sjöholm 2008). A joint development area can encourage a cooperative effort between countries in order to exploit hydrocarbons in a defined maritime area (Lundahl &Sjöholm 2008). Joint-development areas are very common in the South East Asian region where there are still numerous maritime boundary disputes involving multiple countries (Buszynski & Sazlan 2007; Fravel 2011; Storey 2013).

Prior to the delimitation of the maritime boundary between Australia and Timor-Leste in 2019, there was a joint development area between Australia and Timor-Leste in the Timor Sea (Lundahl & Sjöholm 2008), which is located north of Australia. **Figure 4-6** (below) details the arrangement made for the former Australia-Timor-Leste Joint Development Area.

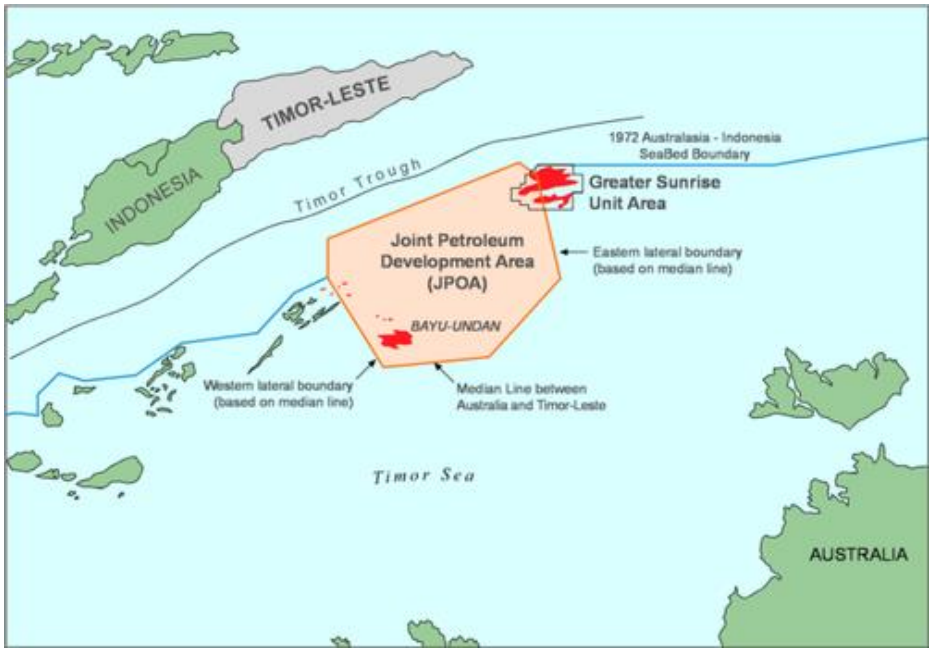


Figure 4-6 – The Australia Timor-Leste Joint Petroleum Development Area (KeyFactsEnergy 2018)

Considering that this research was conducted from 2017 to 2020, and that the delimitation of the maritime boundary between Australia and Timor-Leste took place in 2019, it can be seen that regulatory arrangements can change unexpectedly, creating uncertainties for oil and gas activities in the area.

The delimitation of the maritime boundary between Australia and Timor-Leste created plenty of regulatory uncertainties for oil and gas decommissioning in the area. For example, the newly established maritime boundary has divided the Bayu-Undan and Kitan oil and gas facilities into two. Both the Bayu-Undan and Kitan oil and gas facilities were installed prior to the delimitation of the maritime boundary. There are, then, uncertainties regarding the validity of legal arrangements that were made prior to the establishment of the new maritime boundary, such as financial obligations for decommissioning, and residual liability conditions post-decommissioning. Overall, this indicates that there can be plenty of regulatory uncertainties when it comes to the management of oil

and gas decommissioning projects. This finding also suggests that there are opportunities to explore the regulating of oil and gas decommissioning projects in joint development areas.

The way Australia and Timor-Leste attempted to address the uncertainties regarding the decommissioning of existing oil and gas facilities in the former joint-development area was to have detailed and prescriptive legislation included in the treaty for the delimitation of the maritime boundary. For example, Article 6 of the treaty between Australia and the Democratic Republic of Timor-Leste establishing their maritime boundaries in the Timor Sea established a Designated Authority in order to *"carry out day-to-day regulation and management of petroleum activities…on behalf of Australia and Timor-Leste"*. This suggests that despite the delimitation, it may be best for regulations governing existing oil and gas facilities to continue as if they were still in joint development.

The agreement is also detailed and prescriptive on the management of each of the individual decommissioning projects. For example, Article 14(1) of the Treaty between Australia and the Democratic Republic of Timor-Leste establishing their maritime boundaries in the Timor Sea states that:

> *As soon as practicable, but in any case no later than seven years after commencement of production of Petroleum in the Special Regime Area, the Greater Sunrise Contractor shall be required to submit to the Designated Authority a decommissioning plan and total estimate of decommissioning costs for approval in accordance with Articles 6(3)(s) and 7(3)(c) of this Annex, which shall be updated in accordance with the Development Plan and the applicable Petroleum Mining Code.*

– *Article 14(1), Treaty between Australia and the Democratic Republic of Timor-Leste establishing their Maritime Boundaries in the Timor Sea, 2019*

It shows clearly that the regulatory arrangement for oil and gas decommissioning in the Special Regime Area of the Timor Sea region is completely different from the rest of Australia. The decommissioning of oil and gas facilities in the Special Regime Area was still in its planning stages when this thesis was written. This suggests that there are opportunities to explore

how this unique regulatory arrangement impact oil and gas decommissioning projects in joint development areas.

4.2.3.9 – A Comparison between the Commonwealth and Western Australian Regimes

Overall, the review of the regimes indicates that the oil and gas decommissioning legislation is relatively similar in both Commonwealth and Western Australian state waters. In terms of the regulatory process, the Commonwealth and Western Australian state regulations are similar, both requiring the submission of the Environmental Plan for regulatory approval prior to commencing oil and gas decommissioning activities.

However, the regulatory and legislative governmental stakeholders that are involved are significantly different. In Commonwealth waters, oil and gas decommissioning activities are regulated by NOPSEMA, but the decision regarding the surrender of the petroleum title is determined by the Joint-Authority. In Western Australian state waters, DMIRS is responsible for regulating oil and gas decommissioning activities and for making the final decision regarding the surrender of the petroleum title. This suggests that there is more complexity for oil and gas decommissioning projects in Commonwealth waters.

4.2.4 – United States of America

Similar to Australia, the United States also operates under a federal jurisdiction, as established by the Constitution of the United States 1789. This distributes legislative powers between the federal government and the respective state government. In terms of the distribution of legislative rights of the marine environment, the Submerged Lands Act 1953 gave jurisdiction right to the states up to 3.5 nm (nautical miles) from the coastline, with the exception of Texas, Florida, and California, where the jurisdiction right is granted up to 10 nm from the coastline (IOGP 2017b, 2017a).

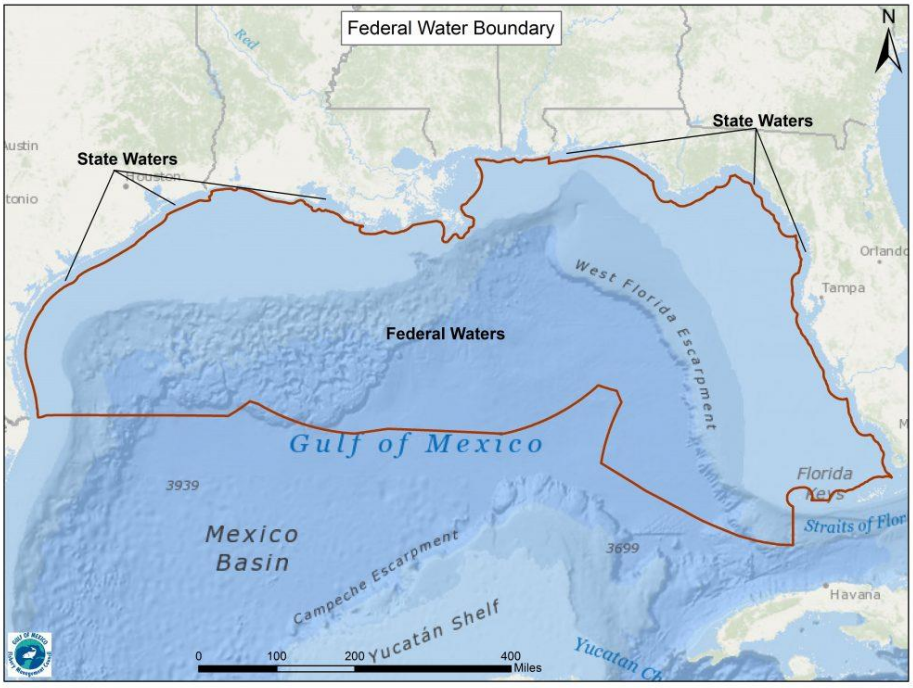


Figure 4-7 – Federal and State Waters in the Gulf of Mexico Region of the United States of America (GulfCouncil 2020)

4.2.4.1 – Federal Level – Outer Continental Shelf Lands Act 1969

The Outer Continental Shelf Lands Act 1969 has no specific legislation regarding oil and gas decommissioning. However, as noted by the Bureau of Safety and Environmental Enforcement, decommissioning obligations are usually included in the terms and conditions of the lease signed by the oil and gas operator (BSEE 2014). This means that decommissioning obligations in federal waters of the United States are governed by commercial contracts rather than legislation.

4.2.4.2 – Federal Level –
30 CFR 250 Subpart Q – Decommissioning Activities 2012

30 CFR 250 Subpart Q – Decommissioning Activities, published by the Bureau of Safety and Environmental Enforcement in 2012 details the specific regulations with regard to decommissioning activities in Federal Waters. Section 250.1703 of 30 CFR 250 Subpart Q states clearly that:

> *When your facilities are no longer useful for operations, you must:*
>
> *(a) Get approval from the appropriate District Manager before decommissioning wells and from the Regional Supervisor*

before decommissioning platforms and pipelines or other facilities;

(b) Permanently plug all wells

(c) Remove all platforms and other facilities, except as provided in Section 250.1725(a) and 250.1730

(d) Decommission all pipelines

(e) Clear the seafloor of all obstructions created by your lease and pipeline right-of-way operations; and

(f) Conduct all decommissioning activities in a manner that is safe, does not unreasonably interfere with other uses of the Outer Continental Shelf, and does not cause undue or serious harm or damage to the human, marine, or coastal environment.

– Section 250.1703 of 30 CFR 250 Subpart Q – Decommissioning Activities

The condition stated in Section 250.1725(a) is that *"if there is an approval to maintain the structure to conduct other activities"*, while the condition stated in Section 250.1730 is that *"if the structure becomes part of a State artificial reef program, and the responsible State agency acquires a permit from the U.S. Army Corps of Engineers and accepts the title and liability for the structure"*.

It can be seen that both conditions are dependent on the interest for the use of the structure to be decommissioned by stakeholders, which suggests that stakeholders are highly influential and impactful to oil and gas decommissioning decisions.

A unique finding in 30 CFR 250 Subpart Q – Decommissioning Activities 2012 is that it specifies a timeframe for oil and gas decommissioning. Section 250.1725(a) states that:

You must remove all platforms and other facilities within 1 year after the lease or pipeline right-of-way terminates.

– Section 250.1725(a) of 30 CFR 250 Subpart Q – Decommissioning Activities

This indicates that regulations can have an influence on project schedule, making the management of oil and gas decommissioning projects challenging.

4.2.4.3 – State Level – Louisiana Artificial Reef Plan 1987

It must be noted that various states in the Gulf of Mexico region including Florida, Alabama, Mississippi, and Texas have their own Rigs-to-Reefs programs. The reason for using the Louisiana Rigs-to-Reefs program as an example is because Rigs-to-Reefs activity is highest in that state. As of 2017, there are 363 oil and gas platforms that are reefed as part of the Louisiana Rigs-to-Reefs program (BSEE 2019).

In 1984, the National Fishing Enhancement Act (33 USC 2101) was passed, which started the National Artificial Reef Plan in 1985. Subsequently, in 1987, the Louisiana Rigs-to-Reefs program was created as part of the Louisiana Fishing Enhancement Act 1986 (Kaiser, Shively & Shipley 2020).

The process involves the donation of the oil and gas facility to the State of Louisiana in order for it to become a reef. However, the cost of transporting and reefing the oil and gas facility is to be paid by the oil and gas operator. The title and liability of the oil and gas facility is only transferred to the State of Louisiana after the reefing (Kaiser, Shively & Shipley 2020).

Overall, the review of Rigs-to-Reefs found that there is a greater interest in the United States for the use of oil and gas facilities as artificial reefs than the United Kingdom and Australia. This suggests that stakeholder interests can vary quite significantly from location to location, which can create complexity in the management of oil and gas decommissioning projects and its stakeholders.

4.2.5 – Thailand

4.2.5.1 – The Petroleum Act [No.6] B.E. 2550 [2007]

Recognising that oil and gas decommissioning is an emerging issue in Thailand, the Petroleum Act [No.6] B.E. 2550 [2007] introduces specific legislation on oil and gas decommissioning. Section 80/1 of The Petroleum Act [No.6] B.E. 2550 [2007] states that:

> *For the purposes of promotion and preservation of environment, the concessionaire shall be responsible for the decommissioning of installations, structure, materials, equipment, and facilities used in the exploration, production, storage, or transportation of petroleum whereby the concessionaire shall submit this decommissioning plan together with estimated expenses thereof in order to seek the concurrence of the Director-General in accordance with the rules, procedures, conditions and period of time prescribed in the Ministerial Regulations.*
>
> *– Section 80/1, the Petroleum Act [No.6] B.E. 2550 [2007]*

Section 80/1 suggests that oil and gas decommissioning is viewed by legislative governmental stakeholders in Thailand as primarily an environmental issue, similar to legislative governmental stakeholders in Australia. Section 80/1 also made it clear that concessionaires have an obligation to undertake a decommissioning project. Section 80/1 also appears to be very prescriptive as the *"procedures and period of time"* are required to abide by the Ministerial Regulations. This means that regulatory governmental stakeholders can have a significant influence on the management of oil and gas decommissioning projects.

Section 80/2 on the other hand, indicates that the Thai government require financial security. Section 80/2 of the Petroleum Act [No.6] B.E. 2550 [2007] states that:

> *The concessionaire shall deposit a security for the decommissioning of installations, structures, materials, equipment, and facilities under Section 80/1 with the Director-General in accordance with the rules, procedures, conditions and period of time prescribed in the Ministerial Regulations. The security can be in the form of cash, Thai government bonds, a bank guarantee, or any other form. If the concessionaire fails to deposit the security, or deposit the security not in full as required or not within the period of time prescribed in paragraph one, the concessionaire shall pay a surcharge of two percent per month of the amount required or the shortfall, as the case may be, commencing from the due date and the Director-General shall give him a notice on the deposit of the security with surcharge to be made within 30 days from the date of receipt of the written notice. If the security and surcharge still are not properly deposited, the Minister may issue an order revoking the concession.*
>
> *– Section 80/2, the Petroleum Act [No.6] B.E. 2550 [2007]*

It must be noted that there are concession agreements that date back to the 1960s (Beckstead 2018), long before the introduction of Section 80/1 and 80/2, which were only introduced in 2006 via the Petroleum Act [No.6] B.E. 2550 [2007].

The approach to ensuring financial security for oil and gas decommissioning is slightly different from the United Kingdom Section 29 approach. The review of Section 80/1 and 80/2 found that Thailand's approach to ensure financial security for oil and gas decommissioning did not consider the event if the concessionaire ceased to exist, unlike the United Kingdom Section 29 approach, where there is a chain of body corporate that decommissioning obligations can be placed upon. This shows that there are significant variations in regulatory approaches in oil and gas decommissioning.

4.2.5.2 – The Ministerial Regulation Prescribing Plan and Estimated Cost and Security for Decommissioning of Installations Used in the Petroleum Industry B.E. 2559 [2016]

The Ministerial Regulations specified in Sections 80/1 and 80/2 of the Petroleum Act [No.6] B.E. 2550 [2007] refers to the Ministerial Regulation Prescribing Plan and Estimated Cost and Security for Decommissioning of Installations Used in the Petroleum Industry B.E. 2559 [2016] (Beckstead 2018). This means there is a nine-year gap which suggests that there are regulatory uncertainties on what the Ministerial Regulations were in that nine-year gap. This suggests that in terms of oil and gas decommissioning, younger hydrocarbon regions, such as Australia and Thailand have more regulatory uncertainties than older ones like the United Kingdom and the United States. This also suggests that younger hydrocarbon regions have more opportunities to learn from the mistakes of others.

According to the Ministerial Regulation Prescribing Plan and Estimated Cost and Security for Decommissioning of Installations Used in the Petroleum Industry B.E. 2559 [2016], the process of decommissioning can be triggered by any one of the following scenarios:

> *(i) When the concessionaire does not use the installations continuously for more than one year.*
>
> *(ii) When petroleum reserves of the concession are less than 40% of the sum of the accumulated petroleum production and reserves.*
>
> *(iii) When the remaining time for petroleum production as specified in the concession is five years.*
>
> *(iv) If the concessionaire wishes to voluntarily commence decommissioning activities.*
>
> *– Section 5, the Ministerial Regulation Prescribing Plan and Estimated Cost and Security for Decommissioning of Installations Used in the Petroleum Industry B.E. 2559 [2016]*

This is a prescriptive approach adopted by Thailand, listing the conditions for the decommissioning process to begin rather than having a discussion-based approach like the United Kingdom. The decommissioning process in the

United Kingdom is triggered when the production of a field becomes non-economical, which can vary depending on various factors, such as the overall business portfolio and financial capability of the oil and gas company (OGA 2016b).

With regard to the approval process, Thailand adopted a regulatory process similar to that of the UK Decommissioning Programme Process, but with a few variations. **Figure 4-8** (below) details the process for oil and gas decommissioning in Thailand:

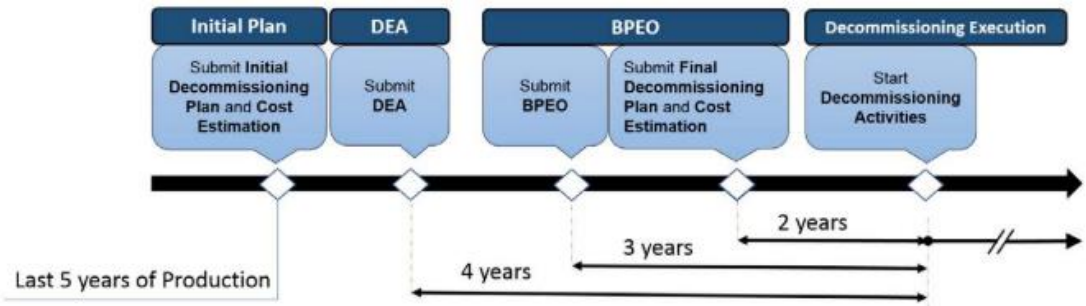


Figure 4-8 – Decommissioning Process in Thailand (Department of Mineral Fuels, 2016)

The most noticeable feature in Thailand's decommissioning process is the preference for using the multi-criteria decision-making tool – BPEO. As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 74), there are several different multi-criteria decision-making tools, such CA (Comparative Assessment) and NEBA (Nett Environmental Benefit Analysis). It was also noted in ***Chapter 3: Managing Oil and Gas Decommissioning*** that BPEO has more qualitative analysis elements than CA. Additionally, as mentioned earlier, CA is the more preferred multi-criteria decision-making tool in the United Kingdom. This suggests that stakeholders' perception of procedural fairness can differ depending on location and stakeholder landscape.

Despite the prescriptive and detailed legislation of the Petroleum Act 2007 and the Ministerial Prescribing Plan 2016, there are still gaps that are unresolved (Beckstead 2018). This suggests that there are still many issues in oil and gas decommissioning that are not yet well understood, making it difficult for policy makers to clarify their expectations. The presence of gaps also means that

there are uncertainties when it comes to the management of oil and gas decommissioning projects and their stakeholders.

4.3 – A Comparison of Four Domestic Regimes

Overall, the review of the evolution of the domestic regimes of the United Kingdom, Australia, the United States, and Thailand found that there are significant variations in their approaches to regulate oil and gas decommissioning activities including financial security measures and arrangements on residual liabilities.

4.3.1 – Position on Oil and Gas Decommissioning

The review found that older and more mature landscapes like the United Kingdom and the United States are firmer regarding their position on oil and gas decommissioning and Rigs-to-Reefs. As mentioned earlier, Rigs-to-Reefs is currently not an acceptable option in the United Kingdom (Gordon, Paterson & Usenmez 2018a), while the United States has a National Artificial Reefs Plan that promotes Rigs-to-Reefs activities (Kaiser, Shively & Shipley 2020).

On the other hand, the positions of younger profiles such as Australia and Thailand are less firm, and tend to be similar to the positions of key international instruments such as UNCLOS 1982, London Dumping Convention 1972, London Protocol 1996, and the IMO Guidelines 1989 (IOGP 2017b, 2017a).

This suggests that the level of regulatory influence on decommissioning decisions increases with the level of maturity of the landscape.

4.3.2 – Procedures for Evaluating Decommissioning Options

The review of domestic regulations also found that the approval and regulatory process for oil and gas decommissioning activities differ from country to country. For example, in terms of the process of defining the precise decommissioning option, the UK regulators require the use of CA, while Thailand regulators require the use of the BPEO. CA and BPEO are both multi-criteria decision-making tools, but each uses a different set of criteria in order to evaluate decommissioning options (Sommer et al. 2019). In addition, the literature review, as mentioned earlier, also suggests that there is a variation in opinion regarding the robustness of multi-criteria decision-making tools. This

suggests that oil and gas decommissioning stakeholders have varying expectations regarding procedural fairness.

4.3.3 – Procedures for Stakeholder Engagement

The need for stakeholder engagement was emphasised in all domestic regulations, which suggests there is a global recognition that the management of stakeholders is important when it comes to the management of oil and gas decommissioning projects.

However, the review of domestic regulations finds that there is a variation in the levels of prescriptiveness regarding the stakeholder engagement process. For example, as mentioned earlier, there is a list of specific statutory consultees that must be engaged by oil and gas operators in the United Kingdom prior to the submission of the Decommissioning Programme. However, there are no such specifications in other regimes such as Thailand and Australia, leaving the entire list of stakeholders to be determined by the oil and gas operators themselves. This indicates that the level of regulatory influence on stakeholder management activities changes depending on location.

4.4 – Conclusion

Regulatory law in oil and gas decommissioning is still young and evolving, as evident by the various legislative amendments made over the years. For example, in the United Kingdom, the most recent amendment of the Petroleum Act 1998 was in 2016. Oil and gas decommissioning legislation in Australia was still being developed when this thesis was written. Little is yet known on how legislations and regulations influence the behaviour of oil and gas operators, especially with regard to the management of oil and gas decommissioning projects and their stakeholders.

There are also various unexplored areas within the oil and gas decommissioning field, such as joint-development areas, which are prevalent in emerging decommissioning landscapes such as South-East Asia. This means that there are plenty of opportunities for research. However, it also means there are still plenty of uncertainties when it comes to the regulating and managing of oil and gas decommissioning activities. In addition to regulatory law, the review found that the literature also finds that even within the field of law, the topic of oil and gas decommissioning is also interdisciplinary, encompassing areas of commercial law, property law, insolvency law, environmental law, etc.

Chapter 5: Research Methodology

5.0 – Chapter Abstract

The main goal of this research is to expand the body of knowledge both practically and theoretically in the field of stakeholder management. This chapter will provide a detailed explanation for the research approach adopted in this study.

The chapter will start by explaining the aim of the research. The chapter will then move on to explore the theory of research methodologies and the philosophical approach that was brought to bear on this research. The author's selection of the research philosophy, approach to theory development, methodological choice, research strategy, time horizon, and research techniques will be explained in detail. The chapter will then go on to explain the practical reasons for the selected data collection and data analysis techniques and procedures used in this research.

5.1 – Research Aims and Objectives

In the preceding review of the literature in:

- ***Chapter 2: Exploring Oil and Gas Decommissioning***
- ***Chapter 3: Managing Oil and Gas Decommissioning***
- ***Chapter 4: Regulating Oil and Gas Decommissioning***

It was found that oil and gas decommissioning is multidisciplinary in nature. Additionally, as mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 36), there is an increasing trend of interdisciplinary research in the field of oil and gas decommissioning. In recognition of the integration of multiple disciplines in the topic of oil and gas decommissioning, this research will combine project engineering and stakeholder management. The overarching aim of this research is to enhance project managers' understanding of the oil and gas decommissioning landscape. This aim will be achieved by modelling the wider context of oil and gas decommissioning in the form of stakeholder-oriented critical paths and conceptual frameworks. The objectives of this thesis are as follows:

1) Develop stakeholder-oriented critical paths[4] that are representative of oil and gas decommissioning projects in the United Kingdom and Australia
2) Identify critical points[5] on the stakeholder-oriented critical path and determine where on the stakeholder-oriented critical path considerable stakeholder interactions exist.
3) Identify which stakeholders are most impactful and determine appropriate mechanisms to ensure effective decommissioning.
4) Identify how project managers currently engage stakeholders.
5) Identify what project managers deemed as best practices to manage the stakeholder interactions.
6) Identify the differences in the oil and gas decommissioning landscape between the United Kingdom and Australia.

5.2 – Theory of Research Methodologies

The research philosophy refers to a set of beliefs on the development of knowledge (Saunders, Lewis & Thornhill 2016). According to Burrell and Morgan (2017), a researcher's research philosophy is determined by the researcher's anthological, epistemological, and axiological beliefs. The anthological, epistemological, and axiological beliefs of the researcher will shape the researcher's understanding of the research questions, and the specific methodological choices made by the researcher (Crotty 1998).

Having a credible research philosophy is important in order to ensure coherent research (Saunders, Lewis & Thornhill 2016). **Figure 5-1** (below) illustrates all the underlying research methodological choices to be made when designing a research:

[4] Definitions of critical path and stakeholder-oriented critical path can be found in Section 3.3.2.2 of Chapter 3 – Managing Oil and Gas Decommissioning.
[5] Critical points are activities in the stakeholder-oriented critical path that are potentially subjected to considerable stakeholder impacts.

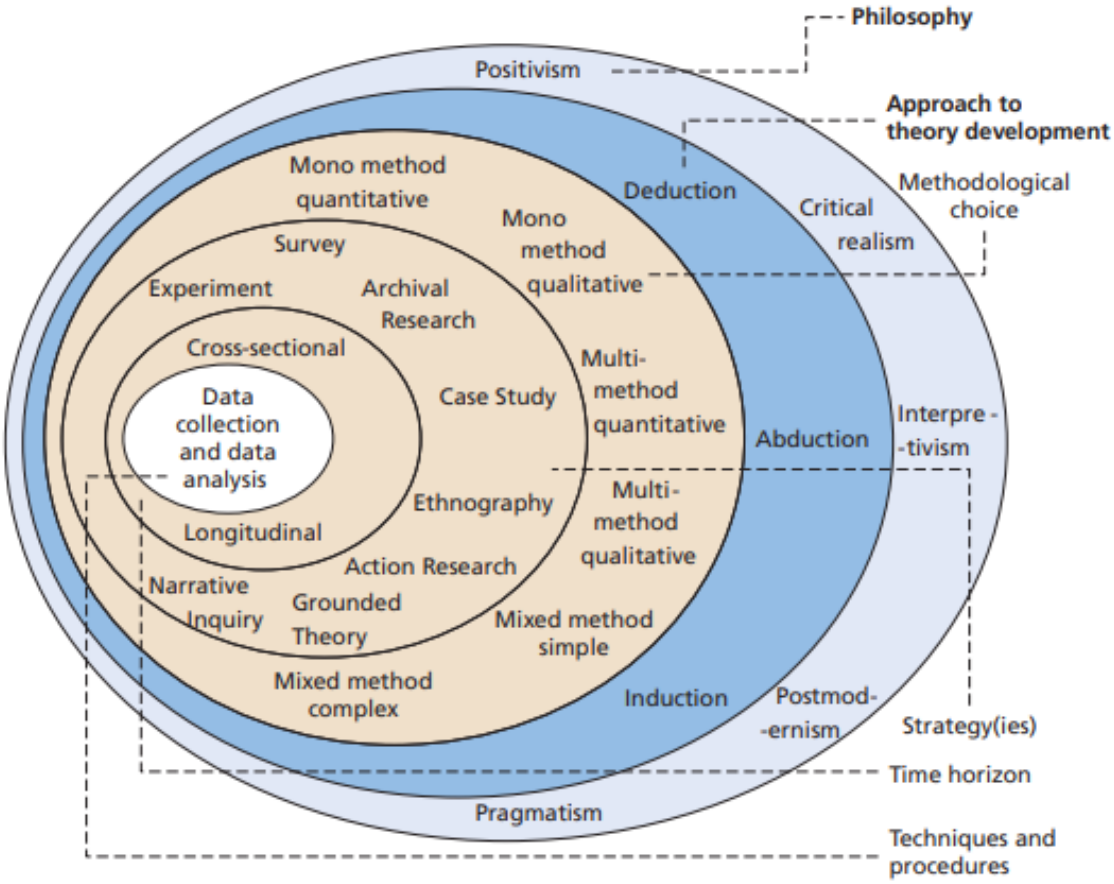


Figure 5-1 – The 'Research Onion' (Saunders, Lewis & Thornhill 2016)

The following sub-sections in this chapter will explain and justify the underlying research methodological choices made for this research, which include the:

- Research Philosophy (Section 5.3)
- Approach to Theory Development (Section 5.4)
- Methodological Choice (Section 5.5)
- Research Strategy (Section 5.6)
- Time Horizon (Section 5.7)
- Research Procedure and Techniques (Section 5.8)

The review of the literature in the field of research methodologies found that some terms are used interchangeably. For example, as noted by Saunders, Lewis and Thornhill (2016), some authors use the words "paradigms" and "philosophies" interchangeably. On occasion, different terms are used by different authors when referring to the same concept (Alexander 2010). For example, what was referred to by Saunders, Lewis and Thornhill (2016) as a

"research strategy", was referred to by Bryman and Bell (2011) as a "research design". In order to ensure consistency in the use of research terms in this thesis, the terms used will follow the definitions as defined in the 8th edition of *Research Methods for Business Students* (Saunders, Lewis & Thornhill 2016). **Table 5.1** (below) are the definitions of the respective terms according to Saunders, Lewis and Thornhill (2016):

Table 5-1 – Definition of Terms (Saunders, Lewis & Thornhill 2016)

Term	Definition
Research Philosophy	A set of beliefs a researcher holds when examining a social phenomenon from which he or she gains an understanding of these phenomena. (e.g. positivism, interpretivism, pragmatism.)
Research Approach	The approach of the research towards theory development. (e.g. inductive, deductive, abductive.)
Research Choice	The methodological choice adopted for the research. (e.g. mono-method quantitative, mixed-method.)
Research Strategy	The plan of action for answering the research questions. (e.g. case study, interview, critical path analysis.)
Time Horizon	The timeframe for the research. (e.g. cross-sectional, longitudinal.)
Research Technique	The specific techniques utilized for the collection and analysis of data. (e.g. snowball sampling, coding analysis.)

5.3 – Research Philosophy

5.3.1 – Positivism

A positivist philosophy adopts the position of the natural scientist (Saunders, Lewis and Thornhill 2016). A positivist assumes that there is one true reality and that knowledge is observable and measurable (Crotty 1998; Saunders, Lewis and Thornhill 2016). Positivist researches are typically deductive, and consist of quantitative methods (Saunders, Lewis and Thornhill 2016).

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 10), the field of oil and gas decommissioning is most commonly viewed through the lens of engineering and science. The literature review found that a positivist research philosophy is most commonly adopted for researches in the field of engineering and science. This suggests that a positivist research philosophy is more suitable for this research.

5.3.2 – Interpretivism

An interpretivist philosophy recognises the world is made up of different groups of people, and that there are multiple realities and worldviews (Crotty 1998; Saunders, Lewis & Thornhill 2016). An interpretivist makes contributions to knowledge by broadening understandings and worldviews (Saunders, Lewis & Thornhill 2016). Interpretivist researches are typically inductive and use qualitative methods (Saunders, Lewis & Thornhill 2016).

While this research takes place in the field of oil and gas decommissioning, the research primarily focuses on identifying and analysing stakeholders. As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 90)***,*** oil and gas decommissioning involve a wide range of different stakeholders, with different views, concerns, and interests. Additionally, the literature review found that an interpretivist research philosophy is more commonly adopted for research in the area of stakeholder management. This suggests that an interpretivist research philosophy is more suitable for this research.

5.3.3 – Critical Realism

The ontology of critical realism is stratified into three different realms – the real, the actual, and the empirical realms (Bhaskar 2013; Heeks & Wall 2018; Lehtinen & Aaltonen 2020). The real domain is the mechanism and structures with enduring activities (Heeks & Wall 2018). The actual domain is the events occuring due to the mechanisms of the real realm (Heeks & Wall 2018). The empirical is the observable experience of the events (Heeks & Wall 2018).

Similar to interpretivism, critical realism recognises that reality is external, independent, and intransient (Saunders, Lewis & Thornhill 2016). Both interpretivist and critical realist philosophies recognise that social phenomena cannot be measured, but rather they must be understood (Sayer 2000). Both interpretivist and critical realist philosophies also recognise the bias of different world views and attempts to minimise it (Saunders, Lewis & Thornhill 2016). However, the main difference between interpretivism and critical realism, is that the latter requires causal explanations for social phenomena (Easton, 2010; Sayer, 2000; Reed 2005).

Based on the review of past works in the field of stakeholder management, the majority of them adopted a critical realist research philosophy. Key works in recent years such as Eskerod & Larsen (2018), Kujala & Sachs (2019), Lehtinen & Aaltonen (2020), all adopted a critical realist philosophical approach. The reason for critical realism being the dominant philosophy employed in the field of stakeholder management is because the phenomenon of stakeholder engagement appears to match well with the three-level stratified ontology of critical realism (Greenwood 2007; Kujala & Sachs 2019; Lehtinen & Aaltonen 2020). From a critical realist point of view, the organisation and stakeholders involved in the engagement are acknowledged as entities in the real domain, the stakeholder engagement activities are acknowledged as the events in the actual domain, and the researcher is able to record observable experiences from the empirical domain (Sayer 2000; Lehtinen & Aaltonen 2020.

Despite critical realism being the dominant paradigm when considering stakeholder management, the rationale underlying the selection of critical

realism as a research philosophy is not clearly articulated in the literature. Furthermore, in this research, the main focus is on designing stakeholder-oriented critical paths rather than observing the mechanisms of stakeholder engagements. As such due to the stakeholder-oriented critical paths being a dominating component of this research, an interpretivist philosophy may be the more appropriate philosophy to be adopted rather than critical realism.

5.3.4 – Research Philosophy Selection

The selection of the research philosophy for this research will consider the findings from the literature review, the research aims and objectives, and the author's background. As shown in the research aims and objectives section, this project is interdisciplinary, combining project engineering with stakeholder management. The project engineering portion of the research is the design of stakeholder-oriented critical paths, while the stakeholder management portion of the research is about the identification and analysis of stakeholders. According to Clark and Creswell (2008), a single research philosophy approach is not sufficient to with complex multidisciplinary issues. Thus, a different research philosophy will be adopted in this research.

The literature review found that a positivist research philosophy is more common in project engineering-related research. The critical paths will also require some form of generalisation in order to be designed (Cho & Eppinger 2005; Zammori, Braglia & Frosolini 2009). Additionally, the author's background is in the field of petroleum engineering, and so prefers a positivist research philosophy. Furthermore, the target audience of the stakeholder-oriented critical paths is project managers, who usually take a more positivist stance (Sage, Dainty & Brookes 2014). Hence, part of this research will adopt a positivist approach.

However, as mentioned in the research aims and objectives, this project involves studying project stakeholders to obtain information to create the stakeholder-oriented critical paths. Stakeholders, as mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 78), are made up of different groups of people, with different views, concerns, and interests. Part

of this research will, therefore, adopt an interpretivist view in order to better understand the perspectives of the various stakeholder groups.

In comparison to critical realism, interpretivism was adopted as the second research philosophy because the focus of the research was on the design of stakeholder-oriented critical paths rather than investigating stakeholder engagements. As such, during the initial design of the research, it was anticipated that the case study component of the research would dominate the study, suggesting an interpretivist approach would be more appropriate. Additionally, there is a value added of utilising a different approach to look at the research arenas so as to get a more nuanced understanding of stakeholder management. However, given the breadth of interview engagement, in hindsight, a critical realist research philosophy could also have been employed.

5.4 – Approach to Theory Development

5.4.1 – Deductive Approach

A deductive approach involves formulating a hypothesis based on a pre-existing concept or theory and testing it in the research (Saunders, Lewis & Thornhill 2016; Silverman 2013; Snieder & Larner 2009). According to Saunders, Lewis and Thornhill (2016), a deductive approach is generally associated with a positivist research philosophy and quantitative research methodology.

5.4.2 – Inductive Approach

An inductive approach involves the researcher developing a theory or a conceptual framework from the collected data (Bryman & Bell 2011; Flick 2011; Saunders, Lewis & Thornhill 2016). According to Saunders, Lewis and Thornhill (2016), an inductive approach is generally associated with an interpretivist research philosophy and qualitative research methodology. However, as noted by Flick (2011), an inductive approach can also be effective with positivist methodologies.

5.4.3 – Abductive Approach

An abductive approach is a combination of deduction and induction (Suddaby 2006), moving back and forth between data and theory. An abductive approach usually begins with a “surprising fact”. Researchers will then attempt to establish an appropriate theory to explain the phenomenon that occurred and test the theory (Saunders, Lewis & Thornhill 2016; Van Maanen et al. 2007).

In comparison to an inductive approach, an abductive approach can be more advantageous as it allows for the modification and testing of theories in addition to theory generation (Saunders, Lewis & Thornhill 2016). Moreover, it allows for the research design to be adapted in consideration of research constraints, such as the lack of data (Easterby-Smith et al. 2012). However, it must be acknowledged that, a longer research period is expected for abductive research (Hakim 2000; Saunders, Lewis & Thornhill 2016).

5.4.4 – Research Approach Selection

As part of this research will take a positivist stance, a deductive approach is possible. However, as mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning***, ***Chapter 3: Managing Oil and Gas Decommissioning***, and ***Chapter 4: Regulating Oil and Gas Decommissioning***, knowledge is still evolving in the field of oil and gas decommissioning. This means the body of knowledge in oil and gas decommissioning is still in its infancy, and pre-existing theories may not have yet stabilised. An inductive approach will be more beneficial in this research in order to generate new concepts and theories not previously explored in oil and gas decommissioning. Adopting an inductive approach to theory development can also reduce any bias from the literature review. As noted by Flick (2011), an inductive approach can also be effective with positivist methodologies. Hence, this research will adopt a primarily inductive research approach.

5.5 – Methodological Choice

The methodological choice concerns the type of data to be collected and analysed (Saunders, Lewis & Thornhill 2016). Quantitative methodology involves numerical data while qualitative methodology deals with non-numerical data (Saunders, Lewis & Thornhill 2016). A combination of single and multiple quantitative and qualitative methodology can also be used. **Figure 5-2** (below) shows all the possible combination of methodological choice:

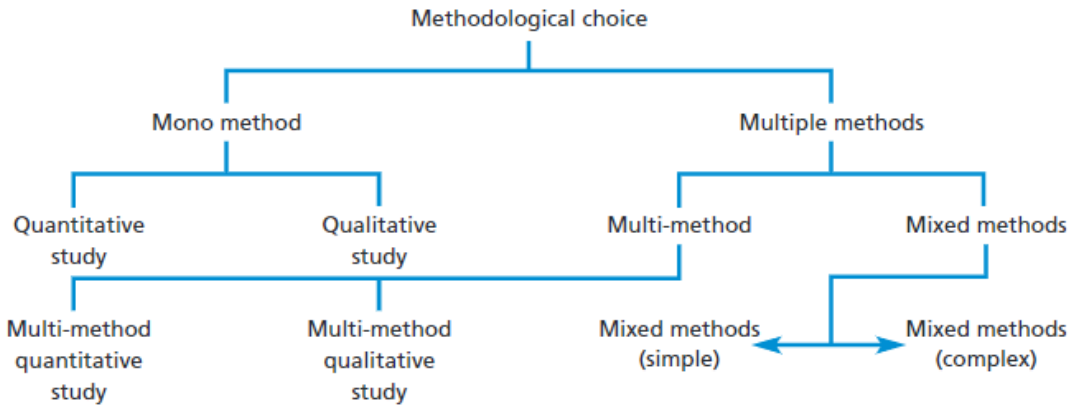


Figure 5-2 – Methodological Choices (Saunders, Lewis & Thornhill 2016)

5.5.1 – Methodological Choice Selection

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 51), oil and gas decommissioning is multidisciplinary in nature. Hence, as mentioned earlier in the research aims and objectives, this research will be interdisciplinary, encompassing project engineering and stakeholder management. Additionally, part of this research takes a more positivist approach, and other parts take a more interpretivist approach.

The literature review also found that mixed-methods have various advantages in research (Greene 2007; Newman & Ridenour 2008; Saunders, Lewis & Thornhill 2016; Teddlie & Tashakkori 2011). Mixed-methods can allow for more diversity in views and allow triangulation of data (Bryman 2008; Greene 2007; Molina-Azorin 2016). This can be beneficial, especially in this research, as there are links between engineering, project management, and stakeholder management (Eskerod & Huemann 2013; Eskerod & Jepsen 2013).

Therefore, mixed-methods will be used in this research in recognition of the integration of multiple disciplines in the topic of oil and gas decommissioning. **Figure 5-3** (below, page 158) shows the mixed-method design for this research, which comprises case studies, critical path design and analysis, and semi-structured interviews. This mixed-method research is designed using the explanatory design type with case study research first followed by semi-structured interviews. The reasons for this are to:

- Select appropriate stakeholders to be interviewed in the following stage
- Gain relevant information on what has been done in the past
- Have an initial base design to bring to the table when engaging the stakeholders

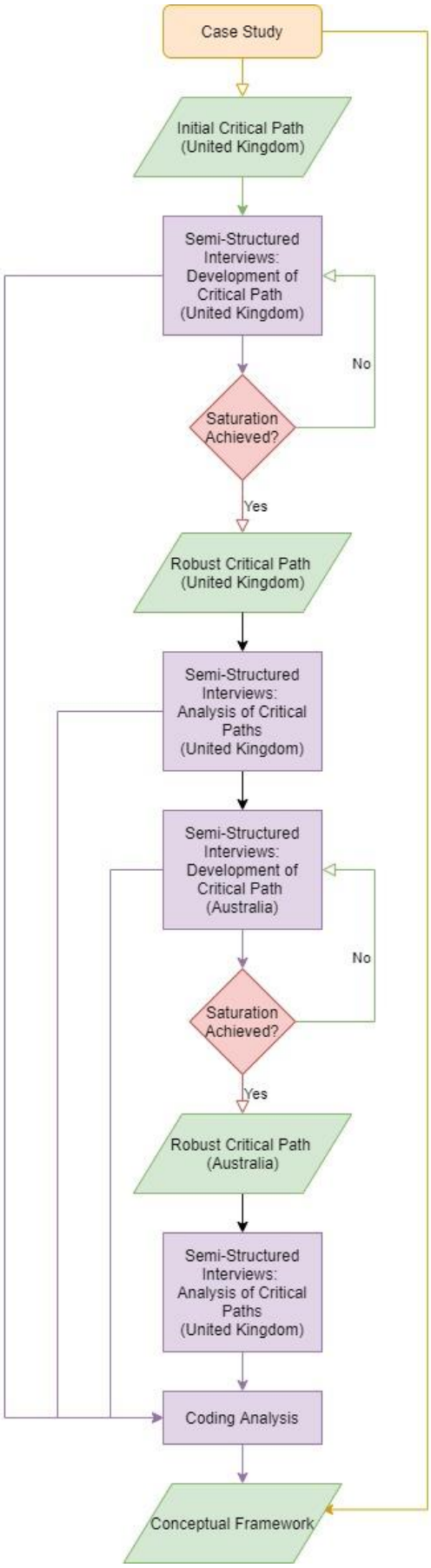


Figure 5-3 – The Overall Research Methodology

5.6 – Research Strategy

A research strategy is an action plan to achieve the research aims and objectives (Saunders, Lewis & Thornhill 2016). As mentioned earlier, this research will be a mixed method of case study, critical path design and analysis, and semi-structured interviews. This section of the chapter will explain and justify each element of the chosen research strategy.

5.6.1 – Design and Analysis of Stakeholder Oriented Critical Paths

A critical path is a project management tool that can be used to illustrate the sequence of project activities, the duration of each project activity, and the dependencies between the activities (Shaffer, Ritter & Meyer 1965). The critical path of the project is determined by identifying the activity pathway with the longest total duration. A stakeholder-oriented critical path considers the level of stakeholder impact on each project activity rather than the duration of the activity. Thus, stakeholder-oriented critical paths can serve as a means for assessing and managing stakeholders at the critical points throughout an oil and gas decommissioning project. A detailed definition of critical paths and stakeholder-oriented critical paths can be found in **Section 3.4.2** of ***Chapter 3 – Managing Oil and Gas Decommissioning***.

The study of critical paths is known as critical path analysis. Critical path analysis is a well-known technique used widely in both the engineering and management worlds enabling it to gain wider acceptance of the project outcome and make it easier for the results to be understood by audiences both inside and outside the industry (Kelley Jr & Walker 1959). Analysing the critical paths can help project managers identify critical points, and determine when during an oil and gas decommissioning project lifecycle stakeholder interaction exists. With this information, project managers can modify the critical paths design to improve the project operation and make more informed project and stakeholder management decisions.

The reason for using a critical path analysis approach is to:

- Contribute to both knowledge and industry; the stakeholder-oriented critical path can act as a useful research artefact for project managers when planning and managing oil and gas decommissioning projects.
- Model the wider decommissioning landscape in a form that is easily understood by people of different backgrounds.

The stakeholder-oriented critical paths will also serve as a platform to present primary and secondary data obtained from interviews and case study research.

5.6.2 – Case Studies of Past Oil and Gas Decommissioning Projects

A case study is a thorough investigation of a phenomenon in a real-life setting (Yin 2017). Case study can generate more in-depth insights into a topic or a phenomenon (Dubois & Gadde 2002; Eisenhardt & Graebner 2007; Ridder, Hoon & McCandless Baluch 2014; Yin 2017). However, there has been some criticism by positivists regarding the feasibility of using case study data to contribute to knowledge (Buchanan 2012; Flyvbjerg 2011).

In comparison to archival research, for case studies, the volume of data required for comparison and triangulation during analysis is smaller (Welch 2000). Additionally, archive documents may be confidential, and access to archives may be restricted (Welch 2000). In comparison to ethnography, case studies take a much shorter timeframe to be completed (Chiseri-Strater 1996). As seen in **Figure 5-3** (above), the purpose of the case study is to obtain information in order to design the initial stakeholder-oriented critical paths. Additionally, the initial critical paths will be further modified through semi-structured interviews. As such, research strategies that involve a longer timeframe, such as archival research and ethnography, are less favourable options than case studies.

In summary, while there are many different qualitative approaches available to obtain information from project managers and stakeholders, each with its own strengths and weaknesses, going by the research question and personal preferences case study is the best approach for the following reasons:

- Ease of access; Professor John Paterson from the University of Aberdeen has excellent contacts in the oil and gas decommissioning arena and will facilitate access to secondary data.
- It enables comparison between multiple sources of data and multiple different decommissioning projects (Flyvbjerg 2011; Yin 2017).
- Studying decommissioning in its real-life context via case study is a better approach since there is limited non-engineering research in the field (Dubois & Gadde 2002; Eisenhardt & Graebner 2007; Ridder, Hoon & McCandless Baluch 2014; Yin 2017).

Acknowledging that there is some criticism regarding the reliability and validity of case study sources, a mixed-method approach is used in this research; the secondary data obtained from the case studies will be supported with primary data obtained from semi-structured interviews.

5.6.3 – Semi-Structured Interviews

A research interview is a purposeful conversation between the researcher and the interviewees (Saunders, Lewis & Thornhill 2016). Interviews can be used to obtain valid and reliable data in order to answer the research questions (Denzin 2001; Heyl, Wahl & Mollenkopf 2005). There are three categories of interview:

- Structured Interviews
- Semi-Structured Interviews
- Unstructured Interviews

Structured interviews have a predetermined set of questions, while unstructured interviews do not. Semi-structured interviews have a list of key questions or themes, but their use can vary depending on the interview itself (Saunders, Lewis & Thornhill 2016). As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 146, the body of knowledge in oil and gas decommissioning is still evolving. This means that the interview sessions should be flexible enough to provide interviewees with opportunities to provide information beyond the initial answers. However, as demonstrated by the extensive literature review, oil and gas decommissioning encompass a wide range of disciplines. Hence, semi-structured interviews are preferred as

they provide some constraints that prevent the interview sessions from diverging too far from the research questions (Saunders, Lewis & Thornhill 2016).

While surveys and questionnaires are less expensive to administer, respondents' feelings, emotions, and agendas are difficult to determine (Hunter 2012; Sauro & Lewis 2011). As this research focuses on understanding stakeholders through their own lenses, semi-structured interviews are more suitable for this research as they allow the researcher to pick out interviewee's feelings, emotions, motives, and agendas through the interview sessions (Denzin 2001; Heyl, Wahl & Mollenkopf 2005; Saunders, Lewis & Thornhill 2016).

Individual semi-structured interviews are easier to organise than focus groups, as it can be difficult to find a common time that is convenient for all participants (Belzile & Öberg 2012; Krueger & Casey 2009; Macnaghten & Myers 2007). It must be acknowledged, though, that focus group discussions can generate new ideas through interactive discussions (Krueger & Casey 2009).

While semi-structured interviews have their strengths, it must be noted that they are often criticised as biased (Gobo & Marciniak 2011; Saunders, Lewis & Thornhill 2016). Semi-structured interviews can be interviewer-biased because it is the interviewer who dictates the flow and progress of the interview sessions (Court & Abbas 2013; Gobo & Marciniak 2011). Consequently, appropriate interviewing techniques such as testing of understanding and summarising responses will be adopted by the researcher during the interview sessions (Brinkmann & Kvale 2015; Saunders, Lewis & Thornhill 2016).

Semi-structured interviews are also often criticised for their lack of generalisability due to the smaller sample size (Court & Abbas 2013; Symon & Cassell 2012). However, as the semi-structured interviews will be conducted until saturation is achieved, their generalisability is enhanced through the research procedure. More detail regarding the research procedure will be discussed later on in **Section 5.9** (see page 191).

In summary, while there are many different qualitative approaches available to obtain information from project managers and stakeholders, each with its own

strengths and weaknesses, based on the research question and personal preferences, semi-structured interviews are the best for the following reasons:

- Qualitative semi-structured interviews can be used to engage different stakeholders with different levels of language and background.
- Qualitative semi-structured interviews allow more flexibility in the answers than quantitative surveys and structured interviews (Rallis & Rossman 2003).
- They enable interviewers to change tack to suit the different stakeholders, and thus give the interviewers more opportunity to gain more information beyond the initial answers and better understand the viewpoint of each stakeholder (Rossman, Chance & Ballman 2000).
- Semi-structured interviews are easier to organise than focus groups (Morgan 1995).

While acknowledging that semi-structured interviews might be biased and that the sample size might not be large enough to represent the entire population, the method nevertheless allows for rich and deep ideographic data to be collected, allowing for some degree of comparison. Data obtained from the interviews will be presented in the form of digital recordings and word-processed transcripts.

5.7 – Time Horizon

The time horizon of a research can be either cross-sectional or longitudinal. A cross-sectional study involves studying a phenomenon at a particular time, while a longitudinal study involves studying changes over a period of time (Saunders, Lewis & Thornhill 2016).

5.7.1 – Time Horizon Selection

Due to time constraints and the preference of the author, this research will take a cross-sectional approach. However, it must be noted that primary and secondary data obtained from semi-structured interviews and case studies respectively may contain information on how the management of oil and gas decommissioning projects and stakeholders changes over time. Furthermore, as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 146), the oil and gas decommissioning landscape was also evolving while this research was conducted. Consequently, while primarily taking a cross-sectional approach towards data collection, depending on the data collected, the research findings in this thesis may also explore the phenomenon longitudinally.

5.8 – Research Procedures and Techniques

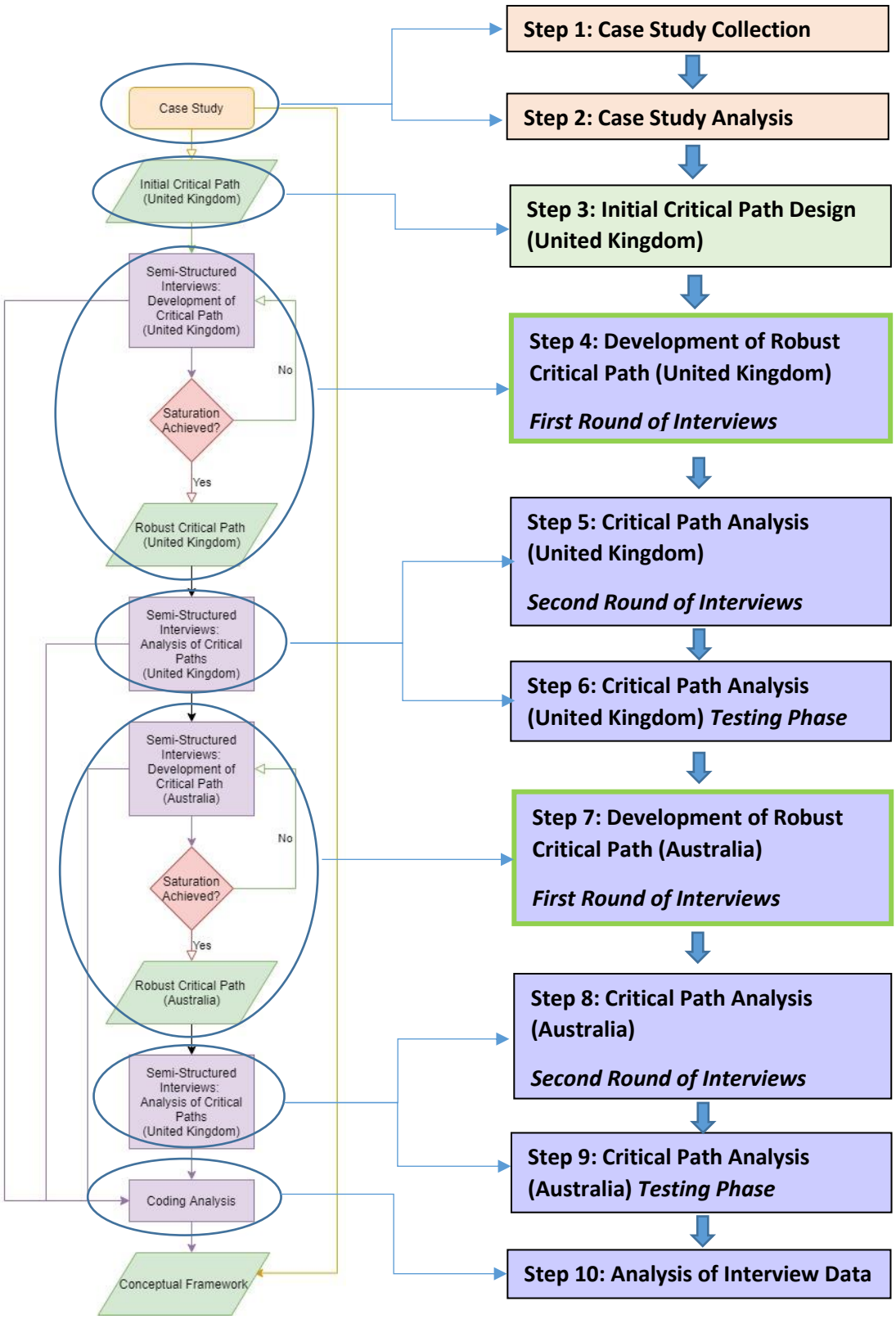


Figure 5-4 – Research Procedure

As illustrated in **Figure 5-4** (above, page 164), there are 10 parts to this research, which will be discussed in detail in the following sections:

1. Step 1: Case Study Collection (Section 5.8.1)
2. Step 2: Case Study Analysis (Section 5.8.2)
3. Step 3: Initial Critical Path Design (United Kingdom) (Section 5.8.3)
4. Step 4: Development of Robust Critical Path (United Kingdom)
   First Round of Interviews (Section 5.8.4)
5. Step 5: Critical Path Analysis (United Kingdom)
   Second Round of Interviews (Section 5.8.5)
6. Step 6: Critical Path Analysis (United Kingdom)
   Testing Phase (Section 5.8.6)
7. Step 7: Development of Robust Critical Path (Australia)
   First Round of Interviews (Section 5.8.7)
8. Step 8: Critical Path Analysis (Australia)
   Second Round of Interviews (Section 5.8.7)
9. Step 9: Critical Path Analysis (Australia)
   Testing Phase (Section 5.8.7)
10. Step 10: Analysis of Interview Data (Section 5.8.8)

5.8.0.1 – Selection of Oil and Gas Decommissioning Landscape

As seen from **Figure 5-4** (above, page 164), this research will involve two decommissioning landscapes. As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 42), the stakeholder landscape can differ from one location to another. However, involving two decommissioning landscapes can allow the research to analyse how the management of oil and gas decommissioning projects and stakeholders differs between different stakeholder landscapes. Investigating multiple landscapes will also provide more credibility when generalising theories.

The UK oil and gas decommissioning landscape was selected because the literature review found that most academic and industry studies were conducted within the context of the UK Continental Shelf. In addition, the notorious Brent Spar incident, which was discussed in detail in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 102), also took place

in the context of the United Kingdom. It would, therefore, be more advantageous to begin the research in the UK landscape.

The Australian oil and gas decommissioning landscape was selected because of the increasing concerns by stakeholders in that landscape, as evident by the increasing amount of academic and industry literature on oil and gas decommissioning in the Australian context since 2015. At the time this research was conducted, Australia was also in the process of developing oil and gas decommissioning legislations and regulations (Chandler et al. 2017; Shaw, Seares & Newman 2018; Barrymore & Ballard 2019). Hence, an investigation into the oil and gas decommissioning landscape would be beneficial in both the management and the regulatory aspects.

Practical reasons were also considered when selecting the oil and gas decommissioning landscapes. This project is a collaboration between the University of Aberdeen, which is based in the United Kingdom, and Curtin University, which is located in Australia. Access to resources and facilities would be easier to obtain if the research is conducted in the countries where the universities are located.

5.8.0.2 – Sequence of Investigation – United Kingdom before Australia

As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 115), the United Kingdom is a much more mature oil and gas decommissioning region than Australia. The literature review also found that there are many more oil and gas decommissioning projects that took place in the United Kingdom than in Australia. This suggests that in the UK landscape, there is much more experience and expertise in oil and gas decommissioning than in Australia. Hence, it would be more advantageous to tap into the experience and expertise in the UK landscape before moving on to the Australian landscape.

Practical reasons were also considered when considering the sequence of investigation. As part of the agreement between the University of Aberdeen and Curtin University, the 1st and 3rd year of the Programme will be based in Australia, while the 2nd year of the Programme will be based in the United Kingdom. Therefore, the research procedure for this research is thus

structured as seen in **Figure 5-4** (above, page 164) in order to maximise the time and resources at both universities.

5.8.0.3 – Absence of Case Study and Initial Critical Paths Design in the Australian Part of the Research

There is a noticeable absence of case study and initial critical path design in the research procedure illustrated in **Figure 5-4** (above, page 164). The purpose of the case study at the beginning of the research is to obtain secondary data in order to create the initial stakeholder-oriented critical paths. The reason for not conducting another case study and initial critical path design in the Australian part of the research is because there will be an existing robust stakeholder-oriented critical path at the end of the United Kingdom part of the research. The robust UK stakeholder-oriented critical path can be used as the initial critical path design in the Australian part of the research and be modified further to form the robust Australian stakeholder-oriented critical path.

While acknowledging that this procedural decision assumes that the UK and Australian stakeholder-oriented critical paths are similar, this is likely to be the case, to judge by the literature review in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 13). While there can be some variations, offshore structures generally comprise the same five components (Wells, Topside, Substructure, Subsea Facilities, and Pipelines) (OGUK 2019). If there are considerable differences between the UK and Australian critical paths, it is unlikely that it will result in significant changes to the research procedure. However, it might mean that more iterations are required before saturation is achieved in Step 7 – Development of Robust Critical Path (Australia).

From a practical perspective, not having the case study and initial critical path design process in the Australian part of the research can save time and resources, allowing more effort to be allocated to semi-structured interviews and the development of the robust Australian stakeholder-oriented critical paths.

5.8.1 – Step 1: Case Study Collection

According to the literature review, the selection of secondary data (case study) sources should consider:

- Their overall suitability to the research questions and objectives (Hakim 2000; Smith 2006)
- Reliability and validity (Lee & Dale 1998; Hair et al. 2012; Hookway 2008; Dochartaigh 2007)
- The assessment of costs and benefits (Hair et al. 2012)

For this research project, the term "case" refers to an oil and gas decommissioning proposal. As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 144), oil and gas operators are usually required to submit a detailed decommissioning plan to the regulators for approvals, which details the project management and stakeholder interactions – the information required to address the research questions. Hence, the type of case study source has been narrowed down to databases containing oil and gas decommissioning proposals.

5.8.1.1 – Single Database vs. Multiple Databases Approach

The search for potential databases found that the OPRED (Offshore Petroleum Regulator for Environment and Decommissioning) official Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines website[6] is the sole source of all completed and ongoing decommissioning projects in the United Kingdom. Note that, as explained earlier, the case study process will only be carried out in the United Kingdom. Furthermore, the website is easily accessible to the public. Therefore, the research will be carried out using a single database source approach.

The author acknowledges that a single database approach may raise questions regarding the validity and reliability of the findings. However, the findings from the case study will be validated with primary data obtained from semi-structured interviews later on in the research.

[6] Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines, Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), Department of Business, Energy and Industrial Strategy (BEIS). Published on 23 January 2013 and continuously updated as decommissioning plans are submitted and approved. Last Updated on 17 December 2020. https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines

5.8.1.2 – The Selected Database: OPRED Website

OPRED's official Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines website[7]was published by OPRED on 23 January 2013 and is continuously updated as decommissioning plans are submitted and approved. OPRED sits within BEIS (the Department of Business, Energy, and Industrial Strategy), then called the Department of Energy and Climate Change (DECC). BEIS was created on 14 July 2016 by then UK Prime Minister Theresa May through the merger of DECC and the Department for Business, Innovation, and Skills (BIS).

As of 17 December 2020, the OPRED website contains information on a total of 142 completed and ongoing oil and gas decommissioning projects in the United Kingdom. The database contains four different types of documents submitted by oil and gas operators to BEIS. The definition for the four types of documents and the information it contains related to the research questions are listed in **Table 5-2** (below, page 170). It is important to note, however, that not all cases have all four types of documents published on the OPRED website. The close-out reports, for example, are only available for completed oil and gas decommissioning projects.

[7] Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines, Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), Department of Business, Energy and Industrial Strategy (BEIS). Published on 23 January 2013 and continuously updated as decommissioning plans are submitted and approved. Last Updated on 17 December 2020. https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines

Table 5-2 – Types of Documents Published on OPRED's Website (OPRED 2019)

Document	Definition	Information Available
Decommissioning Programme	Decommissioning Proposal Submitted to BEIS. An Overall Summary of All Activities Taken to Develop the Proposed Solution.	• Activities that Takes Place during Decommissioning Planning. • Stakeholder Interactions before and during Decommissioning Planning.
Comparative Assessment Report	A Technical Report of the Evaluation of Different Decommissioning Options Using the Assessment Method Promoted by BEIS.	• Activities Regarding Evaluation of Different Decommissioning Options. • Stakeholder Interaction before and during Evaluation of Different Decommissioning Options.
Environmental Statement / Appraisal Report	A Technical Report of the Current Environmental Condition and the Evaluation of Potential Environment Impact due to the Decommissioning Activities.	• Activities Regarding Pre-Planning Surveys and Studies. • Stakeholder Interaction with Environmental Stakeholders.
Close-Out Report	A Report Detailing the Execution of the Decommissioning Activities.	• Executed Decommissioning Activities. • Technical Issues Encountered During Execution.

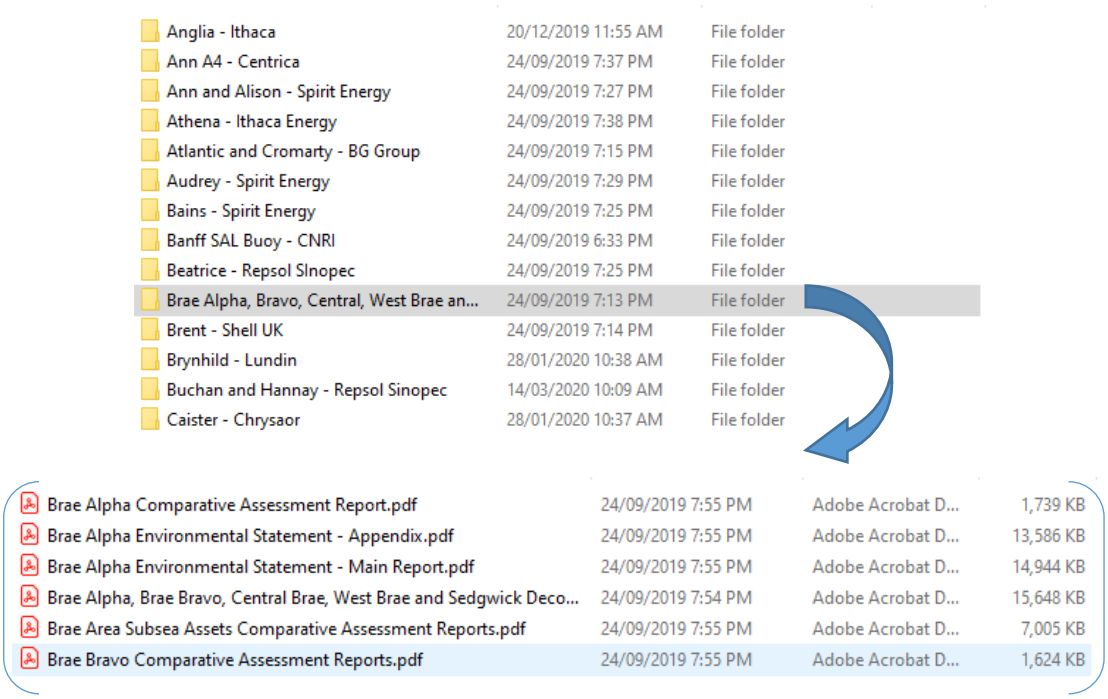
5.8.1.3 – Evaluating the OPRED Website as a Secondary Data Source

The OPRED website is an official governmental resource and publication. Additionally, the primary purpose of the source was to be transparent to the public in the regulatory consideration of decommissioning proposals and invite comments from stakeholders (OPRED 2019). As its purpose is to ensure stakeholders' approval on the decommissioning project, it is highly likely that the information presented is reliable. Note that information obtained from the OPRED website will be validated later on via semi-structured interviews.

As shown in **Table 5-2**, the source contains information regarding the management of oil and gas decommissioning projects and stakeholders, which can be used to address the research questions to be answered in this study. Additionally, the database contains a large number of cases (139 as of 7 December 2020), which enables the ability to triangulate between the different oil and gas decommissioning projects. Finally, the OPRED website was selected as the secondary data source because the source is readily accessible to the public at no cost, which means a high benefit-to-cost ratio.

5.8.1.4 – The Collection Process

All available documents were downloaded from the OPRED website and sorted by case. Due to the presentation format and structure of the documents presented on the OPRED website, one case may have multiple files, as illustrated in **Figure 5-5** (below). All files (secondary data) will be stored in a secure research drive at Curtin University and the University of Aberdeen.



Anglia - Ithaca	20/12/2019 11:55 AM	File folder
Ann A4 - Centrica	24/09/2019 7:37 PM	File folder
Ann and Alison - Spirit Energy	24/09/2019 7:27 PM	File folder
Athena - Ithaca Energy	24/09/2019 7:38 PM	File folder
Atlantic and Cromarty - BG Group	24/09/2019 7:15 PM	File folder
Audrey - Spirit Energy	24/09/2019 7:29 PM	File folder
Bains - Spirit Energy	24/09/2019 7:25 PM	File folder
Banff SAL Buoy - CNRI	24/09/2019 6:33 PM	File folder
Beatrice - Repsol SInopec	24/09/2019 7:25 PM	File folder
Brae Alpha, Bravo, Central, West Brae an...	24/09/2019 7:13 PM	File folder
Brent - Shell UK	24/09/2019 7:14 PM	File folder
Brynhild - Lundin	28/01/2020 10:38 AM	File folder
Buchan and Hannay - Repsol Sinopec	14/03/2020 10:09 AM	File folder
Caister - Chrysaor	28/01/2020 10:37 AM	File folder

Brae Alpha Comparative Assessment Report.pdf	24/09/2019 7:55 PM	Adobe Acrobat D...	1,739 KB
Brae Alpha Environmental Statement - Appendix.pdf	24/09/2019 7:55 PM	Adobe Acrobat D...	13,586 KB
Brae Alpha Environmental Statement - Main Report.pdf	24/09/2019 7:55 PM	Adobe Acrobat D...	14,944 KB
Brae Alpha, Brae Bravo, Central Brae, West Brae and Sedgwick Deco...	24/09/2019 7:54 PM	Adobe Acrobat D...	15,648 KB
Brae Area Subsea Assets Comparative Assessment Reports.pdf	24/09/2019 7:55 PM	Adobe Acrobat D...	7,005 KB
Brae Bravo Comparative Assessment Reports.pdf	24/09/2019 7:55 PM	Adobe Acrobat D...	1,624 KB

Figure 5-5 – Example of the Collection and Organisation of Secondary Data from OPRED

5.8.2 – Step 2: Case Study Analysis

The main rationale of the case study step is to gain insight into the past and to use the information to design the initial stakeholder-oriented critical paths before proceeding to stakeholder interviews. Consequently, the case study analysis procedure will be influenced by the number of initial stakeholder-oriented critical paths to be designed in Step 3.

As mentioned in the summary in **Section 2.2.4** (see page 50) of ***Chapter 2: Exploring Oil and Gas Decommissioning***, the critical path for decommissioning an oil and gas facility may vary depending on the precise decommissioning option. The literature review found that the precise decommissioning option can generally be divided into four main categories:

- Leave-In-Place (In-Situ)
- Leave-In-Place (Moved)
- Partially Leave-In-Place
- Complete Removal

So, four different initial stakeholder-oriented critical paths will be created, each representing one of the precise decommissioning options as mentioned above.

5.8.2.1 – Categorising the Cases

As there are four initial stakeholder-oriented critical paths to be created, the cases will be categorised based on the precise decommissioning option. As illustrated in **Figure 5-6** (below, page 173), the precise decommissioning option is clearly stated for each case on the OPRED website, making the overall categorising process easier.

Ninian Northern Platform (PDF, 2.34MB, 70 pages)	CNR International (U.K.) Limited	-	Large Steel Platform	Topsides and jacket to top of footings to be removed to shore for recycling/disposal. Footings to remain in situ.	→ Partially Leave-In-Place
Nevis N11 WHPS (PDF, 1.66MB, 26 pages)	Apache Beryl I Limited	-	Nevis N11 WHPS	Removal to shore for re-use or recycling	→ Complete Removal

Figure 5-6 – Categorisation of Cases Based on the Precise Decommissioning Option

5.8.2.2 – Analysis of Cases

After categorising the cases, each case will be analysed individually within its own category to identify common patterns by using multiple triangulation methodologies. As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 64), the key information required for the design of a critical path includes:

- A list of all project activities
- Duration for each activity
- Dependencies between activities
- Milestones and deliverables

Therefore, for each case, the above information will be identified and recorded. However, as this project focuses on identifying stakeholder interactions and the creation of stakeholder-oriented critical paths, information regarding stakeholder interactions will also be recorded.

The cases will be compared with other cases within their categories in order to identify common patterns by using multiple triangulation methodology. Similarities based on patterns will be recorded using Microsoft Excel and used to form the initial design of the stakeholder-oriented critical paths. Microsoft Excel allows multiple cases to be presented side-by-side in different columns in the same spreadsheet format, allowing for easier triangulation between different cases. The cases will be analysed using an inductive approach to prevent any bias from the literature review. There is both academic and industry literature such as Akinyemi, Sun and Gray (2020) and Blacklaws (2018) that has details regarding project activities, durations, dependencies,

milestones, and deliverables, which may influence the researcher when analysing the cases.

In order to develop the initial stakeholder-oriented critical paths, some forms of generalisation of the case study data are required. There are various techniques that can be used to detect patterns inductively, including statistical analysis (Mills, Durepos & Wiebe 2010) and structural analysis (Bjork & Holopainen 2004).

For information regarding the list of project activities, milestones and deliverables, and the dependencies between activities, a statistical approach will be used by tallying the frequency of appearance. A statistical approach, while not common for case study analysis, can be useful in this research as it allows the required information to be obtained faster (Duffy 1987; Almalki 2016). Furthermore, there is no need to understand the meaning behind the phenomena using a qualitative approach as the purpose of the case study is to obtain information to design the initial stakeholder-oriented critical paths. Information that appears in more than 80% of cases within each category will be used for the design of the initial stakeholder-oriented critical path for that category. The reason for using 80% as a threshold is that it has been cited in much research literatures as the minimum level of confidence (Cocks & Torgerson 2013; Krejcie & Morgan 1970).

For the duration of each activity, the mean number will be used. The mean, or average, is used because it is the most used measure of central tendencies (Wilcox & Keselman 2003; Manikandan 2011).

Information regarding stakeholder interactions will be recorded in a case study log along with the associated project activity or activities. Any other significant information and emerging themes from the case study process will also be recorded in the case study log. Information in the case study log can be referred to when conducting and analysing the semi-structured interviews. The analysis of the case study data will be presented in this thesis in a written format.

5.8.3 – Step 3: Initial Critical Path Design (United Kingdom)

The main rationale for this step is to design four initial stakeholder-oriented critical paths to be used as an engagement tool for semi-structured interviews in the later part of the research.

Using the information obtained from case studies (Step 1 and Step 2), the initial stakeholder-oriented critical paths will be created using Microsoft Project software. Microsoft Project is a project management tool that can be used to design critical paths. Microsoft Project was selected because it is a commonly used package in the industry, and it has a good track record (Carr & Tah 2001; Kostalova, Tetrevova & Svedik 2015). This suggests that the presentation of the stakeholder-oriented critical path model produced by Microsoft Project would be much more familiar to project managers, who will be interviewed later on in the project to further develop the stakeholder-oriented critical paths. Additionally, the software is readily available at both Curtin University and the University of Aberdeen.

The results and findings from the process of designing the initial critical paths will be used to answer the following research questions.

Research Question 1: Can Stakeholder-Oriented Critical Path(s) be Modelled?

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 32), the precise decommissioning option is dependent on the design of the oil and gas facility, location, regulations, and stakeholder interests and concerns. This indicates that there are a lot of uncertainties in an oil and gas decommissioning project which suggests that it is possible that a stakeholder-oriented critical path could not be modelled.

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 66), there exist many project management tools produced by the industry literature that can be used for all oil and gas decommissioning projects, such as the Oil and Gas UK Decommissioning WBS (Work Breakdown Structure) (OGUK 2019). This suggests that it is highly likely that stakeholder-oriented critical paths can be modelled using Microsoft Project. However, the review of the literature cannot give a definitive answer as to whether a stakeholder-

oriented critical path can be modelled or not, hence the existence of this research question.

In the event that stakeholder-oriented critical paths cannot be modelled, that finding would itself also be a contribution to knowledge. While not having stakeholder-oriented critical paths modelled would mean that robust stakeholder-oriented critical paths will not be produced at the end of this research, other research objectives can still be achieved through the collection and analysis of primary data from semi-structured interviews in the absence of stakeholder-oriented critical paths.

Research Question 2: At What Level of Granularity can Homogeneity for each of the Stakeholder Oriented Critical Path(s) be achieved?

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 32), the precise decommissioning option is dependent on the design of the oil and gas facility, location, regulations, and stakeholder interests and concerns. This indicates that there are a lot of uncertainties in an oil and gas decommissioning project which suggests that certain assumptions must be made in order for the stakeholder-oriented critical paths to be modelled. This research question will be answered by showing the list of assumptions made for the stakeholder-oriented critical paths to be modelled.

5.8.4 – Step 4: Development of Robust Critical Path(s) (United Kingdom) – First Round of Interviews

The main rationale for this step is to further develop the initial critical paths in order to form the robust stakeholder-oriented critical path(s) for the United Kingdom. The development of the robust stakeholder-oriented critical path(s) for the United Kingdom will be achieved by obtaining information through semi-structured interviews, using the initial stakeholder-oriented critical paths as an engagement tool.

5.8.4.1 – First Round of Semi-Structured Interviews

The main rationale for the first round of semi-structured interviews is to:

- Validate and confirm the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* deduced from the case study.
- Obtain additional information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in the secondary data.
- Obtain recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust oriented stakeholder-oriented critical paths.

The targeted interviewees are industrial representatives who have experience in the management of oil and gas decommissioning projects and/or stakeholders. Industrial representatives with prior experience in managing oil and gas decommissioning projects and/or stakeholders were selected as targeted interviewees because they are more likely to be able to provide the information required to improve the initial stakeholder-oriented critical paths.

Collection of data for research in the oil and gas industry has been noted in past studies to be difficult in many research projects because of the issue of confidentiality (Hardwicke-Brown 1996; Kaiser & Yu 2010). This suggests that industrial representatives could be difficult to reach. Snowball sampling has been regarded as an effective sampling technique in hard-to-reach scenarios (Atkinson & Flint 2001; Waters 2015). Hence, snowball sampling will be used in this research.

The first interviewee will be selected based on experience, seniority and recognition in the industry, and connections in the UK oil and gas decommissioning community. Snowballing from an interviewee with wider connections can make the snowball sampling method more effective (Biernacki & Waldorf 1981; Goodman 1961; Heckathorn 2011; Noy 2008).

As semi-structured interviews involve human participants, ethical guidelines from both the University of Aberdeen and Curtin University were strictly followed to the letter. Informed consent and permission to record audio information will be collected from each interviewee prior to the commencement of the interview sessions. Each recorded interview will also be transcribed and the transcript sent to the respective interviewees for verification.

Appropriate semi-structured interview skills, such as using the critical incident technique (Keaveney 1995) and the recording of contextual data (Saunders, Lewis & Thornhill 2016), will be adopted by the researcher. Notes will also be made during each interview session recording the modifications made to the previous critical path design and the rationale for the modification so that the similarities and differences in viewpoints, ideas, and rationale of project managers can be analysed accordingly.

5.8.4.2 – Iterative Process of Developing the Robust Stakeholder-Oriented Critical Paths

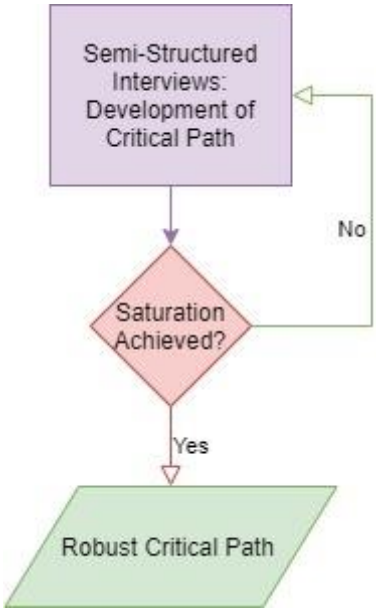


Figure 5-7 – Iterative Process of Developing the Robust Stakeholder-Oriented Critical Paths

As illustrated in **Figure 5-7** (above), the first round of semi-structured interviews and the development of the robust stakeholder-oriented critical paths is an iterative process. After each semi-structured interview session, the stakeholder-oriented critical paths will be modified using Microsoft Project based on the notes recorded during the interview. A newer version of the stakeholder-oriented critical paths will be produced before the next semi-structured interview session. This process is repeated until saturation is achieved and robust stakeholder-oriented critical paths are produced.

In the field of research methodology, saturation is achieved when there is no new information that can be obtained (Guest, Bunce & Johnson 2006; Glaser & Strauss 1967). However, as noted by Saunders, Lewis and Thornhill (2016), there is still a lot of uncertainty regarding the conceptualisation of saturation in research. For this research, saturation for the robust stakeholder-oriented critical paths is determined to be achieved when there are no or minor changes made to the robust stakeholder-oriented critical paths. **Table 5-3** (below, page 181) clearly defines the criteria for achieving saturation for the robust stakeholder-oriented critical paths.

This decision regarding saturation for the development of robust stakeholder-oriented critical paths is based on Ashby's Law of Requisite Variety (Ashby 1964). Ashby's Law, also commonly known as the First Law of Cybernetics, states that in order for a system to be stable, the number of states at the input must be equal to or higher than the number of states in the regulating process. This means that saturation can be said to be achieved even if there are tiny changes (Ashby & Goldstein 2011). Ashby's Law is used because it is commonly referred to by business management studies (Ashby & Goldstein 2011; Raadt 1987).

Table 5-3 – Achieving Saturation on the Robust Stakeholder Oriented Critical Paths

Modifications to Critical Paths	**Saturation is Achieved When:**
List of project activities	Less than two changes recommended by interviewees
Duration of project activities	Less than two changes recommended by interviewees
Dependencies between activities	Less than two changes recommended by interviewees
Milestones and deliverables	Less than two changes recommended by interviewees

The reason for allowing minimum changes as a criterion for achieving saturation is the high level of uncertainty involved in an oil and gas decommissioning project, as mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 15). A high level of uncertainty suggests that there might be multiple right answers for the robust stakeholder-oriented critical paths.

5.8.4.3 – Presenting the Stakeholder-Oriented Critical

The final versions of the robust stakeholder-oriented critical paths will be presented in the form of a Gantt chart modelled using Microsoft Project. The rationale for this is that a Gantt chart is a well-known project management tool, as mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 64), which will make the research artefacts more familiar to the targeted audience – project managers. Findings from the analysis of semi-structured interviews can also be overlaid onto the stakeholder-oriented critical paths to assist project managers in the management of oil and gas decommissioning projects.

5.8.4.4 – Analysis of Stakeholder-Oriented Critical Paths Modification Notes

In addition to developing the robust stakeholder-oriented critical paths, the notes detailing interviewees' ideas on the modification of the stakeholder-oriented critical paths and the rationale behind the modifications will be analysed qualitatively together with the semi-structured interviews using a thematic analysis approach. The thematic analysis approach will be explained together with the analysis of semi-structured interviews later on in this chapter in **Section 5.8.8** (see page 188).

5.8.5 – Step 5: Critical Path Analysis (United Kingdom) – Second Round of Interviews

The main rationale for this step is to use the robust stakeholder-oriented critical path as an engaging tool, developed in Step 4: Development of Robust Critical Path, in order to obtain primary data to answer the various research questions.

This second set of semi-structured interviews will be conducted with the same set of interviewees interviewed in Step 4: Development of Robust Critical Path. The same set of interviewees was interviewed because they have worked on the critical paths before and will be more familiar with the critical paths, which should lead to a more efficient interview session. Speer and Wagner (2009) note that interviewees who are more knowledgeable generally have a higher sense of purpose and direction during the interview sessions, which can help the researcher obtain greater detail from the interviewees.

Similar to Step 4: Development of Robust Critical Path, informed consent, and permission to record audio information will be collected from each interviewee prior to the commencement of the interview sessions. Each recorded interview will also be transcribed and the transcript sent to the respective interviewees for verification.

The data analysis technique to analyse the semi-structured interviews will be described in **Section 5.8.8** (see page 188).The results and findings from this second round of interviews will be used to answer the following research questions:

Research Question 3: Where is/are the Critical Point(s)? i.e. Where on the Stakeholder-Oriented Critical Path does Stakeholder Interaction Exist?

Interviewees will be asked to identify where along the stakeholder-oriented critical path stakeholder interaction exists – critical points.

Research Question 4: Which Stakeholder(s) are Involved at the Critical Point(s)?

Interviewees will be asked to identify the stakeholders and/or type of stakeholder groups involved at the critical point(s). The level of specificity provided by interviewees may differ depending on confidentiality or other agendas, for example, maintaining business reputation.

Research Question 5: How Impactful was/were the Stakeholder(s) at the Critical Points?

Interviewees will be asked to describe how the stakeholder interactions(s) that occurred at the critical point(s) identified impacted the oil and gas decommissioning project in terms of cost, schedule, and scope.

Research Question 6: Which Critical Point is the Most Important? And Why?

Interviewees will be asked to identify the most important critical point. Interviewees will also be asked to identify the most influential and impactful stakeholder on an oil and gas decommissioning project

Research Question 7: Why was/were the Stakeholder(s) Impactful at the Critical Points?

Interviewees will be asked to provide perceived and/or actual reason(s) for the stakeholder interaction(s) that occurred at the critical point(s) identified.

Research Question 8: What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?

Interviewees will be asked to describe the decision(s) made to manage the stakeholder interaction(s) that occurred at the critical point(s) identified.

Research Question 9: What was/were the Reason(s) for the Decision(s) made to Manage the Stakeholder(s)?

Interviewees will be asked to provide the rationale behind the decision(s) made to manage the stakeholder interaction(s) that occurred at the critical point(s) identified.

Research Question 10: How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?

Interviewees will be asked to describe the stakeholder's(s') response(s) to the decision(s) made to manage them.

Research Question 11: How different would Project Managers Manage the Stakeholders if given Hindsight?

Interviewees will also be asked if they would change their decision(s) given hindsight.

Research Question 12: How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?

In the event where there are multiple critical points, interviewees will be asked to describe how decision(s) made on earlier critical points impact future stakeholder interaction(s) and vice-versa.

5.8.6 – Step 6: Critical Path Analysis (United Kingdom) – Testing Phase

The main rationale for this testing phase is primarily to validate the primary data obtained from the semi-structured interviews in Step 5: Critical Path Analysis (United Kingdom) – Second Round of Interviews, and to understand stakeholder interactions from the perspective of the stakeholders.

Understanding the perspective of the stakeholders is important because, as demonstrated in the literature review, decommissioning is viewed differently depending on the stakeholders and their objectives. Additionally, these differences and their ramifications can overlay onto the stakeholder-oriented critical paths to assist project managers in managing oil and gas decommissioning projects.

Stakeholders will be the targeted interviewees in this step. The main criteria for selecting the stakeholders for this step are accessibility and coverage across the decommissioning arena, as summarised in **Table 2-1** (above, page 33) in ***Chapter 2: Exploring Oil and Gas Decommissioning***. **Table 5-4** (below, page 186) shows the example of targeted interviewees in the testing phase.

Table 5-4 – Example of Targeted Interviewees for Testing Phase

Stakeholder Category	Example of Organisations
Internal	Shell BP ExxonMobil
Governmental (Regulatory and Legislative)	Oil and Gas Authority Department for Business, Energy, and Industrial Strategy Department of Mines, Industry Regulation and Safety
Environmental Conservative	Greenpeace Friends of the Earth WWF (World Wide Fund for Nature)
Marine Science	Marine Scotland Australian Institute of Marine Science
Fishing (Commercial and Recreational	National Federation of Fishermen's Organisation Scottish Fishermen's Federation RecFishWest
Tourism	VisitAberdeenshire Ningaloo Visitor Centre
Transport and Logistic	Evergreen Maritime Northern Lighthouse Board
Supply Chain	Ramboll Saipem Subsea7

The questions asked during the interviews will cover the same set of questions (Research Questions 3 to 11) listed in **Section 5.8.5** (see page 183). However, recognising that stakeholders may have cultural differences and differing level of knowledge (Brinkmann & Kvale 2015; Saunders, Lewis & Thornhill 2016), the questions will be modified accordingly in a way that makes them understandable for the interviewees but retains the same meaning as much as possible.

5.8.7 – Steps 7 to 9: Research in the Australian Landscape

As shown below, Steps 7 to 9 is a repeat, in the Australian landscape, of Steps 4 to 6 of the UK part of the research:

- Step 4: Development of Robust Critical Path (United Kingdom)
  First Round of Interviews
- Step 5: Critical Path Analysis (United Kingdom)
  Second Round of Interviews
- Step 6: Critical Path Analysis (United Kingdom)
  Testing Phase
- Step 7: Development of Robust Critical Path (Australia)
  First Round of Interviews
- Step 8: Critical Path Analysis (Australia)
  Second Round of Interviews
- Step 9: Critical Path Analysis (Australia)
  Testing Phase

The same process for the development of the robust critical path and collection of primary data from the semi-structured interviews will be used, as detailed in **Sections 5.8.6**, **5.8.7**, and **5.8.8**. The same process is used in order to ensure consistency in methodology between the two regions. Many studies such as Mertens et al. (2016), Hayes, Glynn and Shanahan (2005), and Huarng (2016) state that a consistent methodology can improve the credibility of the research.

It must be noted there is an absence of the Case Study and Initial Critical Paths Design steps in the Australian part of the research. The rationale for their absence has already been explained earlier in this chapter in **Section 5.8.0.3** (see page 167).

5.8.8 – Step 10: Analysis of Interview Data

As illustrated in **Figure 5-4** (above, page 186), all primary data collected from semi-structured interviews in Steps 4 to 9 will all be analysed together as a whole. For this research, a thematic analysis method will be used to analyse the primary data collected from semi-structured interviews. Thematic analysis is a suitable approach for this interdisciplinary research because it is not bound to a particular research philosophy (Braun & Clarke 2006; Saunders, Lewis &

Thornhill 2016). Additionally, as noted by Braun and Clarke (2006), it is useful in breaking down large amounts of qualitative data, creating richer descriptions and explanations. A large amount of qualitative data will be expected as there are six different sets of interviews (Steps 4 to 9), and two different countries involved.

5.8.8.1 – Coding the Interview Data

Coding is a data analysis method used to categorise qualitative data (Boyatzis 1998; Mayring 2010; Miles, Huberman & Saldaña 2014; Rustemeyer 1992; Schreier 2012). The process of coding involves labelling data items with a code that represents their meaning. A code can be a short as a single word or as long as an entire paragraph (Miles, Huberman & Saldaña 2014; Schreier 2012). The codes will be guided by the research objectives as stated in **Section 5.1** (see page 148), but not limited to the research objectives. So, the types of code will be divided into two groups:

- *A priori* codes – Codes that focus on answering the research questions.
- Emergent codes – Codes beyond the research questions but still relevant to the research theme.

Not limiting the coding process strictly to the research objectives can allow the research to generate new and emerging insights, which can be beneficial for disciplines where the body of knowledge is still young and evolving (Griffith, Cavusgil & Xu 2008). Note that as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 146), the field of oil and gas decommissioning is still young and evolving.

Based on both the research procedure and the literature review, a large quantity of qualitative data is expected from this research. Hence, NVivo software will be used to aid in the qualitative analysis process. The use of NVivo software has been shown in past studies to be able to assist in analysing large quantities of qualitative data (Hoover & Koerber 2009; Gibbs 2002; Welsh 2002).

Intercoder reliability testing is an important procedure that ensures the reliability of the coding process (Tinsley & Weiss 2000; Lombard, SnyderDuch & Bracken 2002). Therefore, in order to ensure the reliability of the qualitative analysis process in this research, intercoder reliability testing will be performed prior to the official coding process. The intercoder reliability testing process for this research will be performed by having the author and the two academic researchers code the same interview transcript using the same codebook. The coded transcripts will then be compared with each other to identify the level of agreement as a percentage. In research methodology literature, the coding process is said to be of high reliability when there is an agreement of more than 70% (Burla et al. 2008; Campbell et al. 2013). Thus, 70% agreement will be the threshold adopted in this research for intercoder reliability testing.

5.8.8.2 – Forming Themes and Relationships

After coding the interview data, the process of forming themes and relationships begins. This process involves identifying recurring themes and patterns from the coded data (Flick 2011; Saunders, Lewis & Thornhill 2016; Gibbs 2002; Miles, Huberman & Saldaña 2014).

Table 5-5 (below) shows the four triangulation techniques according to Denzin (2017). The four triangulation techniques, as identified by Denzin (2017) in his study, will be used to identify recurring themes and patterns in this research. Triangulation will be carried out between the various semi-structured interview data, findings from case studies, findings from the design of the stakeholder-oriented critical paths, and findings from the literature review.

Table 5-5 – Types of Triangulation Techniques (Denzin 2017)

Type of Triangulation	Definition
Data Triangulation	Triangulating space, time, and persons
Investigator Triangulation	Triangulating different observers
Theory Triangulation	Triangulating different interpretations of a phenomenon
Methodological Triangulation	Triangulating between different methodologies

Triangulation has been used in many academic studies in the field of business (Almajali & Dahalin 2011; Decrop 1999; Jack & Raturi 2006; Jonsen & Jehn 2009). In addition, triangulation has also been stated by many scholars to improve the validity and credibility of the research (Cohen, Manion & Morrison 2000; O'Donoghue & Punch 2003; Altrichter et al. 2008).

5.8.8.3 – Answering the Research Questions

The analysed data will then be used to answer Research Questions 3 to 11, as shown in **Section 5.8.5** (see page 183), and also Research Questions 12 and 13. The research questions to be answered using the primary data from semi-structured interviews are listed below. A summary of how all the research questions relate to the research objectives and their contribution to knowledge will be presented at the end of this chapter in **Section 5.9** (see page 192).

- Research Question 3: Where is/are the Critical Point(s)? i.e. Where on the Stakeholder Oriented Critical Path Stakeholder does Interaction Exists?
- Research Question 4: Which Stakeholder(s) are Involved at the Critical Point(s)?
- Research Question 5: How Impactful was/were the Stakeholder(s) was/were at the Critical Points?
- Research Question 6: Which Critical Point is the Most Important? And Why?
- Research Question 7: Why was/were the Stakeholder(s) Impactful at the Critical Points?
- Research Question 8: What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?
- Research Question 9: What was/were the Reason(s) for Project Managers Decision(s) made to manage the Stakeholder(s)?
- Research Question 10: How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?
- Research Question 11: How differently would the Project Managers manage the stakeholders if given Hindsight?

- Research Question 12: How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?
- Research Question 13: What is best practice to manage the stakeholder(s) at the Critical Points?
- Research Question 14: What are the differences between the oil and gas decommissioning landscapes in the United Kingdom and Australia?

5.8.8.4 – Emergent Themes and Relationships

In addition to answering the research questions, themes and relationships that emerged from the data analysis process will also be presented in this thesis. Emergent themes and relationships can provide the researcher with the opportunity to extend the body of knowledge beyond the areas identified by the research questions and objectives (Bazeley 2009; Bell, Bryman & Harley 2018).

5.8.8.5 – Forming the Conceptual Framework

While the analysis of primary data will primarily be presented in a written format, key findings from the analysis will also be used to develop a conceptual framework. A conceptual framework is an illustration of the researcher's synthesis of a phenomenon (McGaghie, Bordage & Shea 2001; Miles, Huberman & Saldaña 2014). A conceptual framework can help to frame the research findings such that it is easier to understand by the audience (Kroath 2002; Weaver-Hart 1988). The conceptual framework developed from this research can, therefore, complement the stakeholder-oriented critical paths and be used as a practical tool to enhance the audience understanding of the oil and gas decommissioning landscape.

5.9 – Significance and Contribution to Knowledge

5.9.1 – Significance of the Research

This research is significant to Australia and also the other emerging decommissioning industries across the Asia-Pacific region as it will be able to provide both theoretical and practical contributions at an ideal time when oil and gas industries in the Asia-Pacific region, including Australia, are preparing for the incoming wave of decommissioning activities (Laister & Jagerroos 2018; Bills 2018).

Although the United Kingdom is further down the track in terms of field maturity, this research will also be significant for the United Kingdom as it provides further insight into project planning and stakeholder management in the UK landscape. Insights into the Australian decommissioning landscape can also provide valuable information that can be useful for the United Kingdom's decommissioning landscape.

5.9.2 – Intended Practical Contribution

The stakeholder-oriented critical path(s) will serve as valuable practical artefact(s) to model and understand the wider decommissioning landscape, complementing existing academic and industrial oil and gas decommissioning tools and guidelines such as the various multi-criteria decision-making tools (CA, NEBA, BPEO, etc.), and Oil and Gas UK's suite of oil and gas decommissioning tools and guidelines (OGUK 2019). Details regarding existing academic and industry oil and gas decommissioning tools and guidelines can be found in ***Chapter 3: Managing Oil and Gas Decommissioning*** and ***Chapter 4: Regulating Oil and Gas Decommissioning***. The stakeholder-oriented critical path(s) can serve as a practical tool to assist project managers when managing oil and gas decommissioning projects.

The conceptual framework(s) can also act as valuable practical artefact(s) by presenting the findings in a format that summarises the findings from the research, thus enhancing project managers' understanding of the perspective of each stakeholder. Findings presented in the conceptual framework(s) can also be overlaid onto the stakeholder-oriented critical path(s). Project managers can also use the findings as a guide when developing stakeholder management strategies for oil and gas decommissioning.

5.9.3 – Intended Theoretical Contribution

As mentioned earlier in **Section 5.4.4** (see page 154), this research will employ an inductive approach. For an inductive approach, theories are proposed at the end of the research process (Goddard & Melville 2004; Neuman & Dickinson 2003; Saunders, Lewis & Thornhill 2016). Consequently, the specific details of the theoretical contribution may vary. The theoretical contributions of this research will be discussed in more detail in ***Chapter 11: Discussion***.

The intended theoretical contribution is to extend the existing body of knowledge in stakeholder management in the field of oil and gas decommissioning. However, as mentioned in the literature review chapters, oil and gas decommissioning is interdisciplinary. This suggests that it is possible for the research findings to contribute to the existing body of knowledge in other disciplines as well.

5.10 – Conclusion

This chapter has explained the theory of methods and the philosophical approach that was brought to bear on this research by justifying the author's selection of the research philosophy, approach to theory development, methodological choice, research strategy, time horizon, and research procedure and techniques. The five chapters which follow (Chapters 6 to 10) will present the findings from this research. **Table 5-6** (below, page 194) summarises all the research questions, objectives, outputs, and the intended contribution to knowledge of this research.

Table 5-6 – Summary of Research Questions, Objectives, Outputs, and Contribution to Knowledge

No.	Research Question	Research Objectives	Research Output	Contribution to Knowledge
1	Can Stakeholder-Oriented Critical Path(s) be Modelled?	1	**Objectives 1 and 2** Stakeholder-Oriented Critical Path(s)	**Objectives 1 and 2** Practical Contribution – Stakeholder Oriented Critical Path(s) to act as Research Artefact(s) to enhance Project Managers understanding of the wider oil and gas decommissioning landscape, complementing existing academic and industry frameworks and guidelines, thus providing support to Project Managers.
2	At What Level of Granularity can Homogeneity for each of the Stakeholder-Oriented Critical Path(s) be achieved?	1		
3	Where is/are the Critical Point(s)? i.e. Where on the Stakeholder Oriented Critical Path does Stakeholder Interaction Exists?	1,2		
4	Which Stakeholder(s) are Involved at the Critical Point(s)?	2,3		
5	How Impactful was/were the Stakeholder(s) was/were at the Critical Points?	2,3		
6	Which Critical Point is the Most Important? And Why?	2,3		
7	Why was/were the Stakeholder(s) Impactful at the Critical Points?	2,3		
8	What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?	3,4,5	**Objectives 2,3,4,5,6 and Emergent Findings (If Any)** Conceptual Framework(s) Note that Information from Objective 2,3,4,5,& 6 can also be overlaid onto the Stakeholder-Oriented Critical Path(s)	**Objectives 2,3,4,5 & 6 and Emergent Findings (If Any)** Practical Contribution – Conceptual Framework(s) can act as Research Artefact(s) to enhance Project Managers understanding of the wider oil and gas decommissioning landscape, complementing existing academic and industry frameworks and guidelines, thus providing support to Project Managers. Theoretical Contribution – Extend the existing Body of Knowledge in Stakeholder Management in the field of oil and gas decommissioning. Theoretical Contribution – Additional Theoretical Contributions from Emergent Findings (If Any).
9	What was/were the Reason(s) for the Decision(s) made by Project Managers to Manage the Stakeholder(s)?	3,4,5		
10	How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?	3,4,5		
11	How different would Project Managers manage the Stakeholders if given Hindsight?	3,4,5		
12	How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?	3,4,5		
13	What is best practice to manage the stakeholders at the Critical Points?	3,4,5		
14	What are the differences in the oil and gas decommissioning landscape between the United Kingdom and Australia?	6		
15	(Emergent Findings)	(n/a)		

Research Objectives:

1) Develop stakeholder-oriented critical paths that are representative of oil and gas decommissioning projects in the United Kingdom and Australia
2) Identify critical points on the stakeholder-oriented critical path and determine where on the stakeholder-oriented critical path considerable stakeholder interactions exists.
3) Identify which stakeholders are most impactful and determine appropriate mechanisms to ensure effective decommissioning.
4) Identify how project managers currently engage stakeholders.
5) Identify what project managers deem as best practice to manage stakeholder interactions.
6) Identify the differences in the oil and gas decommissioning landscape between the United Kingdom and Australia

Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects

6.0 – Results Overview

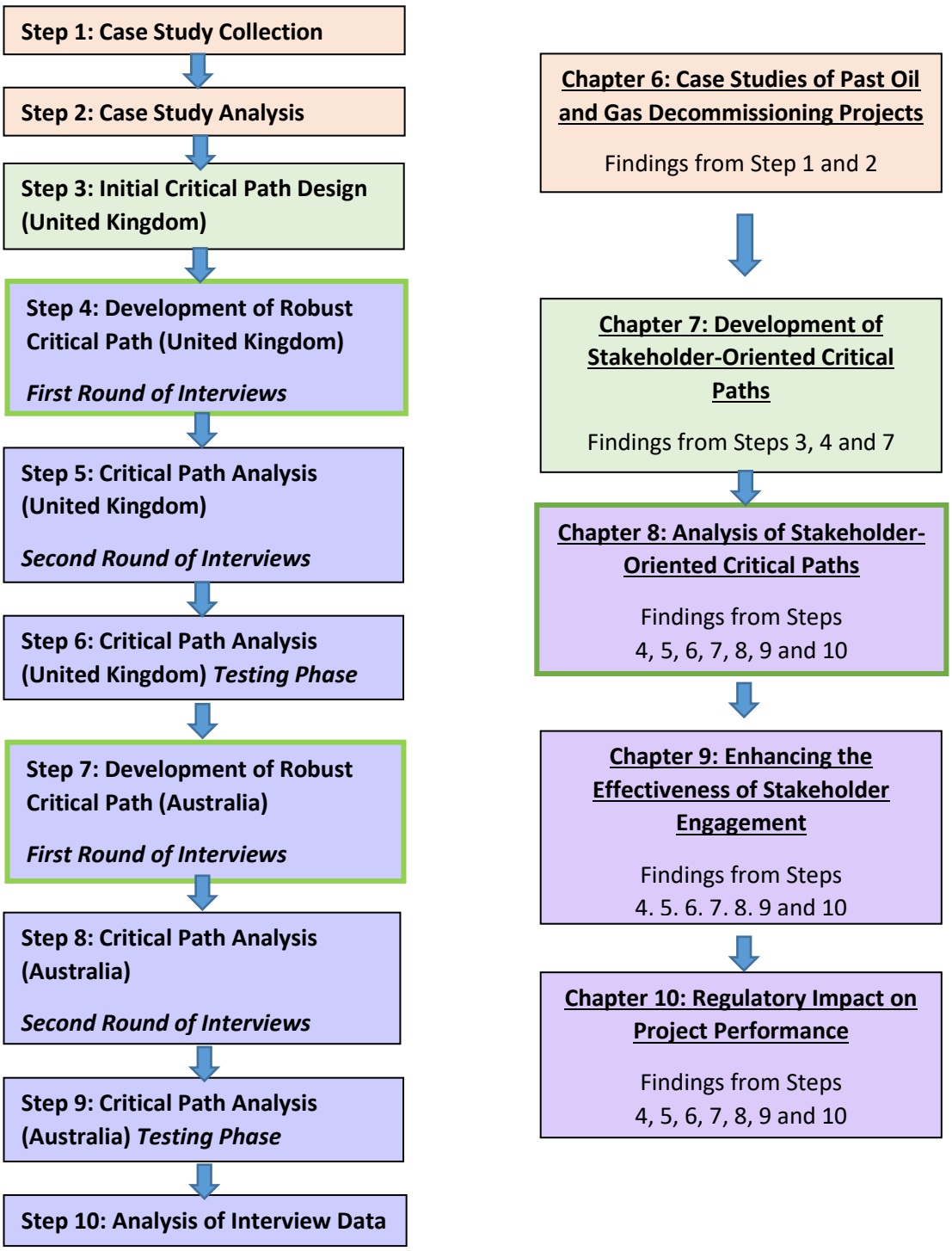


Figure 6-1 – Overview of the Results Chapters

As discussed previously in ***Chapter 5: Research Methodology*** (see page 164), the research procedure for this study is lengthy, comprised of a total of 10 steps as illustrated in **Figure 6-1** (above, page 195). There are a lot of data and findings that have emerged from each step. Presenting all the findings in one single chapter may result in information overload and difficulty in navigation for the audience. Therefore, the results in this thesis will be presented in the form of five smaller chapters in a systematic manner:

- Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects
- Chapter 7: Development of Stakeholder-Oriented Critical Paths
- Chapter 8: Analysis of Stakeholder-Oriented Critical Paths
- Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement
- Chapter 10: Regulatory Impact on Project Performance

Table 6-1 (below) details the results chapter(s) in which the respective research questions will be addressed. In addition to presenting the research findings and discussing how the findings address the research questions, the results chapters will evaluate and discuss the research methodology.

Table 6-1 – Addressing the Results Questions

No.	Research Question	Results Chapter(s) where it will be addressed
1	Can Stakeholder-Oriented Critical Path(s) be Modelled?	6,7
2	At What Level of Granularity can Homogeneity for each of the Stakeholder-Oriented Critical Path(s) be achieved?	7
3	Where is/are the Critical Point(s)? i.e. Where on the Stakeholder-Oriented Critical Path does Stakeholder Interaction Exists?	8,9,10
4	Which Stakeholder(s) are Involved at the Critical Point(s)?	8,9,10
5	How Impactful was/were the Stakeholder(s) at the Critical Points?	8,9,10
6	Which Critical Point is the Most Important? And Why?	8,9,10
7	Why was/were the Stakeholder(s) Impactful at the Critical Points?	8,9,10
8	What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?	8,9,10

9	What was/were the Reason(s) for the Decision(s) made by Project Managers to Manage the Stakeholder(s)?	8,9,10
10	How did the Stakeholder's(s') respond to the Decision(s) made by Project Managers?	8,9,10
11	How different would Project Managers Manage the Stakeholders if given Hindsight?	8,9,10
12	How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?	8,9,10
13	What is best practice to engage the stakeholder(s) at the Critical Points?	8,9,10
14	What are the differences between the oil and gas decommissioning landscapes in the United Kingdom and Australia?	7,8,9,10
15	(Emergent Findings)	6,7,8,9,10

Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects

Chapter 6 will begin by evaluating and discussing the case study collection and analysis procedures. The chapter will then move on to evaluate and discuss the findings regarding the key information collected for the design of the stakeholder-oriented critical paths:

- List of all project activities
- Milestones and deliverables
- Duration of each activity
- Dependencies between activities

Additional observations and findings from the case study collection and analysis process will then be discussed in three different categories:

- Structure of the Decommissioning Programme
- Project Management Tools
- Stakeholder Engagement Activities

Overall, a total of 63 cases were collected and analysed. Findings from the case studies indicate that key project activities, milestones, and deliverables are similar across different oil and gas decommissioning projects. However, there are significant variations in the duration and dependencies of activities.

This suggests that there is some degree of homogeneity, which indicates that it is likely that stakeholder-oriented critical paths can be modelled. However, the level of granularity in which the stakeholder-oriented critical paths can be modelled remains uncertain at the end of the case studies.

Findings from the case studies show that there is an observable trend regarding the structure of the Decommissioning Programme document, project management tools used, and stakeholder management activities. The literature review suggests that the trend appears to be highly influenced by regulations and guidelines. This suggests that regulations and guidelines may have influences on project management and stakeholder management behaviours.

Chapter 7: Development of Stakeholder-Oriented Critical Paths

Chapter 7 will be divided into two parts. Part 1 focuses on the development of initial stakeholder-oriented critical paths using the information from the case studies. Findings from Part 1 will focus primarily on evaluating the research procedure used to develop the initial stakeholder-oriented critical paths. A total of three initial stakeholder-oriented critical paths were produced.

Part 2 focuses on the first round of semi-structured interviews and the iterative process of developing the robust stakeholder-oriented critical paths. Part 2 will start by evaluating the research procedure used to develop the robust stakeholder-oriented critical paths. Modifications made and the rationale for the modifications will then be discussed in terms of:

- A list of all project activities
- Milestones and deliverables
- Duration of each activity
- Dependencies between activities

At the end of the development process, two robust stakeholder-oriented critical paths were produced, one representing the United Kingdom and one representing Australia.

Overall, the creation of the robust stakeholder-oriented critical paths indicates that stakeholder-oriented critical paths can be modelled. However, several assumptions must be made in order for the stakeholder-oriented critical paths to be modelled, which indicates that the stakeholder-oriented critical paths can only be modelled at a very high level of granularity. This indicates that oil and gas decommissioning projects have a very high level of uncertainty.

Chapter 8: Analysis of Stakeholder-Oriented Critical Paths

Chapter 8 will focus on answering the research questions using both the UK and Australia stakeholder-oriented critical paths. Each critical point will be discussed individually before a comparison between the United Kingdom and Australia landscape will be done at the end of the chapter.

Overall, the analysis of stakeholder-oriented critical paths indicates that there are three critical points on the UK stakeholder-oriented critical path, but three different critical points on the Australian stakeholder-oriented critical path. This indicates that stakeholder influences and impacts differ depending on location.

Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement

Chapter 9 will enhance the understanding of the oil and gas decommissioning landscape by discussing each of the identified key factors that can influence the effectiveness of stakeholder engagement for oil and gas decommissioning:

- Project Managers' and Stakeholders' Level of Knowledge of Each Other's Perspectives and Goals
- The Extent of Alignment on Goals, Rationale, and Interests between Project Managers and Stakeholders
- Project Manager's Philosophy and Attitude Towards Stakeholder Engagement
- Operator's and Stakeholder's Level of Stakeholder Engagement Fatigue
- The extent of Trust between Project Manager and Stakeholders
- The Extent of Early Stakeholder Engagement
- Operators' and Stakeholders' Capacity for Engagement

Managerial recommendations will be developed and discussed for each of the identified factors, thus expanding on Chapter 8's answer to Research Question 13, and making contributions to managerial knowledge.

Overall, the findings in this chapter indicate that the extent of alignment and extent of trust between project managers and stakeholders are the most important factors affecting the effectiveness of stakeholder engagement in oil and gas. This means that stakeholder engagement activities should prioritise improving the extent of alignment and extent of trust between project managers and stakeholders.

The research findings also indicate that stakeholder engagement fatigue and the lack of capacity for stakeholder engagement are real occurring phenomena. This means that the development and execution of stakeholder management strategies should consider both the operators' and stakeholders' level of stakeholder engagement fatigue and also their capacity for engagement.

Chapter 10: Regulatory Impact on Project Performance

Chapter 10 will discuss the emerging findings from the semi-structured interviews which centres on the impact of regulations on the management of oil and gas decommissioning. The discussion will also show how regulations impact and influence management behaviours and project performances in terms of cost, schedule, and scope. The findings discussed in this chapter will also expand on Chapter 8's answer to Research Question 14.

Overall, findings in this chapter suggest that domestic oil and gas decommissioning regulations must continuously adapt along with the maturation of the oil and gas decommissioning landscape in order to optimise the management of oil and gas decommissioning projects, and improve project performances. An overall discussion of how the research findings address the research questions and objectives, and how the research will contribute to the existing body of knowledge, both theoretically and practically, will be presented in ***Chapter 11: Discussion***.

6.1 – Case Studies Sources

For the United Kingdom, the primary source of information on past decommissioning projects is the official website on Guidance for Oil and Gas Decommissioning of Offshore Installations and Pipelines website[8], which was published by OPRED (the Offshore Petroleum Regulator for Environmental and Decommissioning) on 23 January 2013 and is continuously updated as decommissioning plans are submitted and approved. The main purpose of the publication of this source, as stated on the website, is to improve the transparency of the process of considering oil and gas decommissioning proposals.

As mentioned in ***Chapter 5: Research Methodology*** (see page 169), the OPRED Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines website was to be the sole source for the cases. As also mentioned in ***Chapter 5: Research Methodology*** (see page 170), the source contains four different types of documents submitted by oil and gas operators to the Department for Business, Energy, and Industrial Strategy (BEIS):

- Decommissioning Programme
- Comparative Assessment Report
- Environmental Statement / Appraisal Report
- Close-Out Report

However, during the collection process, the author found that there are additional documents available on the respective websites of the oil and gas operators, such as stakeholder reports and IRG (Independent Review Group) reports. The existence of these additional documents was also made known to stakeholders on the OPRED website. As seen in **Figure 6-2** (below, page 202), it was stated clearly on OPRED website that there are additional documents on the Brent decommissioning programme on Shell's website:

[8] Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines, Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), Department of Business, Energy and Industrial Strategy (BEIS). Published on 23 January 2013 and continuously updated as decommissioning plans are submitted and approved. Last Updated on 17 December 2020. https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines

OPRED Website Documents	Shell Website Additional Documents
Brent Decommissioning Programme (PDF, 12MB, 322 pages) Brent ES (PDF, 12.5MB, 475 pages) Brent EIA (PDF, 5.05MB, 429 pages) Brent ES Appendix (PDF, 2.52MB, 45 pages) A suite of detailed Technical Documents which support the Decommissioning Programmes documents are available on the Shell Website	

Figure 6-2 – Documents on the Brent Decommissioning Case (OPRED 2019)

The review of the respective websites of the oil and gas operators finds that the additional documents, such as the stakeholder reports and the IRG reports, contain information on project activities that took place prior to the submission of the draft decommissioning programme to BEIS, such as pre-study surveys and early stakeholder engagement activities. Thus, this additional information on projects activities, which is only available in the additional documents from the respective websites of oil and gas operators, is also relevant for the design of the initial stakeholder-oriented critical paths.

The additional documents can also serve as a valuable source of information for the semi-structured interview process in the latter part of this research. Information obtained from the stakeholder reports and IRG reports can be used to initiate more insightful discussions with interviewees. Furthermore, the stakeholder reports and IRG reports can also be used as comparators when analysing the interview transcripts. Hence, multiple sources were used to obtain secondary data for the case studies process:

1) OPRED's Guidance for Oil and Gas: Decommissioning of Offshore Installations and Pipelines Website
2) The Respective Websites of the Oil and Gas Operators

Switching from a single source to a multi-source approach can be beneficial as it adds the ability to triangulate between different sources, thus adding reliability and validity to the research findings (Mills, Durepos & Wiebe 2010).

6.1.1 – Observations on the OPRED Website

6.1.1.1 – Availability of Documents

As mentioned in ***Chapter 5: Research Methodology*** (see page 169, the initial review of the OPRED website as a case study source finds that not all cases have all four types of documents available. A further examination of the OPRED website finds that two trends emerged.

Firstly, there are no available documents on the OPRED website for oil and gas decommissioning cases approved before the year 2000, suggesting a lack of transparency on older oil and gas decommissioning projects. As seen in **Table B-1** (see page 556) in ***Appendix B***, the earliest case with documents available is the Maureen and Moira case, which was approved in 2000. The decommissioning of the Maureen and Moira oil and gas facilities was mentioned in the literature as the first major oil and gas decommissioning project post-OSPAR Decision 98/3 (Johnson 2013). As noted in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 109), OSPAR Decision 98/3 was introduced in the aftermath of the 1995 Brent Spar incident. This suggests that the availability of documents from the year 2000 onwards, and the increase in transparency, is most likely due to regulatory changes made in the aftermath of the Brent Spar incident.

Another finding that emerged is that not all cases have CA reports. For example, the Pickerill Alpha and Bravo case did not have a CA report, whereas the Murchison case did have a CA report included. An initial review finds that the CA reports seem to appear only in cases with Partially Leave-in-Place or Leave-in-Place decommissioning options. The Pickerill Alpha and Bravo case is a Complete Removal case, while the Murchison is a Partially Leave-in-Place case, where the footings of the platforms were left in place. The CA process, as mentioned in ***Chapter 4 – Regulating Oil and Gas Decommissioning*** (see page 120), involves additional project activities such as conducting studies and engaging stakeholders in order to obtain quantitative and qualitative information to conduct a CA of decommissioning options. This indicates that the stakeholder-oriented critical path will differ depending on the precise decommissioning option.

The finding that CA reports seem to appear only in cases with Partially Leave-in-Place or Leave-in-Place options also suggests that the CA process is being used more as a justification tool for Partially Leave-in-Place and Leave-in-Place options rather than a multi-criteria decision-making tool to determine the best decommissioning option. Revisiting the literature finds that to a large extent, this phenomenon is influenced by regulations and guidelines. The Offshore Oil and Gas Decommissioning Notes, also found on the OPRED website, state that:

> *Derogations will only be granted if there are significant reasons why an alternative disposal option is preferable to re-use or recycling or final disposal on land, as assessed in accordance with the comparative assessment and consultation procedure, set out in OSPAR Decision 98/3.*
>
> – *Paragraph 1.12, The Offshore Oil and Gas Decommissioning Guidance Notes, 2018*

As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 109), OSPAR Decision 98/3 introduced a set of three prescriptive criteria whereby leaving offshore installations, wholly or partly, in the marine environment is possible. This suggests that having a prescriptive-based regulatory approach decreases the robustness of multi-criteria decision-making tools when they are being used to determine the best decommissioning option.

6.1.1.2 – Structure of Documents

An initial review finds that the format and structure of the documents seem to change over time. The structure of the documents for cases prior to 2013 seems to be less uniform than the structure of the documents after 2013. For example, all cases after 2013 have the same template for the Document Control and Overview sections. Further review of the OPRED website finds that a Standard Decommissioning Programme Template was introduced in 2013, with an updated version being introduced in November 2018 (OPRED 2019). Interestingly, there are also some minor differences regarding the structure of the documents between cases that were approved before 2019 and those approved from 2019 onwards. This finding suggests that regulatory guidelines do have an influence on oil and gas decommissioning decisions.

6.1.1.3 – Frequency of Cases per Year

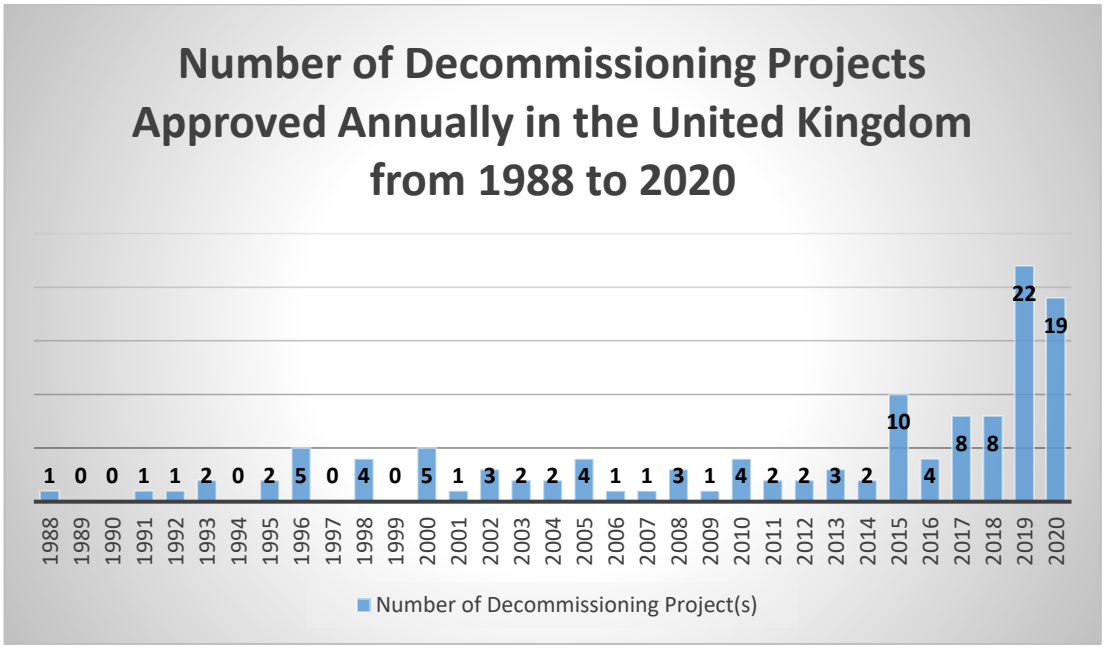


Figure 6-3 – Number of Decommissioning Projects Approved in the United Kingdom over Time[9]

Another observation gleaned from the OPRED website is the marked increase in oil and gas decommissioning activities over the years. The most notable feature in the graph is the spike in the number of decommissioning projects being approved from 2015 onwards (see **Figure 6-3**, above). The price of oil began to fall from USD 100 per barrel in September 2014, reaching USD 30 per barrel in January 2016 (Baumeister & Kilian 2016). This suggests that there is an inverse correlation between the price of oil and the level of oil and gas decommissioning activities.

[9] Data for 2020 only considered number of decommissioning projects approved by OPRED as of 17 December 2020

6.1.2 – Observations on the Respective Websites of the Oil and Gas Operators

Examination of the respective websites of the oil and gas operators finds that there are similarities regarding the information they present. All the websites have an emphasis on “milestone” achievements in their respective decommissioning projects. For example, Fairfield Energy present on their website the successful award of contracts for the various work scopes of decommissioning of the Greater Dunlin facilities (Fairfield Energy 2018). Shell highlighted on their website the various milestones achieved during the decommissioning of the Brent Field facilities, such as the removal of the Brent Delta topside, labelling it as “one for the record books” (Shell 2017c). The overall aesthetics and emphasis on highlighting such achievements suggests that the main purpose of the respective websites of the oil and gas operators is more to highlight their achievements rather than acting as an online platform to engage stakeholders.

While the purpose of these websites is questionable, they do contain additional documents not published on the OPRED website, such as the stakeholder engagement report and the IRG reports.

6.1.3 – Oil and Gas Decommissioning – Projects or Programmes?

Another notable observation from the OPRED website, is that the word "programme" is being used interchangeably. In some instances, the word "programme" appears to be referring to the proposal document. On other occasions, the word "programme" seems to be referring to an oil and gas decommissioning case. For example, Paragraph 6.1 of the Offshore Oil and Gas Decommissioning Notes, also found on the OPRED website, states that:

> *This Section provides an overview of the contents of a decommissioning programme (document), explaining why the information is needed and the policy expectations that operators should take into consideration as they prepare a Decommissioning Programme (case).*
>
> – *Paragraph 6.1, The Offshore Oil and Gas Decommissioning Guidance Notes, 2018*

Note the capitalisation of the word "programme" when it is being used for the second time in Paragraph 6.1, which suggests that the distinction was made by capitalising and non-capitalising the word "programme". However, the capitalisation and non-capitalisation of the word "programme" do not appear to be used consistently throughout the OPRED website, nor the OPRED Offshore Oil and Gas Decommissioning Notes.

The use of the word "programme" interchangeably can result in a lot of confusion, particularly for audiences with a project management background. As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 76), there is a difference between projects and programmes: in short, programmes consist of multiple projects. The methods and techniques used to manage projects and programmes are also different (PMI 2017). Using the word "programme" when referring to a particular oil and gas decommissioning case can result in an impression that the oil and gas decommissioning case is being managed using a programme management approach rather than a project management approach. Overall, this suggests that there is a lack of understanding by the regulators regarding managerial approaches to oil and gas decommissioning.

It could perhaps be more beneficial for BEIS to re-name the decommissioning proposal document for a clearer distinction to be drawn between the

decommissioning proposal and the type of temporary organisation formed to manage the oil and gas decommissioning activities. Each oil and gas decommissioning case could also be labelled “project” or “programme” to appropriately reflect the type of temporary organisation set up to manage them. This clear distinction can serve as valuable information to guide oil and gas operators in the future as they plan for the decommissioning of their oil and gas facilities.

6.2 – Categorisation of Cases

As mentioned in ***Chapter 5: Research Methodology*** (see page 167), the main rationale of the case study step is to gain insight into the past, and to use the information to design the initial stakeholder-oriented critical paths before proceeding to stakeholder interviews. The original intention, as detailed in ***Chapter 5: Research Methodology*** (see page 173), was to categorise the cases (i.e. decommissioning proposals) into four different categories according to the precise decommissioning options. The information would then be obtained information from the cases that four different initial stakeholder-oriented critical paths would be created, each representing one of the precise decommissioning options. The original four categories, as detailed in ***Chapter 5: Research Methodology***, are:

- Leave-In-Place (In-Situ)
- Leave-In-Place (Moved)
- Partially Leave-In-Place
- Complete Removal

However, there were issues encountered during the first attempt at categorising the cases, which will be explained in more detail in the following sections.

6.2.1 – Observations from the First Attempt at Categorising the Cases

6.2.1.1 – No Cases with Leave-In-Place (Moved)

Firstly, the first attempt at categorising the cases found that there were no cases that fitted the Leave-in-Place (moved) decommissioning option. As there will be no information available to model a stakeholder-oriented critical path for the Leave-In-Place (Moved) category, that category was removed from this research.

Hence, in the second attempt, the cases will be categorised into three categories, and only three initial stakeholder-oriented critical paths that will be produced using the information obtained from the case study process. The lack of Leave-In-Place (Moved) from the OPRED website suggests that the dumping of offshore installations at another location is not a popular decommissioning option in the UK context. A revisit to the literature review

finds that many oil and gas structures were left in place because it was not technically and financially feasible to move them (Ahiaga-Dagbui et al. 2017), hence the lower popularity of the Leave-In-Place (Moved) option than Leave-In-Place (In-Situ).

6.2.1.2 – Variation in Project Scopes

Secondly, the cases were found to vary significantly in project scopes. Smaller cases, such as Nevis N11, and Stirling A33, consisted of the removal of just one subsea infrastructure. On the other hand, there are larger cases, such as Buchan and Hannay, Ettrick and Blackbird, and Alma and Galia, which contain multiple oil and gas facilities in their proposal documents. For cases that involve multiple oil and gas facilities, it can be difficult to categorise the cases as each of the oil and gas facilities included in the same case, may have different precise decommissioning options. An example of a case that involves multiple facilities is the Ettrick and Blackbird case, as illustrated in **Figure 6-4** (below):

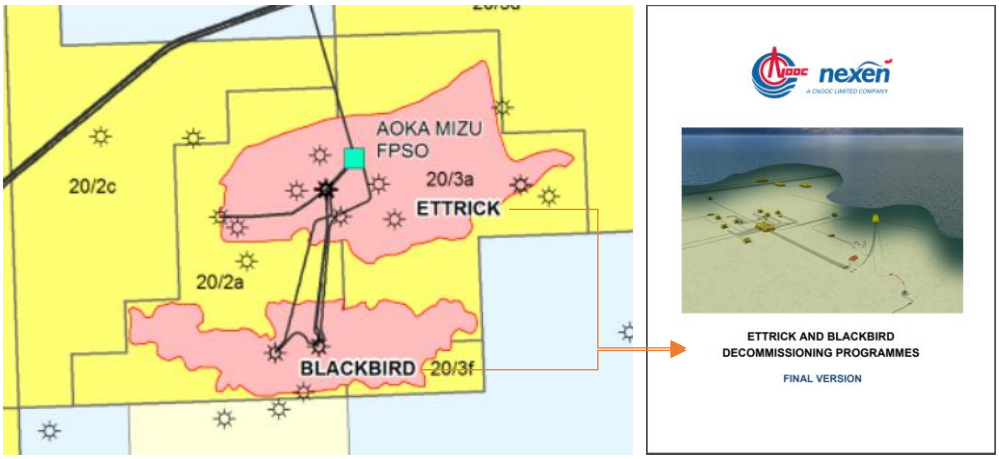


Figure 6-4 – Ettrick and Blackbird, a Case Involving Multiple Facilities (CNOOC 2017)

As seen in **Figure 6-4** (above), Ettrick and Blackbird are two separate oil and gas facilities, despite being included in a single proposal document, and also being labelled on the OPRED website as a single case. Although the Ettrick and Blackbird facilities are approximately 10 kilometres apart, the facilities are adjacent to each other, and there are cables and pipelines (shown as black lines in **Figure 6-4**, above) connecting the two facilities together (CNOOC 2017). This indicates that the decommissioning of a particular oil and gas

facility cannot be viewed in isolation. Due to the connections between the different facilities, as evident in the Ettrick and Blackbird case, the impact of decommissioning to the surrounding facilities will need to be considered.

From a project management point of view, this finding indicates that the stakeholder-oriented critical path for the decommissioning of an oil and gas facility will differ depending on the facility's relationship with neighbouring facilities. This also suggests that perhaps the decommissioning of an oil and gas facility should be managed more as a programme than a project.

From a stakeholder management point of view, this finding means that the owners of the neighbouring facilities are also potentially influential and impactful stakeholders, as their facilities may be impacted by the decommissioning activities undertaken.

6.2.1.3 – Multiple Proposals Approach

There are also oil and gas facilities that have multiple proposals for decommissioning, each of them being submitted at different points in time. However, each of the proposals was labelled as an individual case on the OPRED website, despite the proposed decommissioning activity for each case being undertaken for the same oil and gas facility. Those cases that only involve the decommissioning of a part of the facility can also be difficult to categorise, as other parts of the oil and gas facility may have a different precise decommissioning option. This also raises the question of what constitutes an oil and gas facility. An example of an oil and gas facility that used this multiple proposal approach is the Brae field, as illustrated in **Figure 6-5** (below, page 212):

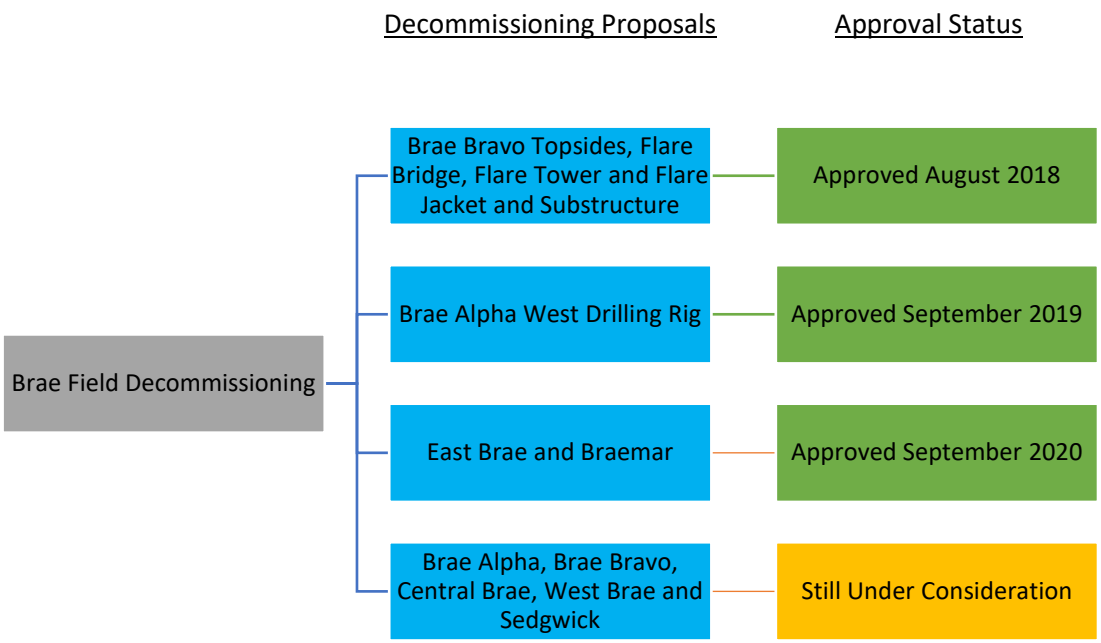


Figure 6-5 – The Multiple Proposals Approach of Decommissioning the Brae Field[10] (Marathon Oil 2017; RockRose Energy 2019; RockRose Energy 2020)

A comparison between the Brae field and Buchan and Hannay finds that the Brae oil and gas facilities are significantly larger than Buchan and Hannay. Buchan and Hannay have one floating platform and the Hannay subsea infrastructures. The Brae field, however, has three large fixed platforms, and associated pipelines and subsea infrastructures. This suggests that the management approach, and hence, the stakeholder-oriented critical paths, can differ depending on the size of the facility.

If an assumption is made such that multiple decommissioning proposals reflect a programme approach while single proposals reflect a project approach, this means that oil and gas decommissioning can either be managed as either a project or a programme. Overall, the variation in project scopes suggests there is still a lack of understanding by oil and gas operators on the management of oil and gas decommissioning.

This finding also suggests that perhaps it would be better for OPRED to reorganise the cases presented on the OPRED website according to fields rather than by date of approval. Organising the documents according to fields

[10] Approval status as of 17 December 2020

rather than the date of approval can enable better visualisation of the management of each decommissioning project or programme, as demonstrated in **Figure 6-5** (above, page 212). Such information could be beneficial to oil and gas operators when they are planning for the decommissioning of their oil and gas facilities in the future.

6.2.2 – Solving the Problems from the First Attempt at Categorising the Cases

In summary, the problems that were faced during the first attempt at categorising the cases, are as follows:

- **Problem 1** – There are no cases for the Leave-In-Place (Moved) category.
- **Problem 2** – Difficulty in categorising cases that involve multiple oil and gas facilities in the same case.
- **Problem 3** – Difficulty in categorising cases that only involve the decommissioning of part of an oil and gas facility.

Regarding Problem 1, as mentioned in **Section 6.2.1.1** (see page 210), the Leave-In-Place (Moved) category will be removed because there will not be any information available to model a stakeholder-oriented critical path that can represent that category.

6.2.2.1 – Redefining the "Case"

As mentioned in ***Chapter 5: Research Methodology*** (see page 173), the original definition for this research, of a "case" is an oil and gas decommissioning proposal. However, inconsistent with this original definition, the decommissioning of an oil and gas facility can involve multiple proposals, as demonstrated in **Section 6.2.1.3** (see page 211). Furthermore, a single proposal can involve multiple oil and gas facilities, as demonstrated in **Section 6.2.1.2** (see page 210). This variation in project scopes across different oil and gas decommissioning proposals has made the categorisation process difficult.

As mentioned earlier, in ***Chapter 5: Research Methodology*** (see page 173), the goal of the case study is to obtain information for the design of the initial stakeholder-oriented critical paths, which will represent the lifecycle of a project for the decommissioning of an oil and gas facility for different precise decommissioning options. Therefore, a "case" will, for this research, be redefined as "*a project for the decommissioning of an oil and gas facility*". The rationale for that it will enable the unit of analysis to be kept consistent throughout the case study process. Having a consistent unit of analysis is extremely important as it plays a central role in case study researches (Dolma 2010; Rowley 2002; Zivkovic 2012).

6.2.2.2 – Decisions regarding Problem 2 and Problem 3

Based on the new definition of a "case", Problem 2 and Problem 3 can be solved by reorganising the data collected.

For oil and gas decommissioning proposals that involve multiple oil and gas facilities, the decision is to view each oil and gas facility on its own as individual cases. For example, Ettrick and Blackbird will be viewed as two cases instead of one.

For oil and gas facilities that took a multiple proposals approach, the decision is to consider all these proposals together as one case. For example, the Dunlin Fuel Gas Import (DFGI) and Dunlin Power Import (DPI), Dunlin Alpha Topside, the Dunlin Alpha to Cormorant Alpha Pipeline, and Dunlin Alpha Field proposals, will all be viewed together as a single case.

Overall, this finding from the categorisation process indicates that case study researchers should not determine their unit of analysis solely by the way the data is organised by the case study source. This research also supports the work of Yin (2017), who suggests that on occasion, the data from the case study source may need to be reorganised by the researcher in order to fit the chosen unit of analysis.

6.2.3 – Observations from the Second Attempt at Categorising the Cases

As mentioned earlier in **Section 6.2.2** (see page 214), the Leave-In-Place (Moved) category was removed. Thus, there are only three categories for the second attempt at categorising the cases:

- Leave-In-Place
- Partially Leave-In-Place
- Complete Removal

Additionally, it must be noted that the definition of "case", as mentioned in **Section 6.2.2.1** (see page 214), has been redefined as "*a project for the decommissioning of an oil and gas facility*". Overall, the second attempt at categorising the cases was successful. The categorisation of the cases can be found in **Table C-1** (see page 577) in ***Appendix C***.

6.2.3.1 – The Meaning of the Precise Decommissioning Option

While the second attempt at categorising the cases was successful, it was found that different parts of the oil and gas facility were subjected to different precise decommissioning options. For example, as illustrated in **Figure 6-6** (below), the platform of Markham ST-1 oil and gas facility was removed, while the pipelines of the facility were left in place:

Markham ST-1 (PDF, 2.39MB, 49 pages)	Centrica Production Nederland B.V.	-	Fixed Platform	Removal to shore for either re-use or recycling
			Pipelines	Two pipelines to be decommissioned in situ

Figure 6-6 – Different Precise Decommissioning Option for Different Parts of Markham ST-1 Oil and Gas Facility (OPRED 2019)

A revisit to the literature finds that many studies do not specify the part of the oil and gas facility to be used as reference when classifying the oil and gas facilities based on the precise decommissioning options (Bothamley 2004; Tularak, Khan & Thungsuntonkhun 2007; Cheng et al. 2016; Zawawi, Liew, Shawn, et al. 2019; Fowler et al. 2014b; Claisse et al. 2015).

An interesting finding based on this revisit to past literature is that when classification of oil and gas decommissioning options (Complete Removal, Partial Removal, etc.) was discussed in the literature, the arguments were primarily based on the substructure. The diagram used by Dauterive (2000) and Claisse et al. (2015) in their research, for example, as reproduced in **Figure 6-7** (below), focuses on the substructure.

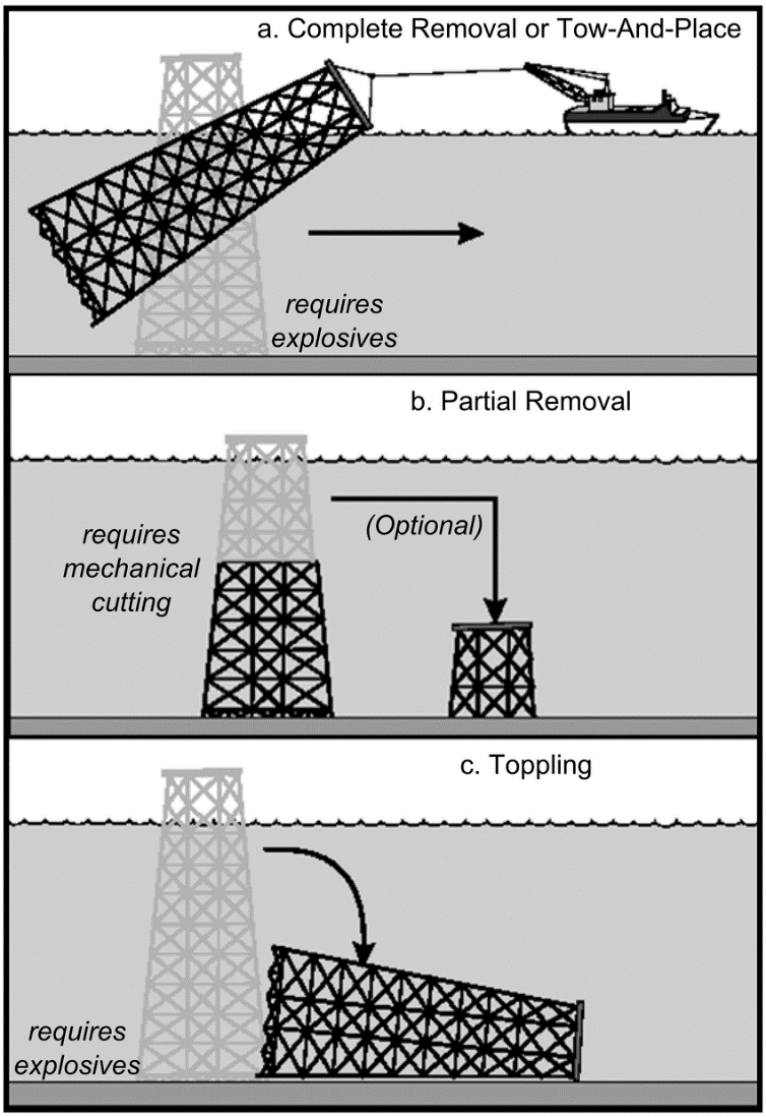


Figure 6-7 – The Reference to the Substructure when Discussing Oil and Gas Decommissioning Options (Dauterive 2000)

Consequently, the assumption that will be adopted in this research is that the precise decommissioning option of the oil and gas facility refers to the substructure component of the oil and gas facility.

6.2.3.2 –A Comparison of the Categories

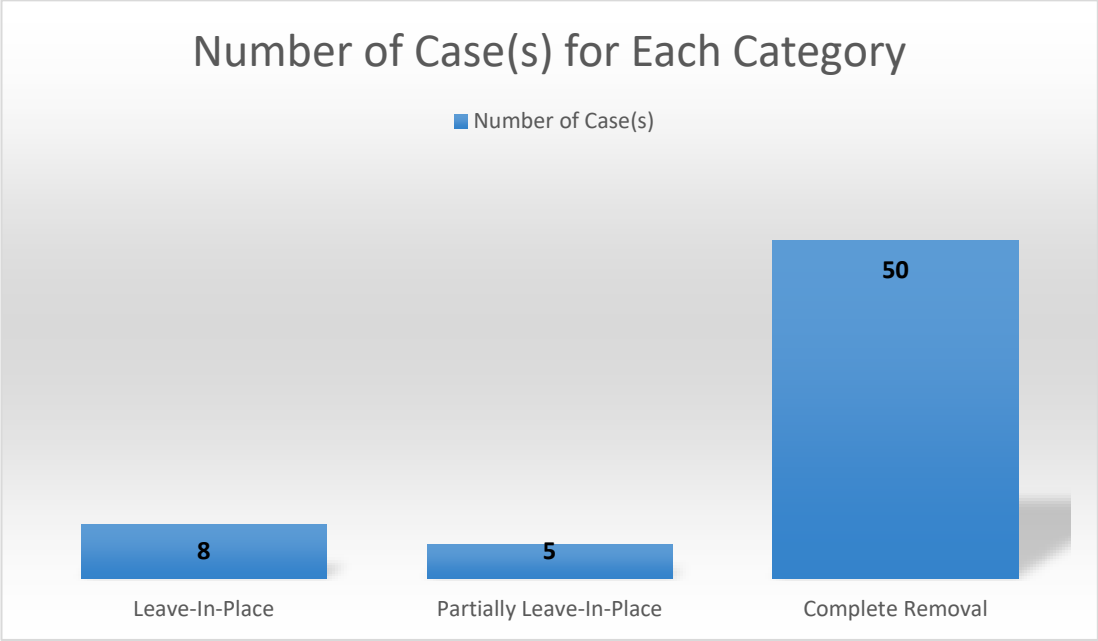


Figure 6-8 – The Number of Case(s) for Each Category

It can be clearly seen from **Figure 6-8** (above) that there are significantly more oil and gas facilities that are being completely removed than are being left wholly or partially in place in the marine environment. Noting that these cases are from the United Kingdom, which is subjected to the regulations of OSPAR Decision 98/3, it is possible that this trend is due to the impact of OSPAR Decision 98/3. However, it is also possible that the Complete Removal decommissioning option is more favourable for the operators.

This shows that in the presence of prescriptive regulation, like that of OSPAR Decision 98/3, it can be very difficult for oil and gas operators to convince stakeholders that their chosen decommissioning option was not solely based on regulatory compliance alone. From a stakeholder management perspective, this suggests that managing stakeholders in a goal-setting regime environment could be much easier than in a prescriptive regime environment.

Also shown in **Figure 6-8** is that there are very few cases for the Leave-In-Place and Partially Leave-In-Place categories. This is both advantageous and problematic. From a positive stance, this paucity offers a lot of opportunity for learning regarding Leave-In-Place and Partially Leave-In-Place decommissioning options. For example, more biological science studies can

be commissioned in order to understand the impact of leaving oil and gas facilities partly or wholly in place.

However, the fact that there are few cases for Leave-In-Place and Partially Leave-In-Place categories may result in difficulty in triangulation and convergence of the secondary data, according to Yin (2013). As such, all four types of triangulation methodology (data source, analysts, theory, and methods) as suggested by Patton (2002) will be used to increase the likelihood of result convergence.

Another observation when comparing the categories is that the precise decommissioning option for the offshore facility almost always follows the categories of OSPAR Decision 98/3. As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning***, there are three categories in which it is possible for the oil and gas facility to be left wholly or partly in place:

> *(i) All or part of the footings of a steel installation weighing more than 10,000 tonnes in air emplaced before 9 February 1999.*
>
> *(ii) A concrete installation (including a gravity based concrete installation, a floating installation and any concrete anchor-base which results, or is likely to result, in interference with other legitimate uses of the sea)*
>
> *(iii) Any other disused offshore installation when exceptional or unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties can be demonstrated*
>
> *– Paragraph 3, OSPAR Decision 98/3*

This suggests that there is no incentive for the industry to go beyond compliance with regulations. What this means is that most operators are not willing to pay more to remove a facility if the facility is allowed to be left in place according to regulations. Although, it is worth noting the enthusiasm for removal that some operators seem to exhibit because they are worried about liability for infrastructure left in place.

One exception to the trend is the decommissioning of the Maureen platform, in which the substructure weighed more than 10,000 tonnes in air (Phillips Petroleum Company 2001). Rather than seeking derogation, the entirety of the

Maureen platform was removed to shore. In the Maureen decommissioning proposal document, the reason provided was that:

> *The Maureen decommissioning studies confirm that refloating the structures is a technically sound solution and does not pose unacceptable safety or technical risks. Refloating and removing them will comply with the general rule of removal in OSPAR Decision 98/3, and will preserve the opportunity for reuse, thereby meeting the principles of the waste hierarchy. For these reasons refloating was the only shortlisted removal alternative, and hence the Selected Decommissioning Option, for these facilities.*
>
> *– Phillips Petroleum Company[11], 2001*

The reason provided by the Phillips Petroleum Company indicates that the reason for removing the Maureen platform was that the scientific evidence supported it. This suggests that oil and gas operators based their decommissioning decisions primarily on scientific evidence.

From a regulatory perspective, the Maureen case indicates that there are exceptions to OSPAR Decision 98/3 derogation categories which suggests that a goal-setting regime is perhaps much more applicable in practice.

Additionally, as already explained earlier in **Section 6.1.1.1** (see page 203), the decommissioning of the Maureen oil and gas facility was mentioned in the literature as the first major oil and gas decommissioning project post-OSPAR Decision 98/3 (Johnson 2013). This suggests that it is also highly likely that the decision to remove the Maureen platform to shore was made in order to set a precedent for the future oil and gas decommissioning projects that would follow in a post-OSPAR Decision 98/3 world.

Further observation finds that all Leave-In-Place cases involved concrete gravity-based platforms. All Partially Leave-In-Place cases involve large steel jacket platforms weighing more than 10,000 tonnes in air, and all Complete Removal cases, with the exception of Maureen, involved steel jacket platforms that weighed below 10,000 tonnes in air. This suggests, firstly, that the cases can also be divided into the same three categories when divided by the type

[11] Note that Phillips Petroleum Company no longer exists. Phillips Petroleum Company merged with Conoco to form ConocoPhillips in 2002.

of structures. It also suggests, however, that the method of decommissioning, in general, is dependent on the type of the structure.

6.3 – Extraction of Information from the Cases

After categorising the cases, as mentioned in ***Chapter 5: Research Methodology*** (see page 174), all documents collected for each case will be studied in order to extract the information required for the design of the stakeholder-oriented critical paths, which include the:

- List of all project activities
- Duration of each activity
- Dependencies between activities
- Milestones and deliverables

However, as this project focuses on identifying stakeholder interactions and the creation of stakeholder-oriented critical paths, information regarding stakeholder interactions will also be recorded. The information for each case was recorded using Microsoft Excel, **Table 6-2** (below) shows a small work example of the recorded information.

Table 6-2 – A Small Work Sample for the Extraction and Recording of Information

List of Project Activities	Start Date	End Date	Stakeholder Interactions Notes
Prototype Development of Navigation Aid	1-Mar-04	1-Mar-05	The Norwegian Coastal Directorate, UK Northern Lighthouse Board
Shut-In of Production	26-Oct-04	26-Oct-04	
Final Production of Navigation Aid	Feb-05	1-Mar-07	The Norwegian Coastal Directorate, UK Northern Lighthouse Board
Removal of Bridge connecting TCP2 to TP1	Feb-05		Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Removal of TP1 Topside			Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
During Removal Phase Environmental Survey	May-06	May-06	
Checking of Exact Centre of Gravity for Module Support Frame		1-Jan-07	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Cutting of 2 Concrete Columns	May-07	May-07	
Single Lift of 3016 tonne Module Support Frame by S7000	1-Jan-07	1-Jan-07	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Installation of Navigation Aids on Concrete Substructures	1-Jan-07	1-Jan-07	The Norwegian Coastal Directorate, UK Northern Lighthouse Board, The UK Hydrographic Office, The Norwegian Hydrographic Services
Removal of External Risers Entering the Concrete Columns at the top of the Caisson	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)

As seen in the work sample, there are four columns for each example. The project activities, milestones, and deliverables are listed in the first column. The duration of project activities is recorded in terms of start date and end date in the second and third columns, respectively. The stakeholder interactions are noted in the fourth column.

It is very noticeable that there is an absence of information regarding the dependencies between activities. This absence is because there is no data from the sources that explicitly provide information regarding the dependencies between activities. The absence of information on the dependencies between activities will be discussed in **Section 6.3.1.6** (see page 234).

Additional examples of the recorded information are available in ***Appendix D*** (see pages 578 to 588). The examples in ***Appendix D*** were selected in order to have at least one example representing each of the three categories (Leave-In-Place, Partially Leave-In-Place, and Complete Removal). In ***Appendix D***, **Table D-1** (see page 578) shows the recorded information for the Frigg TP1 case, which is a Leave-In-Place case. **Table D-2** (see page 582) shows the recorded information for the North West Hutton case, a Partially Leave-In-Place case. **Table D-3** (see page 584) shows the recorded information for the Indefatigable Juliet case, a Complete Removal case.

All 63 cases, as listed in **Table C-1** (see page 577) of ***Appendix C***, were studied, and the required information was extracted from each case. All cases were used in order to ensure comprehensive coverage. The cases were analysed chronologically starting with the oldest decommissioning project in order for easier identification of patterns and relationships. The information for each case is recorded in separate Microsoft Excel files as illustrated in **Figure 6-9** (below, page 223):

BP Miller Platform Critical Path (UK) - Partial Removal.xlsx	3/06/2018 2:53 PM	Microsoft Excel W...
BP North Hutton Platform Critical Path (UK) - Relocate.xlsx	1/06/2018 2:26 PM	Microsoft Excel W...
CNR International Murchison Platform Critical Path (UK) - Partial Removal.xlsx	1/06/2018 2:16 PM	Microsoft Excel W...
ConocoPhillips LOGGS Satellite Vampire OD Critical Path (UK) - Complete Removal.xlsx	31/05/2018 1:46 PM	Microsoft Excel W...
ConocoPhillips LOGGS Satellite Viscount VO Critical Path (UK) - Complete Removal.xlsx	31/05/2018 1:47 PM	Microsoft Excel W...
ConocoPhillips LOGGS Satellite Vulcan UR Critical Path (UK) - Complete Removal.xlsx	31/05/2018 1:49 PM	Microsoft Excel W...
ConocoPhillips Viking Satellite CD Critical Path (UK) - Complete Removal.xlsx	31/05/2018 2:53 PM	Microsoft Excel W...
ConocoPhillips Viking Satellite DD Critical Path (UK) - Complete Removal.xlsx	31/05/2018 2:54 PM	Microsoft Excel W...
ConocoPhillips Viking Satellite ED Critical Path (UK) - Complete Removal.xlsx	31/05/2018 2:54 PM	Microsoft Excel W...
ConocoPhillips Viking Satellite GD Critical Path (UK) - Complete Removal.xlsx	31/05/2018 2:54 PM	Microsoft Excel W...
ConocoPhillips Viking Satellite HD Critical Path (UK) - Complete Removal.xlsx	31/05/2018 2:55 PM	Microsoft Excel W...
Helix Energy Resource Technology Camelot CA Platform Critical Path (UK) - Complete R...	31/05/2018 2:29 PM	Microsoft Excel W...
Perenco Thames AP Platform Critical Path (UK) - Complete Removal.xlsx	1/06/2018 1:22 PM	Microsoft Excel W...
Perenco Thames AR Platform Critical Path (UK) - Complete Removal.xlsx	1/06/2018 1:22 PM	Microsoft Excel W...
Perenco Thames AW Platform Critical Path (UK) - Complete Removal.xlsx	1/06/2018 1:22 PM	Microsoft Excel W...
Shell Brent Delta Platform Critical Path (UK) - Leave in Place.xlsx	5/06/2018 11:55 AM	Microsoft Excel W...
Shell Juliet Platform Critical Path (UK) - Complete Removal.xlsx	29/05/2018 1:03 PM	Microsoft Excel W...
Shell Kilo Platform Critical Path (UK) - Complete Removal.xlsx	29/05/2018 12:51 PM	Microsoft Excel W...
Shell Leman BH Platform Critical Path (UK) - Complete Removal.xlsx	5/06/2018 11:23 AM	Microsoft Excel W...
Shell Lima Platform Critical Path (UK) - Complete Removal.xlsx	29/05/2018 12:53 PM	Microsoft Excel W...
Shell Mike Platform Critical Path (UK) - Complete Removal.xlsx	29/05/2018 1:02 PM	Microsoft Excel W...
Shell November Platform Critical Path (UK) - Complete Removal.xlsx	29/05/2018 12:59 PM	Microsoft Excel W...
Spirit Energy Markham ST-1 Platform Critical Path (UK Netherlands) - Complete Remova...	5/06/2018 11:00 AM	Microsoft Excel W...
Total Frigg CDP1 Platform Critical Path (UK) - Partial Removal.xlsx	29/05/2018 12:03 PM	Microsoft Excel W...
Total Frigg DP1 Platform Critical Path (Norway) - Partial Removal.xlsx	29/05/2018 11:19 AM	Microsoft Excel W...
Total Frigg DP2 Platform Critical Path (Norway) - Complete Removal.xlsx	29/05/2018 11:25 AM	Microsoft Excel W...
Total Frigg QP Platform Critical Path (UK) - Partial Removal.xlsx	29/05/2018 11:53 AM	Microsoft Excel W...
Total Frigg TCP2 Platform Critical Path (Norway) - Leave in Place.xlsx	18/04/2018 9:39 AM	Microsoft Excel W...
Total Frigg TP1 Platform Critical Path (UK) - Leave in Place.xlsx	29/05/2018 11:57 AM	Microsoft Excel W...
Total MCP-01 Platform Crtical Path (UK Norway) - Leave in Place.xlsx	19/04/2018 11:23 AM	Microsoft Excel W...

Figure 6-9 – The Extraction of Information from the Cases

6.3.1 – Observations from the Extraction of Information

There are a lot of observations that have emerged during the extraction of information, which are summarised in the following sections:

- Decommissioning Proposals Details (Section 6.3.1.1)
- Variations in the List of Project Activities (Section 6.3.1.2)
- Dependencies between Oil and Gas Facilities (Section 6.3.1.3)
- Similarities in Milestones and Deliverables (Section 6.3.1.4)
- Variations in the Duration of Project Activities (Section 6.3.1.5)
- Dependencies between Project Activities (Section 6.3.1.6)
- Variations in the Order of Project Activities (Section 6.3.1.7)
- Execution of Project Activities in Parallel (Section 6.3.1.8)
- Stakeholder Interactions (Section 6.3.1.9)
- Variations in Comparative Assessment Sub-Criteria (Section 6.3.1.10)
- Project or Programme? (Section 6.3.1.11)
- The Ever-Evolving Oil and Gas Operator Landscape (Section 6.3.1.12)

In terms of methodology, the use of Microsoft Excel was found to be a useful tool for recording and organising the information extracted from the cases in this research. Microsoft Excel allows the information to be sorted into rows and columns which enabled the researcher to identify patterns and relationships. For example, in **Table 6-3** (below, page 225) (a section extracted from **Table D-2** (see page 582) in ***Appendix D***), by presenting the stakeholder interaction notes in columns, it can be observed that stakeholder interactions change throughout the lifecycle of the oil and gas decommissioning project. As seen in **Table 6-3**, after the trenching activities, stakeholder interactions shifted from interacting with Heerema Marine Contractors (i.e. contractors) to the Department of Energy and Climate Change (i.e. regulators). This suggests that oil and gas operators' prioritisation of stakeholders' changes throughout the lifecycle of a project.

Table 6-3 – A Section from Table D-2

List of Project Activities	Start Date	End Date	Stakeholder Interactions Notes
Trenching of 13km of (10"Concrete Coated Section) of PL 148	16-Jul-11	17-Aug-11	Heerema Marine Contractors
Trenching of 13km of (10"Concrete Coated Section) of PL 147	16-Jul-11	17-Aug-11	Heerema Marine Contractors
Removal of 209m of (6"Flexible Section) of PL 147	16-Jul-11	17-Aug-11	Heerema Marine Contractors
Removal of SSIV[12] Umbilical of PL 147	16-Jul-11	17-Aug-11	Heerema Marine Contractors
Searching of Spool piece			Department of Energy and Climate Change, DNV
Debris Clearance	1-Nov-12	1-Nov-12	Department of Energy and Climate Change, DNV

6.3.1.1 – Decommissioning Proposals Details

During the extraction of information, it was observed that there is a significant variation in level of detail of the proposal documents. Some decommissioning programme documents included detailed engineering designs and diagrams such as the Leman BH case. A sparse example would be the Stamford case which included only descriptions of the chosen decommissioning option and the rationale of the chosen option. What this suggests is there is a difference in what operators felt should be included in their proposal documents in order to justify their chosen method of decommissioning.

Another observable trend is that there is a variation in the length of the proposals. Across all cases, a typical length for a decommissioning proposal document is approximately 50 pages. However, the length of a decommissioning proposal document ranges from 24 pages to 332 pages, as summarised in **Table 6-4** (below, page 228):

[12] SSIV: Subsea Isolation Valve

Table 6-4 – Variation in Length of Decommissioning Proposal Documents

Proposal Document	Proposal Document Length	Infrastructures Involved
Brae Alpha West	24 Pages	1 x Drilling Rig
South Morecambe	57 Pages	1 x Platform + Pipelines
Ninian Northern	70 Pages	1 x Platform
Dunlin Alpha	77 Pages	1 x Platform
Beatrice	88 Pages	3 x Platforms + Pipelines
Brent	322 Pages	4 x Platforms

As seen in **Table 6-4** (above), it can be observed that the length of the proposal document seems to have a direct relationship with the size of scope of the decommissioning activity. The most noticeable feature in **Table 6-4** (above), is that the Brent decommissioning proposal document is significantly longer than the others, with a total of 332 pages. While the length can be said to be a reflection of the size and scale of the Brent oil and gas facility, it cannot be ruled out that the additional details in the Brent decommissioning proposal document could be a strategy to counter the negative publicity from the Brent Spar saga (Gordon, Poot & O'Connor 2019; Sanwoolu et al. 2017; Zyglidopoulos 2002).

6.3.1.2 – Variations in the List of Project Activities

In terms of project activities, it was observed that there are significant variations between cases within the same category. For example, when comparing the Indefatigable Juliet case (**Table D-3** (see page 584) of ***Appendix D***) with the Leman BH case (**Table D-4** (see page 586) of ***Appendix D***), it is notable that there were no well plugging and abandonment activities on the Leman BH case. Further observations find that the variation of project activities was primarily due to the design of the facility. For example, there were no well plugging and abandonment activities on the Leman BH case because there were no wells included in the design of the Leman BH structure. This suggests that the list of project activities, and hence the stakeholder-oriented critical paths will differ depending on the design of the facility.

The variation of project activities was also observed to be different between different categories. For example, when comparing the Frigg TP1 case (**Table D-1** (see page 578) of ***Appendix D***) and the North-West Hutton case (**Table D-2** (see page 582) of ***Appendix D***), it can be seen that there was no installation of navigation aids for the North-West Hutton case. As mentioned in the Frigg TP1 decommissioning proposal:

> *The IMO [International Maritime Organization) Guidelines recommend that the coastal State ensures that installations that are not entirely removed be indicated on nautical charts and be properly marked with navigation aids.*
>
> *– Total, 2003*

This means that the installation of navigation aids is not undertaken if a Complete Removal decommissioning option is chosen. This indicates that the list of project activities, and hence, the stakeholder-oriented critical paths will differ depending on the precise decommissioning option, which supports the findings from the review of engineering literature in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 51).

6.3.1.3 – Dependencies between Oil and Gas Facilities

In terms of project activities, a unique finding was observed when extracting information on the list of project activities from the Dunlin Alpha case. This finding is the Dunlin Bypass Project, which involves extra project activities to install new oil and gas structures (EnQuest 2020; Fairfield Energy 2018). The rationale for installing new oil and gas structures, according to Fairfield Energy (2018) and EnQuest (2020), was the impact the decommissioning of Dunlin Alpha will have on its surrounding facilities.

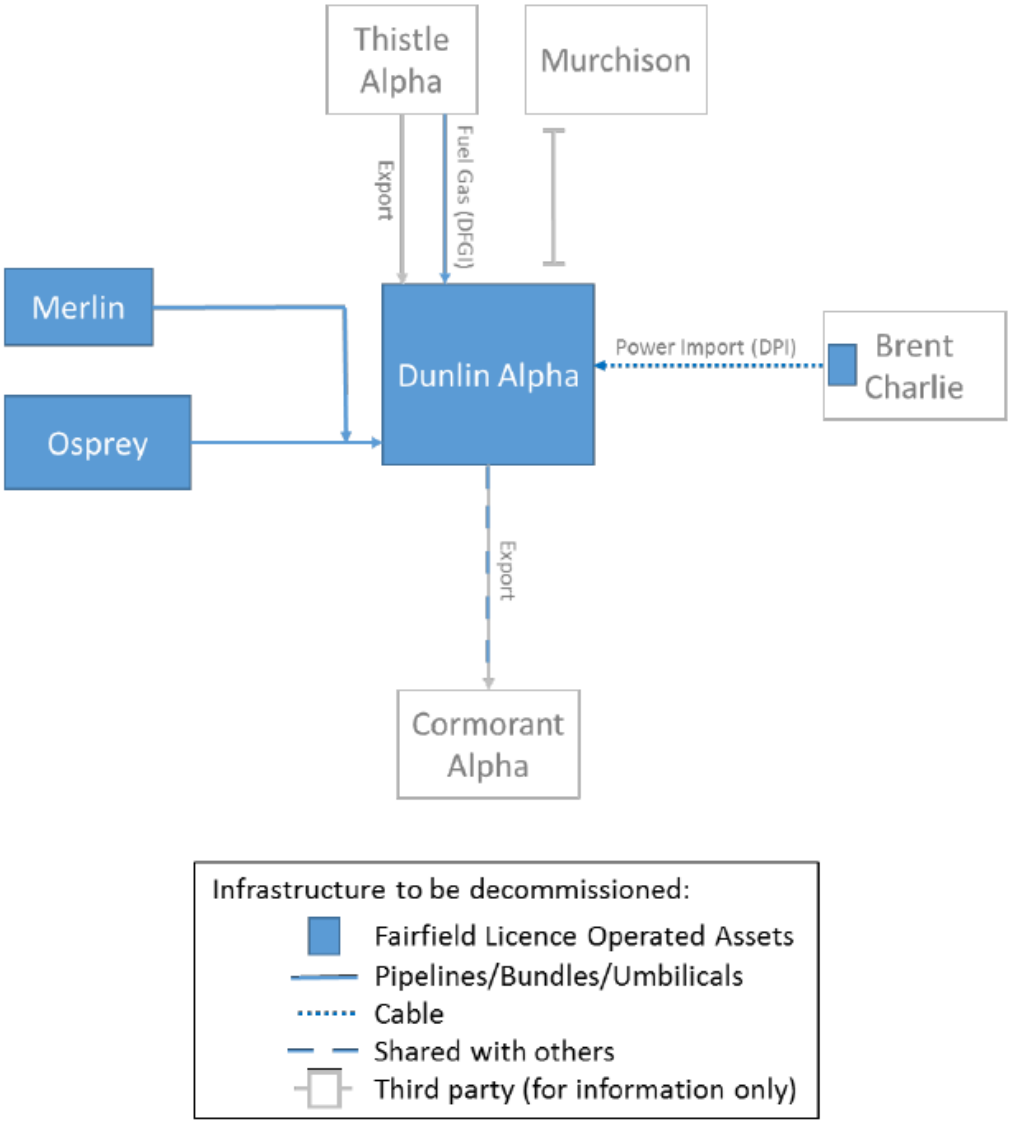


Figure 6-10 – The Relationship between Dunlin Alpha Facility and its Adjacent Facilities (Fairfield Energy 2018)

As illustrated in **Figure 6-10** (above, page 228), Thistle Alpha facility depends on the Dunlin Alpha facility to export their hydrocarbons via the Cormorant Alpha facility and the Brent pipeline system to the Sullom Voe Terminal. The decommissioning of the Dunlin Alpha facility means that the Thistle Alpha facility can no longer export its hydrocarbons via the Cormorant Alpha facility and the Brent pipeline system. This means that the decommissioning of the Dunlin Alpha facility can potentially impact the business performance of Thistle Alpha's owner – EnQuest. The purpose of the Dunlin Bypass Project, then, was to install new pipelines to bypass Dunlin Alpha in order for Thistle Alpha to continue to export its hydrocarbons via the Brent pipeline system via the Cormorant Alpha facility (EnQuest 2020; Fairfield Energy 2018).

A revisit to the literature finds that the dependencies between oil and gas facilities is not just limited to Dunlin Alpha and its surrounding facilities in the Brent pipeline system. **Figure 6-11** (below) presents the extensive network of more than 70 oil and gas facilities, all linked together by the Forties Pipeline System.

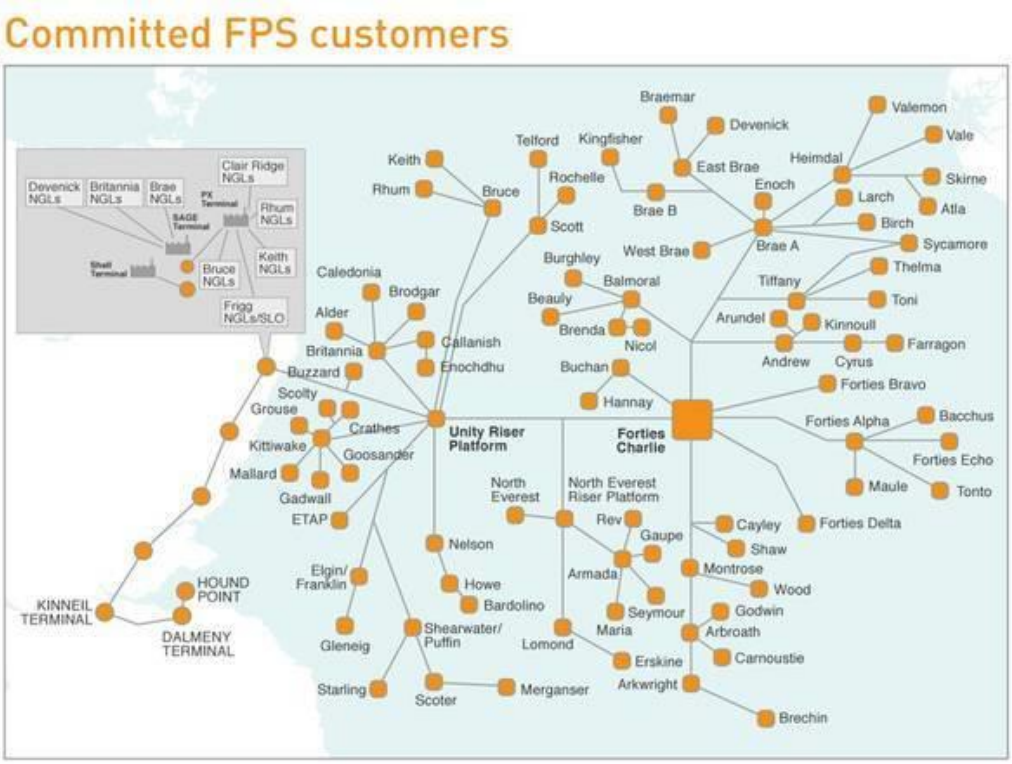


Figure 6-11 – Oil and Gas Facilities in the Forties Pipeline System (FPS) (INEOS 2020)

The attempted shutdown of the Forties Pipeline System for maintenance amidst the COVID-19 pandemic required an extensive stakeholder consultation with every single oil and gas operator linked to the Forties Pipeline System (INEOS 2020). This finding suggests that any activity, including the decommissioning of oil and gas facilities, cannot be viewed in isolation. Consideration will have to be given to the surrounding oil and gas facilities as well. From a stakeholder management perspective, this indicates that the owners of neighbouring oil and gas facilities, and perhaps even the entire pipeline system, could potentially be impactful stakeholders.

When comparing the United Kingdom's North Sea region and Australia's North-West Shelf region, it was found the pipeline system in Australia's North-West Shelf region, as illustrated in **Figure 6-12** (below), is significantly less extensive than the Forties pipeline system in the United Kingdom (see **Figure 6-11** above, page 229).

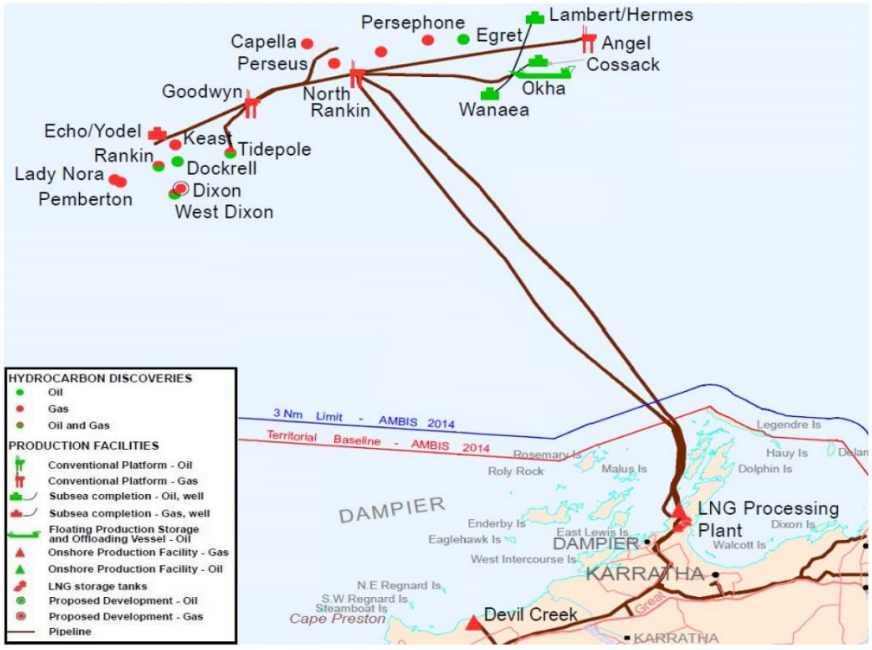


Figure 6-12 – Oil and Gas Facilities in the North-West Shelf Pipeline System (Woodside 2017)

While this finding suggests that the number of neighbouring oil and gas facilities required to be considered is smaller in the Australian landscape, the owners of neighbouring oil and gas facilities could still be potentially impactful stakeholders in the oil and gas decommissioning project or programme.

6.3.1.4 – Similarities in Milestones and Deliverables

In terms of milestones and deliverables, it was observed that there is a high level of similarities between cases within the same category. For example, as seen in **Figures 6-13** (below) and **6-14** (below, page 232), the CoP (cessation of production) has been labelled as the only milestone in both the Ninian Northern case and the Miller case. Note that both Ninian Northern and Miller are Partially Leave-In-Place cases.

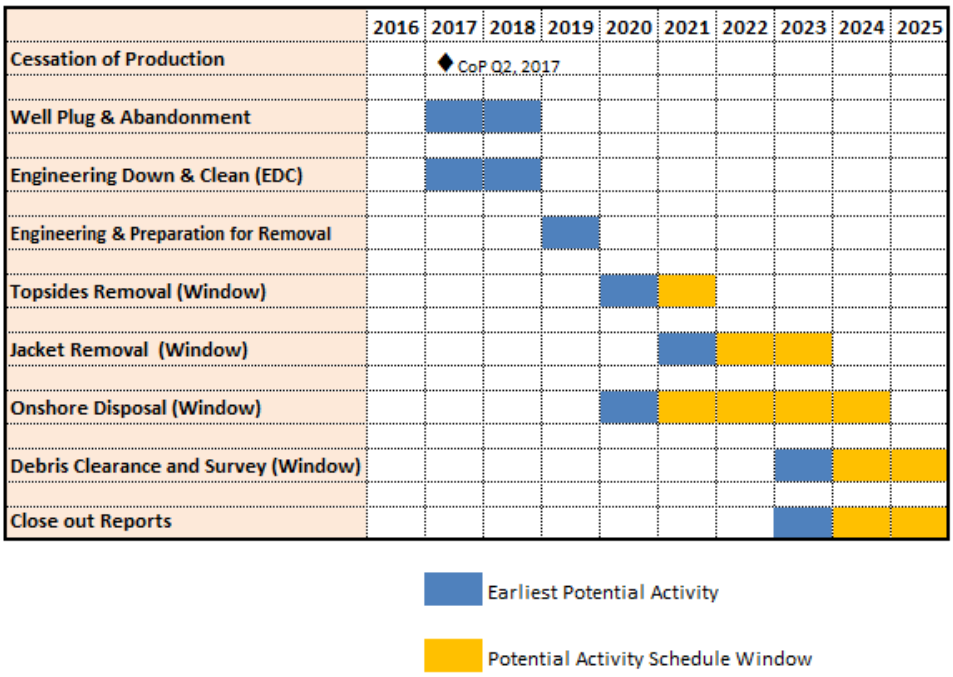


Figure 6-13 – The Gantt Chart for the Ninian Northern Case (CNR 2019)
**Milestone Labelled using a Black Diamond*

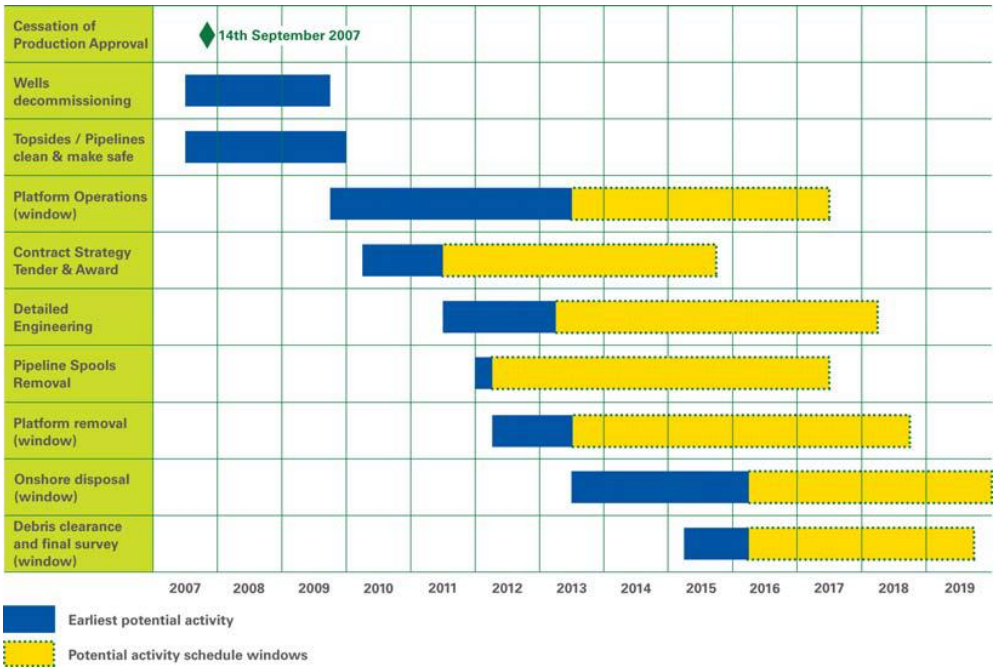


Figure 6-14 – The Gantt Chart for the Miller Case (BP 2011)
**Milestone Labelled using a Green Diamond*

Overall, this suggests that while the project activities may differ depending on the precise decommissioning options, the key milestones to be achieved remain largely the same for all oil and gas decommissioning projects or programmes.

6.3.1.5 – Variations in the Duration of Project Activities

In terms of duration of project activities, it was observed that there are significant variations between cases, regardless of the project activity. For example, when comparing the Indefatigable Juliet case (**Table D-3** (see page 652) of ***Appendix D***) and the Leman BH case (**Table D-4** (see page 655) of ***Appendix D***), it was observed that the time taken for the approval of the decommissioning proposals varied quite significantly.

Table 6-5 – Variation in Duration of Project Activities

Case	**Proposal Submission Date**	**Proposal Approval Date**	**Duration**
Indefatigable Juliet	30th May 2007	6th Aug 2007	68 days
Leman BH	5th Apr 2017	27th Apr 2017	22 days

Overall, the variation in project activities suggests that the body of knowledge in oil and gas decommissioning has not yet stabilised, and there may still be a knowledge gap in the field. However, as seen in **Table 6-5** (above), there appears to be a decreasing trend in terms of the duration of project activities, which suggests that the body of knowledge in oil and gas decommissioning is steadily growing.

6.3.1.6 – Dependencies between Project Activities

While the decommissioning proposals do detail the list of project activities that take place, there is a lack of data that explicitly confirms the dependencies between the different project activities. For example, as seen in the Gantt chart for the Jupiter case shown in **Figure 6-15** (below), there is no clear information regarding the dependencies between the respective project activities.

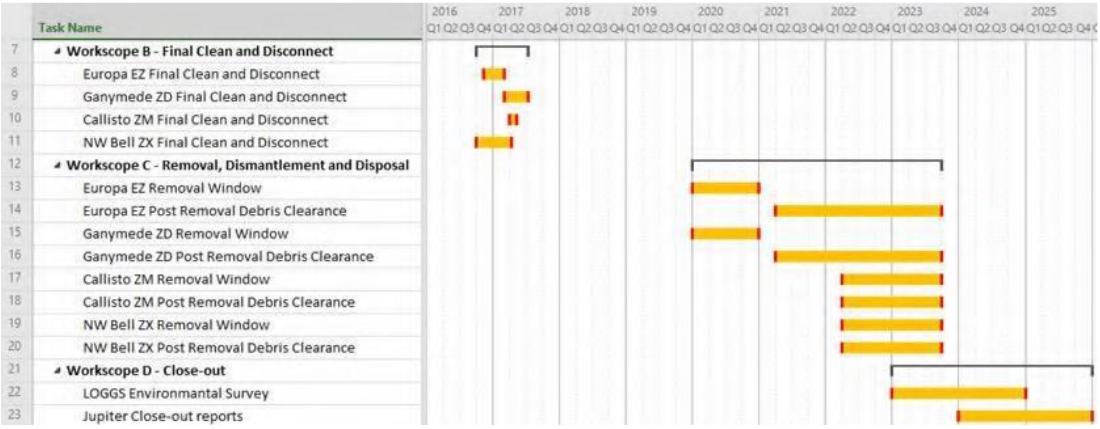


Figure 6-15 – The Gantt Chart for the Jupiter Case (Chrysaor 2020)

The dependencies between project activities can only be deduced based on the start and end dates of the respective activities, and the technical knowledge of the researcher. For example, when examining the closing report on the removal of the Indefatigable Juliet case, it was found that the report on the platform removal states that:

The facility removal has been executed by Seaway Heavy Lifting (SHL) with their heavy lift vessel Stanislav Yudin*. The offshore lifting campaign started 15 March 2011. The* Stanislav Yudin *left on 11 April 2011 to execute a job for another client and returned to Inde on 3 May 2011. The lifting of all facilities was completed on 11 July 2011.*

The following main activities have been executed by the crew of the HLV for each of the platforms:

- *Remove all objects, which are considered as a hazard (falling object*
- *Install scaffolding around the legs of the topsides at the cutline positions.*
- *Weld guide plates at the cutline positions of the legs of the topsides……"*

– Shell, 2014

When analysing the above quotation from an engineering perspective, it can be deduced that scaffolding must be installed around the legs in order to enable workers to stand on the scaffolding and weld the guide plates on to the legs. That being said, without explicit information from the case study source that confirms this dependency between the project activities, this deduction cannot be entirely confirmed as there has no evidence to back up the deduction.

While some may argue that it is common sense to seek approval before commencing a decommissioning activity, and to remove the topside before removing a substructure, a reader without technical knowledge of the oil and gas decommissioning process may not be able to deduce the dependencies between the project activities. Furthermore, as will be discussed later in **Sections 6.3.1.7** (see page 240) and **6.3.1.8** (see page 242), there are variations both in the order of project activities and project activities being executed in parallel with each other, which can make it difficult even for a researcher with a high level of technical knowledge of the oil and gas decommissioning process to determine the dependencies between project activities.

From a research methodology perspective, this means that it is highly recommended that a researcher in the field of oil and gas decommissioning be thoroughly equipped with the requisite technical knowledge of the oil and gas decommissioning process prior to undertaking the research.

From a stakeholder management perspective, this finding also suggests that stakeholders will require a high level of technical knowledge of the oil and gas decommissioning process in order to understand the rationale behind the decisions made by the oil and gas operators. This also suggests that the level of technical knowledge of the stakeholders of the oil and gas decommissioning process can have an impact on the effectiveness of stakeholder engagement. Thus, it may be beneficial for oil and gas operators to plan stakeholder engagement activities that focus on enhancing stakeholders' understanding of the oil and gas decommissioning process rather than just informing them of the proposed decommissioning plan and inviting comments.

The benefits of knowledge sharing regarding stakeholder management is not a new idea (Aarikka-Stenroos & Jaakkola 2012; Bierly III, Damanpour & Santoro 2009; Cepeda & Vera 2007; Grant 1996; Mauser et al. 2013; Menguc, Auh & Yannopoulos 2014; Eskerod, Huemann & Ringhofer 2015; Eskerod & Ang 2017; Eskerod, Ang & Andersen Erling 2018). A revisit to the literature finds that there is a body of knowledge that centres on co-creation of knowledge with stakeholders and the benefits co-creation of knowledge can bring to a firm. Co-creation of knowledge with stakeholders has also been stated in the literature to be a source of competitive advantage (Bierly III, Damanpour & Santoro 2009; Cepeda & Vera 2007; Grant 1996; Menguc, Auh & Yannopoulos 2014).

However, the benefits of co-creation of knowledge between oil and gas operators and stakeholders have not yet been explicitly explored in the context of oil and gas decommissioning. This suggests there is an opportunity to extend the body of knowledge by testing co-creation of knowledge frameworks in the context of oil and gas decommissioning. It is possible that co-creation of knowledge can be an effective strategy for managing oil and gas decommissioning stakeholders.

From a regulatory perspective, the finding that a reader without technical knowledge of the oil and gas decommissioning process may not be able to deduce the dependencies between the project activities from the case study source, suggests that it may be necessary for regulators to ensure that their regulatory officers are thoroughly equipped with technical knowledge of the oil and gas decommissioning process.

A revisit to the literature finds that there is a very small body of knowledge that explores the relationship between technical knowledge and the competencies of government departments (Kasim 2015; Kasim 2008). In the oil and gas sector, research focuses on studying the competencies of oil and gas companies rather than the competencies of government departments. This suggests that there is an opportunity to extend the body of knowledge by exploring the relationship between technical knowledge and competencies of government departments in the context of oil and gas decommissioning.

Establishing a competent government department well equipped with technical knowledge of the oil and gas decommissioning process could be the primary rationale of the Ministry of Energy of the Kingdom of Thailand in sponsoring their regulatory officers to pursue a Master of Science in Decommissioning at the University of Aberdeen (Muanthongthae 2019; Chumphonwong 2020).

6.3.1.7 – Variations in the Order of Project Activities

During the extraction of information, it was also observed that there is a significant variation in the order of project activities. As mentioned earlier in **Section 6.3.1.6** (see page 256), the difficulty in obtaining information regarding the dependencies between activities can also be attributed to the variation in the order of project activities across different cases.

For example, when comparing the Gantt chart of the Buchan Alpha case (see **Figure 6-16** below) and the Dunlin Alpha case (see **Figure 6-17** below, page 239), it can be observed that the well plugging and abandonment commenced after platform removal for the Buchan Alpha case, but before platform removal for the Dunlin Alpha case.

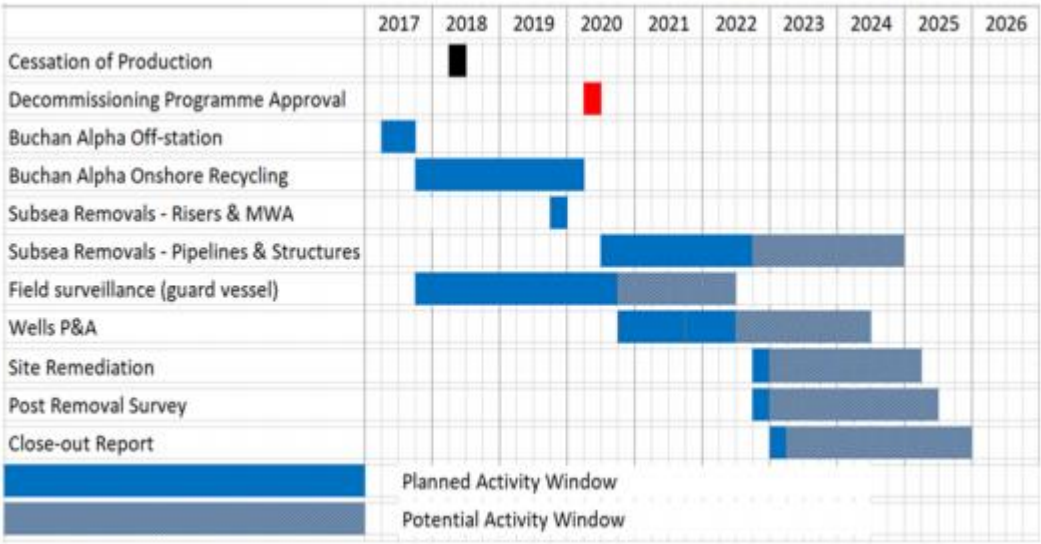


Figure 6-16 – The Gantt Chart for the Buchan Alpha Case (Repsol 2020)

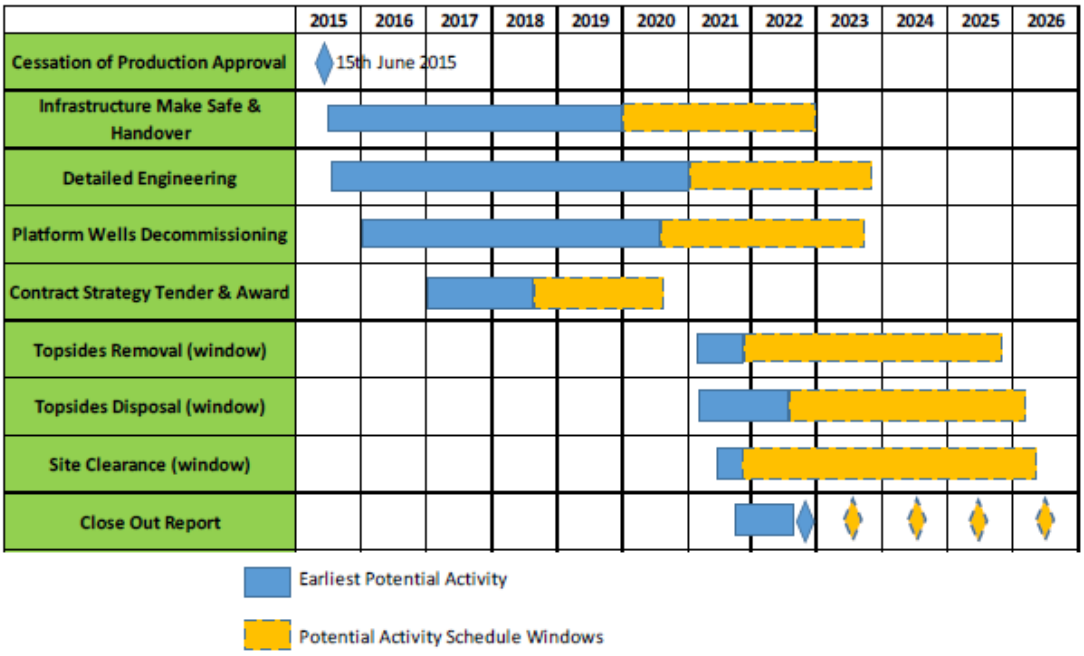


Figure 6-17 – The Gantt Chart for the Dunlin Alpha Case (FairfieldEnergy 2018)

Further investigation finds that the Buchan Alpha facility has subsea wells whereas the Dunlin Alpha facility has platform wells. This means that the designs of the Buchan Alpha facility and the Dunlin Alpha facility are different. This finding indicates that the order of project activities differs depending on the design of the oil and gas facilities, which suggests that the stakeholder-oriented critical paths will differ depending on the design of the facility.

6.3.1.8 – Execution of Project Activities in Parallel

During the extraction of information, it was also observed that there are many project activities being executed in parallel with each other. As mentioned earlier in **Section 6.3.1.6**, the difficulty in obtaining information regarding the dependencies between activities arose because of project activities being executed in parallel with each other. An example of a case where project activities are being executed in parallel with each other is the Murchison case, as illustrated in **Figure 6-18** (below):

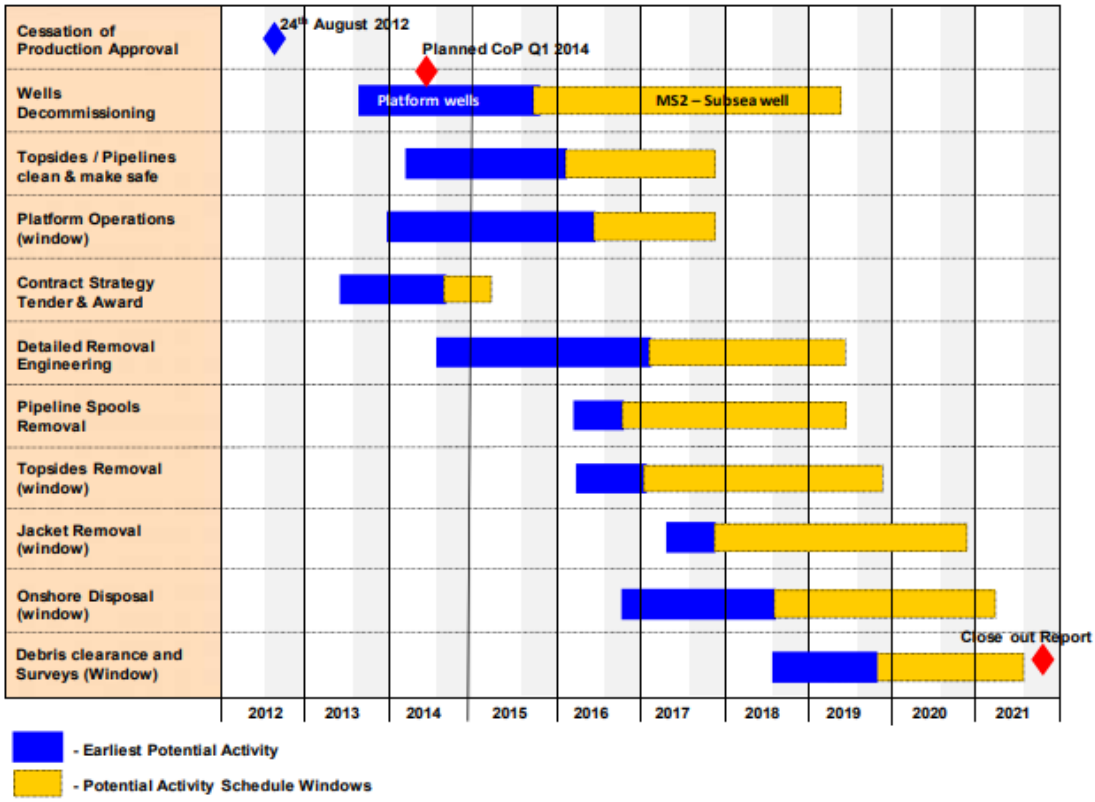


Figure 6-18 – The Gantt Chart for the Murchison Case (CNR 2014)

As seen in **Figure 6-18** (above), wells decommissioning runs in parallel with topsides/pipelines clean and make safe operations, platform operations, contract strategy tender and award, and detailed removal engineering. Parallel project activities are also observable in the various Gantt charts presented in previous sections – **Figures 6-13**, **6-14**, **6-15**, **6-16**, and **6-17** (see pages 233 to 240), demonstrating that the phenomenon is true across different oil and gas decommissioning projects or programmes.

Having project activities being executed in parallel with each other suggests that resource allocation is an important part of managing an oil and gas decommissioning project or programme. Stakeholder-oriented critical paths could thus be useful in this regard, helping project managers to identify project activities that are potentially subject to considerable stakeholder impacts, and enabling them to allocate resources and manage stakeholders more effectively.

6.3.1.9 – Stakeholder Interactions

During the extraction of information, it was found that there are two periods throughout an entire oil and gas decommissioning project or programme where considerable stakeholder interactions exists:

- Comparative Assessment Period
- Removal Execution Period

<u>Stakeholder Consultation Period</u>

When studying the Stakeholder Reports of the various cases, it was found that there were a significant number of interactions between the oil and gas operators and public stakeholders during the Comparative Assessment Period. The Comparative Assessment Period, based on the dates identified on the various Stakeholder Reports, takes places early on in an oil and gas decommissioning project or programme, as illustrated in **Figure 6-19** (below):

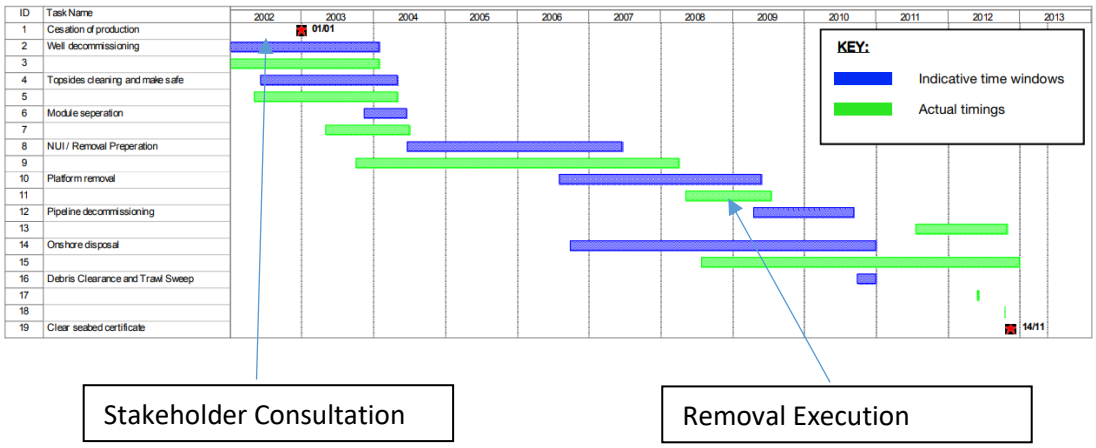


Figure 6-19 – Illustration of the Location of the Stakeholder Interactions using the Gantt Chart for the North-West Hutton Case (BP and Jee 2013)

This suggests that the Stakeholder Consultation Period is a potential critical point[13] on the stakeholder-oriented critical paths.

[13] Critical points are activities in the stakeholder-oriented critical path that are potentially subjected to considerable stakeholder impacts

Removal Execution Period

Based on the examination of the close-out reports of the various cases, the Removal Execution Period was identified as the second project activity where considerable stakeholder interaction exists. The Removal Execution Period generally takes place towards the end of a decommissioning project or programme, as illustrated in **Figure 6-19** (above, page 242).

Stakeholder interactions that take place during removal execution primarily involve the oil and gas operator and the removal contractors. For example, the close-out report of the Indefatigable Juliet case stated that during the removal execution:

> ***It was found*** *that four of the platform leg piles (D2, D3, E2 and E3) were internally grouted to above the minus 3-metre level below seabed. Therefore, leg piles had to be cut externally for which excavation work by a subcontractor of Seaway Heavy Lifting (SHL) was scheduled.* ***Excavation was not performed by SHL since a conflict about indemnities could not be resolved****.*
>
> *– Shell, 2014*

This shows clearly that there were interactions between Shell (oil and gas operator) and Seaway Heavy Lifting (the removal contractor) during removal execution, largely because of unexpected scope creep, but also because of conflict about indemnities. Scope creep and conflict about indemnities was also observed in various other cases such as the North-West Hutton case and the MCP-01 case, which suggests that both these issues are common in oil and gas decommissioning. This also suggests that the Removal Execution Period is a potential critical point[3] on the stakeholder-oriented critical paths.

6.3.1.10 – Variations in Comparative Assessment Sub-Criteria

In particular, when examining the CA documents of the various cases, it was found that different sub-criteria were used by different oil and gas operators. For example, the societal criterion in the CA of the Dunlin Alpha Concrete Gravity-Based Structure, as seen in **Table 6-6** (below) has two sub-criteria, whereas the societal criterion in the CA of the Brent Delta Concrete Gravity Based Structure, as seen in **Table 6-7** (below), has three sub-criteria.

Table 6-6 – The Societal Criterion for the CA of Dunlin Alpha Concrete Gravity Based Structure (Fairfield Energy & Xodus 2018)

Main Criteria	Sub-Criteria	Description
Societal (20%)	Fishing Industry (10%)	This sub-criterion addresses the impact of the option on commercial fishing operations. It includes consideration of impacts from both the decommissioning activities and any residual impacts post decommissioning such as reinstatement of access to area.
	Other Groups (10%)	This sub-criterion addresses any socio-economic impacts on other users both offshore and onshore where the impact may be from dismantling, transporting, treating, recycling and land filling activities relating to the option.

Table 6-7 – The Societal Criterion for the CA of Brent Delta Concrete Gravity-Based Structure (Shell 2017d)

Main Criteria	Sub-Criteria	Description
Societal (20%)	Effects on Commercial Fisheries (6.67%)	An estimate of the financial gain or loss compared with the current situation that might be experienced by commercial fishermen as a result of the successful completion of the planned programme of work
	Employment (6.67%)	An estimate of the man-years of employment that might be supported or created by the option
	Impact on Communities (6.67%)	An assessment of the effects of the option on communities and onshore infrastructure

Overall, this finding indicates that there is a lack of consistency in the use of the CA tool by the oil and gas operators. From a stakeholder management perspective, this suggests that the prioritisation of stakeholders differs from one oil and gas operator to another.

A revisit to the literature finds that the lack of consistency can result in stakeholder concerns regarding procedural justice (Tyler 1988; Tyler & Bies 1990; Kerman & Hanges 2002), which can have a further impact on the effectiveness of stakeholder engagement (Moffat & Zhang 2014; Genter 2019). However, as mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 74), and also in earlier sections of this chapter, the stakeholder landscape can differ depending on location. This suggests that it is possible that the lack of consistency in the use of the CA and oil and gas operators' prioritisation of stakeholders is because of the variation in the stakeholder landscapes.

6.3.1.11 – Project or Programme?

When studying the decommissioning proposal documents, it was observed that there is a mixed-use of the word "project" and "programme" when oil and gas operators are referring to their own case. For example, CNR International (CNRI) used the word "programme" when referring to their Ninian Northern case in their decommissioning proposal:

> *A CNRI project management team will be appointed to manage the operations of competent contractors selected for the well abandonment, decommissioning, and removal and disposal scopes of work. CNRI will control and manage the progress of all permits, licences, authorisations, notices, consents and consultations required. Any changes to this **decommissioning programme** will be discussed with BEIS and approval sought.*
>
> *– CNR, 2019*

In comparison, BP used the word "project" when referring to their Miller case in their decommissioning proposal:

> *The Miller **decommissioning project** represents an important activity for the Section 29 Notice Holders. The project management process will require the rigorous levels of quality control, inspection and assurance that would be expected for a capital investment project of this size. BP as the Operator of the Field will be responsible for the implementation of the overall project management.*
> *– BP, 2011*

This finding suggests that it is possible is that oil and gas decommissioning can be managed either as a project or a programme. However, it is also possible that the phenomenon occurred because the oil and gas operators themselves are unsure whether oil and gas decommissioning should be managed as a project or a programme. It is highly recommended that oil and gas operators in the UK landscape make a clear distinction in their decommissioning proposals between references to the document, and to the temporary organisation set up to manage the oil and gas decommissioning activity.

6.3.1.12 – The Ever-Evolving Oil and Gas Operator Landscape

Another interesting finding is that there are instances where the operatorship and ownership of the oil and gas facility changes in the middle of its decommissioning. For example, in the Leadon case, the decommissioning of the Leadon oil and gas facility was initially managed by Maersk Oil until 2018 where Total took over the operatorship and ownership of the Leadon oil and gas facility.

Overall, this demonstrates that the oil and gas operator landscape is ever-changing and relatively unstable. From a stakeholder management perspective, this means the stakeholders' landscape is also ever-changing. It is highly recommended, therefore, that the prioritisation of stakeholders of an oil and gas decommissioning project or programme should be continuously reviewed by the management team throughout the project or programme.

From a regulatory perspective, the ever-changing oil and gas operator landscape means that there is no guarantee that the oil and gas operator will always be present to fulfil their decommissioning obligations. A revisit to the literature finds that many studies, such as Gordon, Paterson and Usenmez (2018a), Chandler et al. (2017), and Beckstead (2018), have emphasised the importance of decommissioning obligations being clear by governments to oil and gas operators. This suggests that currently, there are regulatory uncertainties with regard to decommissioning obligations in many jurisdictions.

6.4 – Analysis of Cases

As mentioned in ***Chapter 5: Research Methodology*** (see page 173), after extracting the information, the cases will then be compared with other cases within their own categories in order to finalise the information which will be used to model the initial stakeholder-oriented critical paths. As also mentioned in ***Chapter 5: Research Methodology*** (see page 173), the information required for the modelling of the initial stakeholder-oriented critical paths is:

- A list of all project activities (Section 6.4.3)
- The duration of each activity (Section 6.4.4)
- The dependencies between activities (Section 6.4.5)
- The milestones and deliverables (Section 6.4.3)

6.4.1 – Assumptions for the Initial Stakeholder-Oriented Critical Paths

As mentioned earlier in **Section 6.3.1.2** (see page 227), it was found that the stakeholder-oriented critical paths will differ depending on the design of the facility. This means that at a very detailed level, it is not possible to create initial stakeholder-oriented critical paths that can represent all the cases in each category. Consequently, a list of assumptions has to be made regarding the design of the facility in order for the initial stakeholder-oriented critical paths to be successfully modelled. The list of assumptions made can be found in **Table E-1** (see page 589) of ***Appendix E****.*

As seen in **Table E-1** (see page 589) of ***Appendix E***, the same 33 assumptions were made for all three categories regarding the design of the facility. The only difference between the categories is the precise decommissioning option for the substructure. The same assumptions were made for all three categories in order to keep all other variables constant so that a better comparison between the three initial stakeholder-oriented critical paths can be made.

It must also be noted that 33 assumptions is a relatively large amount, which indicates that there are a lot of uncertainties when it comes to managing oil and gas decommissioning projects or programmes.

6.4.2 – Comparing the Extracted Information between Cases

After establishing the assumptions, as mentioned in ***Chapter 5: Research Methodology*** (see page 174), Microsoft Excel will be used to compare the extracted information between the cases. The comparison will be made by placing the information for each case in individual columns and comparing them. The actual comparison process, however, as mentioned in ***Chapter 5: Research Methodology*** (see page 174), will be carried out differently for different information types.

Overall, the author found that Microsoft Excel allows for a quick comparison of data from the different cases by placing the lists of activities in adjacent columns. Juxtaposing the data in this way allows for rapid identification of similarities between different cases. This indicates that Microsoft Excel can be a useful tool for organising and analysing the case study data.

6.4.2.1 – Determining the List of Project Activities, Milestones and Deliverables

As mentioned in ***Chapter 5: Research Methodology*** (see page 175), for information regarding the list of project activities, milestones and deliverables, a statistical approach will be used by tallying the frequency of occurrence. Information that appeared in more than 80% of cases within each category, will be used for the design of the initial stakeholder-oriented critical path for that category. The reason for using 80% as a threshold is that it has been cited in many studies as the minimum level of confidence (Cocks & Torgerson 2013; Krejcie & Morgan 1970). A short example of this statistical approach is presented below in **Table 6-8** (below).

Table 6-8 – A Short Sample of the Statistical Approach for Determining the Final List of Project Activities, Milestones, and Deliverables

Activity/ Milestone	NW Hutton	Miller	Murchison	Ninian Northern	Brent Alpha	% of Appearance	Include?
CoP	1	1	1	1	1	100%	Yes
Production By-Pass	1	1	1	0	0	65%	No

6.4.2.2 – Determining the Duration of Project Activities

As mentioned in ***Chapter 5: Research Methodology*** (see page 175), for the duration of each activity, the mean number will be used. The mean, or average, is used because it is the most used measure of central tendencies (Manikandan 2011; Wilcox & Keselman 2003). A short example of this statistical approach is presented below in **Table 6-9** (below).

Table 6-9 – A Short Sample of the Statistical Approach for Determining the Final List of Project Activities Durations

Activity/ Milestone	Juliet	Kilo	November	Lima	Leman BH	Ettrick	Blackbird	Duration
Well Plugging and abandonment (1 Well)	30	30	30	30	n/a	20	20	26.7

As mentioned in earlier sections, there are variations in the design of the oil and gas facilities. In the Leman BH case, the Leman BH oil and gas facility has no wells as it is an accommodation structure. Therefore, there is no information regarding well plugging and abandonment duration, as seen in **Table 6-9** (above).

6.4.2.3 – Determining the Dependencies between Project Activities

As mentioned earlier, there is a lack of information that explicitly states dependencies between project activities. So, the dependencies between project activities are deduced primarily from the literature and the researcher's knowledge of the oil and gas decommissioning process. A short example of determining the dependencies between project activities is presented below in **Table 6-10** (below).

Table 6-10 – A Short Sample of Determining the Dependencies between Project Activities

Activity/ Milestone	Predecessor Activities(s)	Successor Activities(s)	Rationale	Literature
Topside Removal	Topside Clean and Make Safe	Substructure Removal	Topside must be clean before removal to minimise environmental hazard during topside removal. Topside must be removed before substructure can be removed.	(Tan et al. 2017; Liu and Li 2017) (Prasthofer 1997; Tan et al. 2017; Liu and Li 2017; Samudero, Capurso and Zoontjes 2019)
Well Plugging and Abandonment Execution	Well Plugging and Abandonment Planning	Topside Clean and Make Safe	Planning must be done before well plugging and abandonment can be executed. All wells must be plugged before the topside facilities can be cleaned and make safe	(Fields and Martin 1997; Khalifeh et al. 2013; Shine 2019; Vrålstad et al. 2019) (Fields and Martin 1997; Khalifeh et al. 2013; Shine 2019; Vrålstad et al. 2019)

While the author acknowledges that this decision does raise the question of researcher-bias and the validity of the case study process, it must be noted that, as mentioned in ***Chapter 5: Research Methodology*** (see page 175), the information from this case study process will be validated by interviewees during the first round of semi-structured interviews. Thus, any false deduction will be corrected during the first round of semi-structured interviews.

6.5 – Tentative Answers to the Research Questions

6.5.1 – Can Stakeholder-Oriented Critical Path(s) be Modelled?

As the required information for the modelling of the stakeholder-oriented critical paths can be determined at the end of the case study process, it can be tentatively concluded that the stakeholder-oriented critical paths can be modelled. However, the actual modelling process will also have to be taken into account when addressing this research question. The actual design and modelling of the stakeholder-oriented critical paths will be discussed in the next chapter, ***Chapter 7: Development of the Stakeholder-Oriented Critical Paths***.

6.5.2 – At What Level of Granularity can Homogeneity for each of the Stakeholder-Oriented Critical Path(s) be achieved?

As noted in **Section 6.4.1** (see page 248), a large number of assumptions must be made in order to finalise the information required for the design of the stakeholder-oriented critical paths. This tentatively indicates that homogeneity of the stakeholder-oriented critical path(s) can only be achieved at a high level of granularity. However, the stakeholder-oriented critical paths are still subject to modification by the interviewees during the first round of semi-structured interviews. Thus, the level of granularity at which homogeneity can be achieved may change throughout the research.

6.5.3 – Where is/are the Critical Point(s)? i.e. Where on the Stakeholder Oriented Critical Path does Stakeholder Interaction Exist?

As noted in **Section 6.3.1.9** (see page 242), there are two possible places along the stakeholder-oriented critical paths which are potentially subject to considerable stakeholder interactions. These two key possible critical points are the Stakeholder Consultation Period, and the Removal Execution Period. However, it must be noted that this tentative answer is only based on secondary data. Primary data needs to be obtained from interviewees from the semi-structured interviews in order to validate the findings in this chapter.

6.6 – Continuous Evolution of the Case Study Source

As mentioned earlier in **Section 6.3** (see page 221), a total of 63 cases were studied in this case study process. Since the conclusion of this case study process in August 2018, 30 new cases have been published on the OPRED website, as presented in **Table B-2** (see page 563) of ***Appendix B***.

This means that between 2000 and August 2018, there were 63 decommissioning cases, while between August 2018 and March 2020, there were 30 decommissioning cases. This indicates that the decommissioning activity in the United Kingdom has sped up in recent years, which suggests that a longitudinal case study can be done using the case study source

While these new cases were not included in the case study process, they can still be used as information for the subsequent steps in this research. As such, these new cases were reviewed by the researcher to keep up to date with the literature and recent developments in the field of oil and gas decommissioning. Furthermore, insights gained from these new cases can be useful for initiating more insightful discussions with interviewees and also act as references when analysing the interview transcripts.

6.7 – Conclusion

This chapter has detailed the findings and recommendations from the case study process, which are summarised in **Table 6-11** and **Table 6-12** (below, pages 254 to 257).

Table 6-11 – Summary of Findings in Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects

Type of Findings	**Description**	**Section in this Chapter where this Finding is Discussed**
Project Management Findings	There is range of different single-proposal and multiple proposals approaches to oil and gas decommissioning.	Section 6.2.1.3
	Oil and gas decommissioning can be managed either as a project or a programme.	Section 6.3.1.11
	The management approach (project or programme) differ depending on the size of the facility.	Section 6.2.1.3
	Oil and gas decommissioning should be managed more as a programme than a project.	Section 6.2.1.2
	There is a still a lack of understanding by oil and gas operators on the management of oil and gas decommissioning.	Section 6.2.1.3
	Oil and gas operators themselves are unsure as to whether oil and gas decommissioning should be managed as a project or a programme.	Section 6.3.1.11
Scope Management Findings	There are a lot of uncertainties when it comes to managing oil and gas decommissioning projects or programmes.	Section 6.4.1
	The scope of an oil and gas decommissioning project or programme can vary significantly.	Section 6.2.1.2
	The list of project activities will differ depending on the design of the oil and gas facility.	Section 6.3.1.2
	While the project activities may differ depending on the precise decommissioning options, the key milestones to be achieved remains largely the same for all oil and gas decommissioning projects or programmes.	Section 6.3.1.4
	Scope creep and conflict about indemnities are common issues in oil and gas decommissioning	Section 6.3.1.9
Resource Management Findings	Resource allocation is an important part of managing an oil and gas decommissioning project or programme.	Section 6.3.1.8
Stakeholder Management Findings	The stakeholder landscape is changing over time.	Section 6.3.1.12
	The stakeholder landscape is dependent on location	Section 6.3.1.10
	Oil and gas operator's prioritisation of stakeholders' changes throughout the lifecycle of a project.	Section 6.3.1
	The prioritisation of stakeholders differs from one oil and gas operator to another.	Section 6.3.1.10
	There is a difference in what operators feel should be included in their proposal documents in order to justify their chosen method of decommissioning.	Section 6.3.1.1
	While the document length can be said to reflect the size and scale of the Brent oil and gas facility, it cannot be ruled out that the additional details in the Brent decommissioning proposal document could be a strategy to counter the negative publicity from the Brent Spar saga.	Section 6.3.1.1
	There is a lack of consistency in the use of the CA tool by the oil and gas operators.	Section 6.3.1.10
	It is possible that the lack of consistency in the use of the CA and oil and gas operator's prioritisation of stakeholders is because of the variation in stakeholder landscape across different locations	Section 6.3.1.10
	Oil and gas operators based their decommissioning decisions primarily on scientific evidence.	Section 6.2.3.2
	The CA process is being used more as a justification tool for Partially Leave-in-Place and Leave-in-Place options rather than as a multi-criteria decision-making tool to determine the best decommissioning option.	Section 6.1.1.1
	Stakeholders will require a high level of technical knowledge of the oil and gas decommissioning process in order to understand the rationale behind the decisions made by the oil and gas operators.	Section 6.3.1.6
	The level of technical knowledge of the stakeholders on the oil and gas decommissioning process can have an impact on the effectiveness of stakeholder engagements.	Section 6.3.1.6

Regulatory Findings	There is a lack of understanding by the regulators regarding the management approaches regarding oil and gas decommissioning.	Section 6.1.3
	Regulatory guidelines do have an influence of oil and gas decommissioning decisions.	Section 6.1.1.2
	The increase in the level of transparency regarding the approval of oil and gas decommissioning proposals is most likely due to regulatory changes made in the aftermath of the Brent Spar incident.	Section 6.1.1.1
	There are significantly more oil and gas facilities that are being completely removed than being left wholly or partially in place in the marine environment of the UK Continental Shelf. It is possible that this trend is due to the impact of OSPAR Decision 98/3.	Section 6.2.3.2
	It is highly likely that the decision to remove the Maureen platform to shore rather than seeking derogation was made in order set a precedent for future oil and gas decommissioning projects/programmes to follow in a post-OSPAR Decision 98/3 world.	Section 6.2.3.2
	Having a prescriptive based regulatory approach decreases the robustness of multi-criteria decision-making tools when they are being used to determine the best decommissioning option.	Section 6.1.1.1
	In the presence of a prescriptive regulation, such that OSPAR Decision 98/3, it can be very difficult for oil and gas operators to convince stakeholders that their chosen decommissioning option was not solely based on regulatory compliance alone.	Section 6.2.3.2
	Managing stakeholders in a goal-setting regime environment could be much easier than a prescriptive regime environment.	Section 6.2.3.2
	A goal-setting regime is perhaps much more applicable in practice.	Section 6.2.3.2
	There is no incentive for the industry to go beyond compliance with regulations. What this means is that no operator is willing to pay more to remove a facility if the facility is allowed to be left in place according to regulations.	Section 6.2.3.2
	There is no guarantee that the oil and gas operator will always be present to fulfil their decommissioning obligations	Section 6.3.1.12
	There are regulatory uncertainties with regard to decommissioning obligations in many jurisdictions.	Section 6.3.1.12
Implications for this Research	The cases can also be divided into the same three categories when divided by the type of structures.	Section 6.2.3.2
	Stakeholder-oriented critical paths can be modelled.	Section 6.5.1
	Homogeneity of the stakeholder-oriented critical path(s) can only be achieved at a high level of granularity.	Section 6.5.2
	The stakeholder-oriented critical path will differ depending on the precise decommissioning option.	Section 6.1.1.1, Section 6.3.1.2
	The stakeholder-oriented critical path for the decommissioning oil and gas facility will differ depending on the facility's relationship with neighbouring facilities.	Section 6.2.1.2
	The stakeholder-oriented critical paths may differ depending on the size of the facility.	Section 6.2.1.3
	The stakeholder-oriented critical paths will differ depending on the design of the facility.	Section 6.3.1.2, Section 6.3.1.7
	There are two possible places along the stakeholder oriented critical paths which are potentially subjected to considerable stakeholder interactions – Stakeholder Consultation Period, and Removal Execution Period.	Section 6.5.3
	The owners of the neighbouring facilities are potentially influential and impactful stakeholders as their facilities may be impacted by the decommissioning activities undertaken.	Section 6.2.1.2, Section 6.3.1.3
Implications for Future Research	Case study researchers should not determine their unit of analysis solely by the way the data is organised by the case study source.	Section 6.2.2.2
	On occasion, the data from the case study source may need to be reorganised by the researcher in order to fit the chosen unit of analysis	Section 6.2.2.2
	Microsoft Excel can be a useful tool for organising and analysing case study data.	Section 6.4.2
	It is highly recommended that a researcher in the field of oil and gas decommissioning is well equipped with technical knowledge of the oil and gas decommissioning process prior to undertaking the research.	Section 6.3.1.6
	The body of knowledge in oil and gas decommissioning has not yet stabilised, and there is still a knowledge gap in the field.	Section 6.3.1.5

	There is an opportunity to conduct a longitudinal case study using the OPRED website.	Section 6.6
	There is a lot of opportunity for learning regarding Leave-In-Place and Partially Leave-In-Place decommissioning options. For example, more biological science studies can be commissioned in order to understand the impact of leaving oil and gas facilities partly or wholly in place.	Section 6.2.3.2
	There is an opportunity to extend the body of knowledge by testing co-creation of knowledge frameworks in the context of oil and gas decommissioning. It is possible that co-creation of knowledge can be an effective strategy for managing oil and gas decommissioning stakeholders.	Section 6.3.1.6
	There is an opportunity to extent the body of knowledge by exploring the relationship between knowledge and competencies of government departments in the context of oil and gas decommissioning.	Section 6.3.1.6
Other Findings	The decommissioning activity in the United Kingdom has been speeding up in recent years	Section 6.6
	There is an inverse relationship between the price of oil and the level of oil and gas decommissioning activities.	Section 6.1.1.3
	The primary purpose of the respective websites of the oil and gas operators was to highlight their achievements rather than acting as an online platform to disseminate information to stakeholders.	Section 6.1.2
	Many studies did not specify the part of the oil and gas facility to be used as reference when classifying the oil and gas facilities based on the precise decommissioning options. However, the focus seems to be on the substructure.	Section 6.2.3.1

Table 6-12 – Summary of Recommendations in Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects

Type of Recommendation	**Description**	**Section in this Chapter where this Finding is Discussed**
Recommendations to Operators	It may be beneficial for oil and gas operators to plan stakeholder engagement activities that focus on enhancing stakeholders understanding of the oil and gas decommissioning process rather than just informing them of the proposed decommissioning plan and inviting comments.	Section 6.3.1.5
	It is highly recommended that oil and gas operators in the UK landscape make a clear distinction in their decommissioning proposals between references to the document, and to the temporary organisation set up to manage the oil and gas decommissioning activity.	Section 6.3.1.11
	The decommissioning of oil and gas facilities cannot be viewed in isolation. Consideration will also have to be given to the surrounding oil and gas facilities as well.	Section 6.2.1.2, Section 6.3.1.3
.	While the number of neighbouring oil and gas facilities that are required to be considered are lesser in the Australian landscape, the owners of neighbouring oil and gas facilities could still be potentially impactful stakeholders to the oil and gas decommissioning project or programme.	Section 6.3.1.3
Recommendations to Regulators	It could perhaps be more beneficial for BEIS to re-name the decommissioning proposal document in order for a clearer distinction to be drawn between the decommissioning proposal and the type of temporary organisation formed to manage the oil and gas decommissioning activities.	Section 6.1.3
	Each oil and gas decommissioning case could also be labelled “project” or “programme” to appropriately reflect the type of temporary organisation set up to manage them. This clear distinction can serve as valuable information to guide oil and gas operators in the future as they plan for the decommissioning of their oil and gas facilities.	Section 6.1.3
	It would perhaps better for OPRED to reorganise the cases presented on the OPRED website according to fields rather than by date of approval. Organising the documents according to fields rather than date of approval can enable a better visualisation of the management each decommissioning project or programme. Such information could perhaps be beneficial to oil and gas operators when they are planning for the decommissioning of their oil and gas facilities in the future.	Section 6.1.1.3
	It may be necessary for regulators to ensure that their regulatory officers are thoroughly equipped with technical knowledge of the oil and gas decommissioning process in order to ensure its competency in regulating oil and gas decommissioning activities.	Section 6.3.1.6

Chapter 7: Development of Stakeholder-Oriented Critical Paths

7.0 – Chapter Abstract

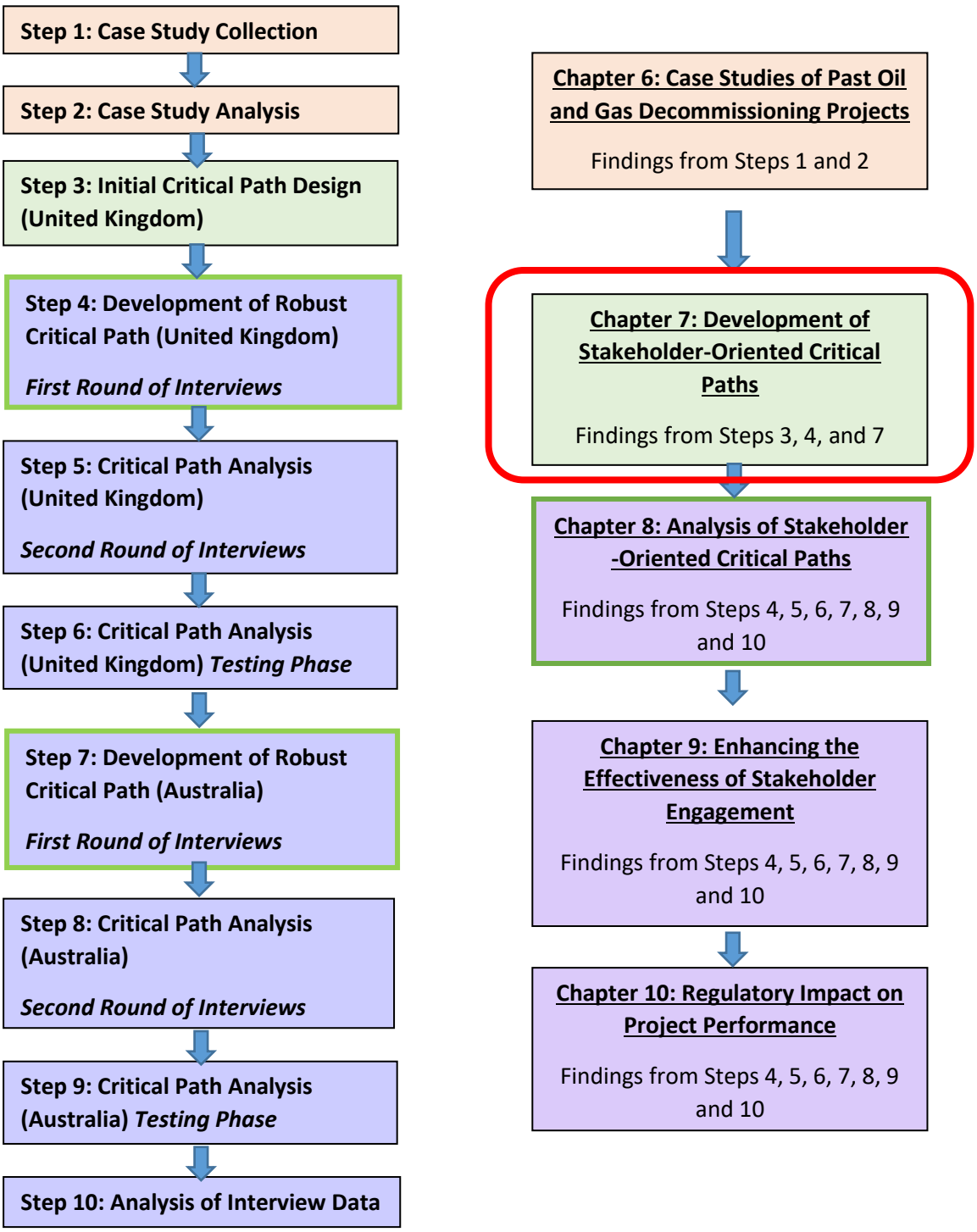


Figure 7-1 – The Second Results Chapter – Development of Stakeholder-Oriented Critical Paths

At the end of ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, the information required for the design of the initial stakeholder critical paths was finalised and ready to be used for the design of the initial stakeholder-oriented critical paths. This chapter will continue from that point to present and reflect on the emergent insights gained from the development of the initial and robust stakeholder-oriented critical paths in both the United Kingdom and Australian landscapes.

The presentation format for this chapter will be divided into two parts:

- Part 1: Development of Initial Stakeholder-Oriented Critical Paths
- Part 2: Development of Robust Stakeholder-Oriented Critical Paths

Part 1: Development of Initial Stakeholder-Oriented Critical Paths

Part 1 will start off by presenting the findings from the development of the three initial stakeholder-oriented critical paths using information obtained from the case studies. The chapter will then move on to evaluate the three initial stakeholder-oriented critical paths by comparing them with each other, and also with similar existing frameworks from academic and industry literature.

Part 2: Development of Robust Stakeholder-Oriented Critical Paths

Part 2 will continue on from Part 1 by presenting the findings from the iterative process of conducting semi-structured interviews and modifying the initial stakeholder-oriented critical paths. The UK and Australian parts of the research (Step 4 and Step 7) will be discussed together in order to highlight the differences between the two landscapes. After this, the chapter will move on to discuss the modifications made in order to create the robust stakeholder-oriented critical paths.

At the end of the development process, two robust stakeholder-oriented critical paths were produced, one representing the United Kingdom, and the other representing Australia. The reduction in number of stakeholder-oriented critical paths from three at the end of Part 1, to two at the end of Part 2, indicates that homogeneity can be achieved between the different initial stakeholder critical paths at a higher level of granularity.

7.0.1 – Re-calling the Research Methodology

As mentioned in ***Chapter 5: Research Methodology*** (see page 178), for the UK part of the research, the initial stakeholder critical paths will be designed using the information obtained from the case study process (Step 3). An iterative process of conducting semi-structured interviews and modifying the initial stakeholder-oriented critical paths will then be performed until saturation is achieved, producing the robust stakeholder-oriented critical path(s) (Step 4). For this research, saturation for the robust stakeholder-oriented critical paths is determined to be achieved when there are no or minor changes made to the robust stakeholder-oriented critical paths. This saturation condition in the research is defined based on Ashby's Law of Requisite Variety (Ashby 1964) More details regarding the iterative process and achieving saturation can be found in **Section 5.8.4.2** (see page 180) of ***Chapter 5: Research Methodology***.

The development of stakeholder-oriented critical paths will be done in the United Kingdom before Australia because, as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 113), the United Kingdom is a much more mature hydrocarbon landscape. This suggests that the UK landscape has much more experience and expertise in oil and gas decommissioning than Australia. Hence, it would be better to tap into the experience and expertise in the UK landscape before moving on to the Australian landscape.

For the Australian part of the research, as mentioned in ***Chapter 5: Research Methodology*** (see page 165), there is no case study and the initial stakeholder-oriented critical paths design process because there will be an existing robust stakeholder oriented-critical path at the end of the UK part of the research. The robust stakeholder-oriented critical path(s) from the UK part of the research will be used as the initial stakeholder-oriented critical path design in the Australian part of the research. The same iterative process will be used to develop the robust stakeholder-oriented critical path(s) in the Australian part of the research in order to ensure consistency in methods. **Figure 7-2** (below, page 261) illustrates the flow chart for the development of stakeholder-oriented critical paths for this research:

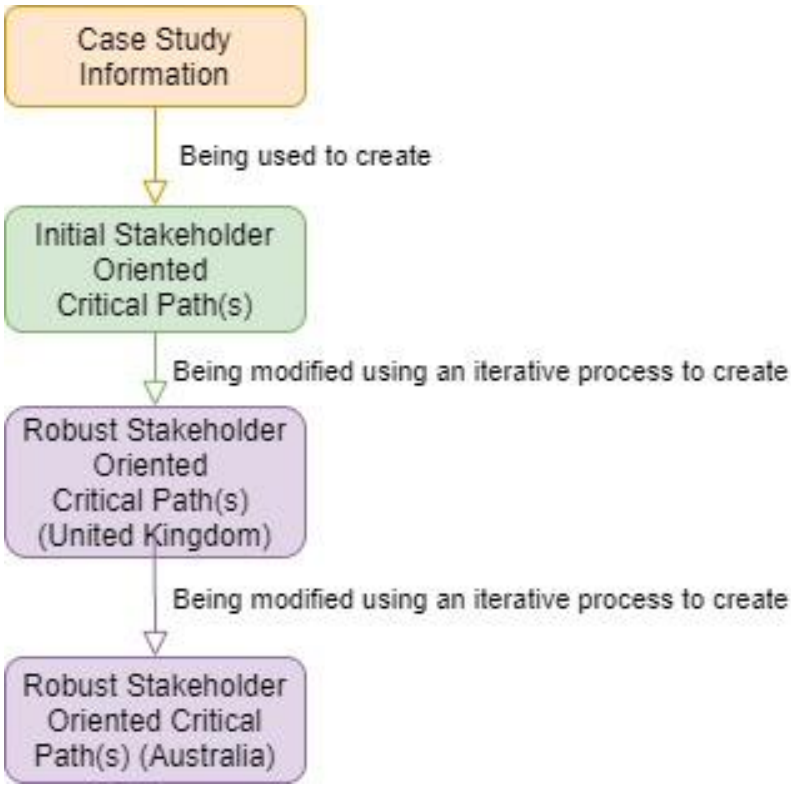


Figure 7-2 – Development of Stakeholder-Oriented Critical Paths

As mentioned in ***Chapter 5: Research Methodology*** (see page 178), the author acknowledges that the procedural decision assumes that the UK and Australian stakeholder-oriented critical paths are similar. However, in the event that there are considerable differences between the UK and Australian critical paths, it is unlikely that this will result in significant changes to the research procedure. However, it does mean that more iterations are likely to be required before saturation is achieved for the development of the robust stakeholder-oriented critical path(s) during the Australian part of the research.

7.1 – Part 1: Development of Initial Stakeholder-Oriented Critical Paths

As mentioned in ***Chapter 5: Research Methodology*** (see page 157), the purpose of the initial stakeholder-oriented critical paths is to use them as engagement tools for semi-structured interviews in the later part of the research. The initial stakeholder-oriented critical paths will be modelled using Microsoft Project software using the data finalised at the end of ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***. The finalised data for all three categories (Leave-In-Place, Partially Leave-In-Place, Complete Removal), which will be inputted to Microsoft Project, are presented in ***Appendix F*** (see pages 595 to 597).

7.1.1 – Presenting the Initial Stakeholder Oriented Critical Paths

According to Saunders, Lewis and Thornhill (2016), presentation can influence the perception of the interviewee, and affect the reliability of the data collected. As the initial stakeholder-oriented critical paths are to be used as engagement tools for semi-structured interviews, having a good presentation format is an advantage.

Microsoft Project has a built-in feature that allows the user to switch between different presentation formats instantaneously. The four pre-set presentation formats that can be generated using Microsoft Project are Task Sheet (or Task Usage), Gantt Chart, Network Diagram, and Calendar. Designing a new presentation format from scratch can be time-consuming, so only the four pre-set presentation formats that can be generated using Microsoft Project are shortlisted for comparison.

The review of each presentation format finds that the key considerations for presentation format selection are:

- Challenges associated with visualising the four types of information (*list of all project activities, duration of each activity, dependencies between activities, milestones and deliverables*)
- Challenges associated with being able to see the entire stakeholder-oriented critical path on both screen form and paper.

Table 7-1 (below) summarises the advantages and disadvantages of each presentation format.

Table 7-1 – A Comparison of Presentation Formats

Presentation Format	**Ability to Visualise:**				
	Project Activities	Milestones and deliverables	Project Activity Duration	Dependencies Between Project Activities	Entire Critical Path on A4 Paper
Task Sheet	Yes	Yes	Yes	No	Yes
Gantt Chart	Yes	Yes	Yes	Yes	No
Network Diagram	Yes	Yes	No	Yes	No
Calendar	No	No	No	No	No

From **Table 7-1** it can be seen that the Task Sheet and Gantt chart are the two best presentation formats, with equal numbers of green and orange boxes.

As mentioned in ***Chapter 5: Research Methodology*** (see page 172), the purpose of the initial stakeholder-oriented critical paths is for use as engagement tools in semi-structured interviews, in order to:

- Validate and confirm the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* deduced from the case study data.
- Obtain additional information *(list of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in secondary data.
- Obtain recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust stakeholder-oriented critical paths.

So, being able to easily visualise and identify the four types of information (*list of all project activities, duration of each activity, and dependencies between activities, milestones and deliverables*) is important. Hence, a Gantt chart presentation format is selected as the presentation format for the initial stakeholder-oriented critical paths.

In order to overcome the limitation of not being able to visualise the entire stakeholder-oriented critical path on A4 size paper, larger A3 size paper is used instead. The three initial stakeholder-oriented critical paths, in Gantt chart presentation format, can be found in ***Appendix G*** (see pages 598 to 606).

7.1.2 – A Comparison between the Initial Stakeholder Oriented Critical Paths

A comparison of the three initial stakeholder-oriented critical paths finds that all three are largely similar in terms of project activities, duration of each activity, dependencies between activities, and milestones and deliverables. This suggests that it may be possible to combine the three initial stakeholder-oriented critical paths into a single design at a higher level of granularity.

The most noticeable difference between the three categories is the number of project activities, as illustrated in **Table 7-2** (below).

Table 7-2 – Details of the Initial Stakeholder-Oriented Critical Paths

Category	No. of Cases Analysed	No. of Activities
Leave-In-Place	8	70
Partially Leave-In-Place	5	72
Complete Removal	50	72

As seen in **Table 7-2** (above), the Leave-In-Place category has two fewer project activities than the other two categories. This indicates that the work scope for a Leave-In-Place decommissioning option is smaller than the other two precise decommissioning options.

When comparing between the three initial stakeholder-oriented critical paths (see ***Appendix G*****,** pages 598 to 606), it can be observed that the two additional activities (for both Partially Leave-In-Place and Complete Removal) are related to the planning and execution of substructure removal. The only difference between Partially Leave-In-Place and Complete Removal is that for Partially Leave-In-Place, only part of the substructure is removed, while for Complete Removal, the entire substructure is removed.

7.1.3 – A Comparison with Similar Frameworks from the Literature

As mentioned in ***Chapter 5: Research Methodology***, the design of the initial stakeholder-oriented critical paths was done inductively. It would therefore be useful to evaluate the three initial stakeholder-oriented critical paths by comparing them with similar existing frameworks from the literature.

A revisit to the academic literature finds that there are no similar frameworks to be found there in. This indicates that stakeholder-oriented critical paths produced from this research, can serve as a useful research artefact and conceptual framework that contributes to the academic literature in the field of oil and gas decommissioning and project management. A revisit to the industry literature, however, finds that there are three similar industry frameworks that are commonly mentioned in industry literature, which are:

- Decom North Sea's L2P2 (Late-Life Planning Portal)
  (Esson 2017)
- Oil and Gas Authority's Decommissioning Roadmap
  (OGA 2016a)
- Oil and Gas UK's Decommissioning WBS (Work Breakdown Structure)
  (Aabel et al. 1997; OGA 2016a; OGUK 2019)

7.1.3.1 – A Comparison with L2P2

L2P2, the late-life planning portal, was published by Decom North Sea in 2017 (Esson 2017). The framework was the result of a collaboration between several oil and gas operators in the United Kingdom, including Marathon Oil and BP. The purpose of L2P2 is to assist operators in planning for decommissioning and promotes the importance of timely planning during the late-life operation of the oil and gas facility (Esson 2017). This suggests that activities that take place prior to the start of a decommissioning project or programme, can also have an influence on the performance of the decommissioning project or programme. A copy of the L2P2 framework can be found in ***Appendix H*** (see page 608).

The most striking feature of L2P2 is that it only has a single design, in comparison to three designs for the initial stakeholder-oriented critical paths. This suggests that it may be possible to combine the three initial stakeholder-oriented critical paths into one single design at a higher level of granularity.

While the initial stakeholder-oriented critical paths are presented in the form of a Gantt chart, as seen in **Table H-2** (see page 608) of ***Appendix H***, L2P2 is presented in the form of a matrix. The list of project activities, milestones, and deliverables on L2P2 are clearly visible. Each project activity and milestone is sorted according to the work scope (left most vertical column) and time relative to CoP (Cessation of Production) (top most horizontal row).

In terms of schedule, the initial stakeholder-oriented critical paths place each project activity relative to the start date of the project or programme. However, for L2P2, each activity is placed relative to CoP instead. This suggests that CoP could be an important milestone for an oil and gas decommissioning project or programme. Another interesting observation is that five out of six of the time intervals are before CoP. This indicates that the bulk of oil and gas decommissioning activities are actually executed before the oil and gas facility ceases production.

In comparison with the initial stakeholder-oriented critical paths, the only information lacking from L2P2 is the dependencies between projects activities. As seen in **Table H-2** (see page 608) of ***Appendix H***, there are no clear visual

links between each of the project activities, milestones, and deliverables. One of the findings from ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** is that the dependencies between project activities are difficult to determine because there is:

- Variation in order of project activities, and
- Project activities running in parallel to each other

It is possible that the oil and gas operators who designed L2P2 faced similar issues when attempting to identify the dependencies between project activities, which ultimately affected the final presentation format. On the other hand, it is also entirely possible that there are actually no dependencies between each of the project activities, and that each of the 10 work scopes are separate projects operating under a broader oil and gas decommissioning programme.

While the stakeholder management was mentioned as a work scope in the bottom-most row of L2P2, as reproduced in **Table 7-3** (below), it is only being discussed at a very broad level. This suggests there is an opportunity to extend the L2P2 framework by exploring oil and gas decommissioning stakeholders at a more in-depth level, enhancing the understanding of stakeholder interactions throughout the lifecycle of an oil and gas decommissioning project or programme.

Table 7-3 – The Stakeholder Management Work Scope in L2P2 (Esson 2017)

STAKEHOLDER MANAGEMENT	MAP AND ANALYSE STAKEHOLDERS	ENGAGE WITH KEY STAKEHOLDERS	ENGAGE WITH ALL STAKEHOLDERS	STAKEHOLDER MANAGMENT

7.1.3.2 – A Comparison with the OGA Decommissioning Roadmap

The OGA (Oil and Gas Authority) Decommissioning Roadmap was developed by the OGA in 2016 in order to provide guidance to oil and gas operators on regulatory engagements (OGA 2016a). The framework is also presented in a matrix format, similar to that of L2P2. This finding suggests that a matrix presentation format could perhaps be the preferred presentation format for frameworks in the oil and gas industry. Such information could be useful when developing a conceptual framework in the latter part of this research. A copy of the OGA Decommissioning Roadmap can be found in ***Appendix H*** (see page 609).

An immediate observation of the OGA Decommissioning Roadmap is that it only has a single design, in contrast to three designs for the initial stakeholder-oriented critical paths. This suggests that it may be possible to combine the three initial stakeholder-oriented critical paths into a single design at a higher level of granularity.

Another immediate observation is that the project activities focus on the regulatory process rather than the actual oil and gas decommissioning process. In comparison to the initial stakeholder-oriented critical paths, the OGA Decommissioning Roadmap has more details regarding regulatory engagement activities and deliverables. However, it lacks details regarding the actual removal of the oil and gas facility, such as trenching of pipelines, or post-decommissioning surveys. This suggests that regulatory stakeholders are more concerned about regulatory engagements than the actual execution of the oil and gas decommissioning process itself. From a research methodology standpoint, it could be beneficial for the initial stakeholder-oriented critical paths to include more details regarding regulatory engagement activities and deliverables.

Another immediate observation is that there is considerable number of regulators that the oil and gas operators are required to consult and engage – BEIS, OGA, HSE (Health and Safety Executive), EA (Environment Agency), and SEPA (Scottish Environmental Protection Agency), and other regulators. As seen in **Table H-3** (see page 609) of ***Appendix H***, almost all regulators are

required to be consulted with regard to the oil and gas decommissioning proposal document. Noting that different people may have different views, this suggests that engaging regulatory stakeholders alone could already be challenging because of the multiple operator-regulator interfaces that must be managed. A revisit to the literature finds that the smaller number of interfaces, the more efficient the project efficiency will be (Morris 1983; Hoegl & Wagner 2005). As such, it could perhaps be that a reduction in the number of operator-regulator interfaces would improve the efficiency of the regulatory processes.

In terms of schedule, the OGA Decommissioning Roadmap has no clear information regarding the timing of the engagements, as seen in **Table H-3** (see page 609) of ***Appendix H***. As illustrated in **Table 6-5** in **Section 6.3.1.5** of ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** (see page 233), the duration of project activities, including regulatory activities, varies quite significantly. It is entirely possible that the absence of information regarding the duration of project activities is due to uncertainties regarding the duration of project activities.

As with L2P2, there is a lack of information in the OGA Decommissioning Roadmap that explicitly states the dependencies between the project activities. For example, when observing the OGA Decommissioning Roadmap in ***Appendix H*** (see page 609), it is hard to tell which regulator should be engaged and consulted first. It could perhaps be beneficial for the OGA to develop a flowchart that shows the dependencies between the different regulatory engagement activities listed in the OGA Decommissioning Roadmap. Such information could be useful for oil and gas operators in order for them to optimise their resources and engage the regulators more effectively. One possible avenue could be to expand upon OPRED's (the Offshore Petroleum Regulator for Environment and Decommissioning) Installation and Pipeline Pathways flowchart as seen in **Figure 7-3** (below, page 271).

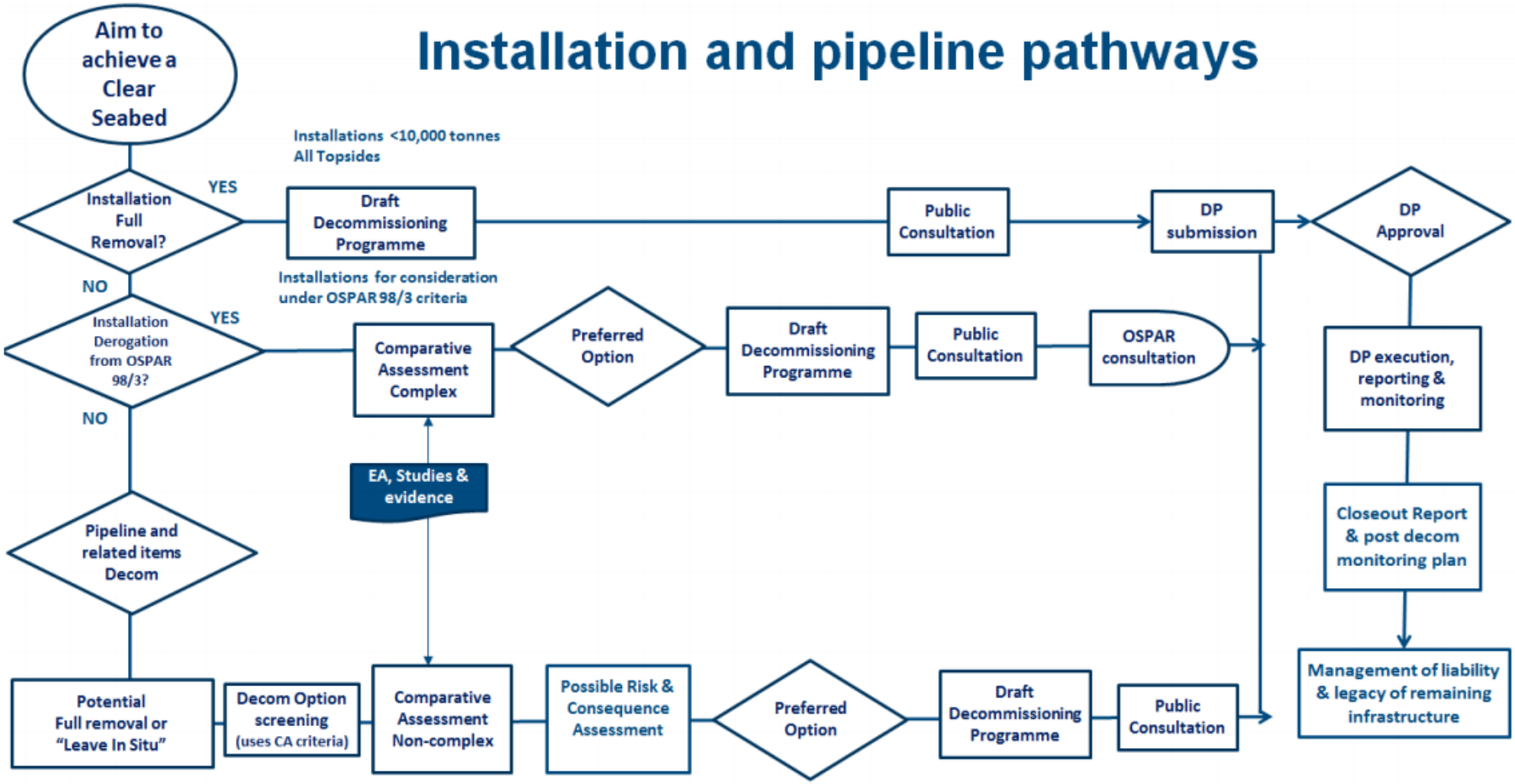


Figure 7-3 – OPRED Installation and Pipeline Pathways (OPRED 2019)

7.1.3.3 – A Comparison with the OGUK Work Breakdown Structure

The OGUK (Oil and Gas UK) Decommissioning WBC (Work Breakdown Structure) was first published in 2013 (OGUK 2019). The purpose of the OGUK Decommissioning WBS is to enhance the industry's understanding of the oil and gas decommissioning work scope. According to OGUK (2019), understanding the oil and gas decommissioning work scope can help the industry identify gaps in the supply chain. Investments can then be made in the right areas to develop the supply chain in order to meet the increasing demand for oil and gas decommissioning goods and services.

A revisit to industry literature finds that the OGUK Decommissioning WBS appears to be more widely used than L2P2 and the OGA Decommissioning Roadmap, appearing in numerous industry conference papers, such as Blacklaws (2018), Learsk (2019), and Thornton (2018). Oil and Gas UK's position as the leading industry representative body for the UK oil and gas industry (OGUK 2019) could be a primary reason for the wider use of the framework in comparison with L2P2 and the OGA Decommissioning Roadmap. A copy of the OGUK Decommissioning WBS can be found in ***Appendix H*** (see page 607).

Another possible reason for the wider use of the OGUK Decommissioning WBS, in comparison with L2P2 and the OGA Decommissioning Roadmap, is that the OGUK Decommissioning WBS offers the most complete picture of the entire oil and gas decommissioning process, starting from the inception of the project management team, and going all the way to post-decommissioning monitoring.

Similar to L2P2 and the OGA Decommissioning Roadmap, the OGUK Decommissioning WBS only have a single design, in contrast to three designs for the initial stakeholder-oriented critical paths. This suggests that it may be possible to combine the three initial stakeholder-oriented critical paths into a single design at a higher level of granularity.

As seen in **Table H-1** (see page 607) of ***Appendix H***, the OGUK Decommissioning WBS categorises the various project activities according to their work scope. One possible reason for categorising the activities according to work scopes is the ease of navigation. From a visual perspective, categorising the project activities according to their work scopes seems to make it easier for the author to navigate through the framework. This suggests it may be beneficial to categorise the list of project activities, milestones and deliverables in the initial stakeholder-oriented critical paths into different work scopes in order to improve ease of navigating through them.

In terms of the list of project activities, milestones, and deliverables, both the initial stakeholder-oriented critical paths and the OGUK Decommissioning WBS are largely similar. The OGUK Decommissioning WBS have a list of 73 project activities, milestones and deliverables while the three initial stakeholder-oriented critical paths have 70, 72 and 72 project activities, milestones and deliverables for the Leave-In-Place, Partially Leave-In-Place, and Complete Removal categories respectively. The similarities in numbers of project activities, milestones, and deliverables suggest that the initial stakeholder-oriented critical paths are not far from achieving saturation.

In terms of minor differences, the key activities missing in the initial stakeholder-oriented critical paths include:

- Waste Management Accounting
- Transportation to Point of Sale/ Disposal
- Cost to Incorporate Impact of Eventual Re-sale/ Disposal of Materials if Known

As seen in **Table H-1** (see page 607) of ***Appendix H***, all the above activities come under the Topside and Substructure Onshore Recycling work scope. The initial stakeholder-oriented critical paths, as seen in ***Appendix G*** (see pages 598 to 606), just summarises all onshore decommissioning activities as “Onshore Load-In, Dismantling, and Disposal”. As the initial stakeholder-oriented critical paths were developed using documents written by oil and gas operators, this finding suggests that it is possible that the onshore dismantling

and disposal part of the oil and gas decommissioning project or programme is often overlooked by oil and gas operators.

While the OGUK Decommissioning WBS contains more details regarding the list of project activities, milestones and deliverables than the initial stakeholder-oriented critical paths, it does not present any information regarding the duration of each project activity, the dependencies between project activities, or the stakeholder considerations. This presents an opportunity for the stakeholder-oriented critical paths, developed in this research, to contribute to the industry by extending the OGUK Decommissioning WBS and enhancing the industry's understanding of the duration of project activities, dependencies between project activities, and stakeholder considerations for oil and gas decommissioning.

During the course of this research (note that this research was conducted from 2017 to 2020), Oil and Gas UK published their Decommissioning WBS Guidelines in October 2019 (OGUK 2019). The purpose, as stated in the introduction, is to:

> *Provide a high-level overview of the elements that make up the scope of a decommissioning project, and the activities within each element for which costs should be allowed.*
>
> *– Decommissioning Work Breakdown Structure Guidelines (OGUK 2019)*

A study of the Decommissioning WBS Guidelines document, and as indicated by the quotation above, shows that the guidelines expand on the 2013 OGUK Decommissioning WBS framework by elaborating on the cost of each project activity. From a research methodology perspective, this suggests that it could be beneficial for a document to be published to explain the features of the stakeholder-oriented critical paths, and to support them.

7.1.3.4 – Summary of the Comparison

Table 7-4 (below) summarises the comparison between the initial stakeholder-oriented critical paths and similar frameworks from industry literature:

Table 7-4 – Comparison of Initial Stakeholder-Oriented Critical Paths with Similar Frameworks from Industry Literature

	Initial Stakeholder Oriented Critical Paths	**L2P2**	**OGA Decom Roadmap**	**OGUK WBS**
No. of Designs	3	1	1	1
Presentation Format	Gantt Chart	Matrix	Matrix	Table
List of Project Activities, Milestones and Deliverables	Yes	Yes	Regulatory Only	Yes
Information on Duration of Project activities	Yes	Only Start Dates, with Reference to COP	No	No
Dependencies Between Project Activities	Yes	No	No	No
Stakeholder Engagement Activities	Yes	Broad Approach	Regulatory Only	No

As summarised in **Table 7-4** (above, page 275), all three industry frameworks have just one design, in contrast to the three designs for the initial stakeholder-oriented critical paths. This suggests that it may be possible to combine the three initial stakeholder-oriented critical paths into a single design at a higher level of granularity. In terms of presentation format, with the exception of the OGUK Decommissioning WBS, which is presented in a table format, both L2P2 and the OGA Decommissioning Roadmap are in a matrix form. This suggests that a matrix presentation format could perhaps be a better presentation format for the stakeholder-oriented critical paths.

With regard to the information presented, all industry frameworks and the initial stakeholder-oriented critical paths have information regarding project activities, milestones and deliverables. However, as illustrated in **Table 7-4** (above, page 275), the OGA Decommissioning Roadmap project activities, milestones and deliverables listed are only the regulatory aspects.

Table 7-4 (above, page 275) also shows that none of the three industry frameworks provide explicit information regarding the duration of each project activity. However, L2P2 does provide an indication of the duration of project activities by arranging the project activities according to the time CoP takes place. This suggests that there is an opportunity for the stakeholder-oriented critical path, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding on the duration on each oil and gas decommissioning project activities. Additionally, as there are no frameworks to be found in the academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge in this area.

Table 7-4 (above, page 275) also shows that none of the three industry frameworks present information regarding the dependencies between project activities. This suggests that there is an opportunity for the stakeholder-oriented critical path, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA

Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding of the dependencies between oil and gas decommissioning project activities. Additionally, as there are no frameworks to be found in the academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge in this area.

In terms of stakeholder management, L2P2 only discusses stakeholder management in broad terms. The OGA Decommissioning Roadmap only elaborates on engagement with regulatory stakeholders. The OGUK Decommissioning WBS makes no reference to stakeholder management. This presents a great opportunity for the stakeholder-oriented critical paths, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding of stakeholder interactions during oil and gas decommissioning. Additionally, as there are no frameworks to be found in the academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge in this area.

7.1.4 – Conclusion

The findings from Part 1 of this chapter indicate that there is currently a lack of conceptual frameworks in oil and gas decommissioning in the academic literature. While there are existing industry frameworks, they do not provide a full picture regarding the duration of oil and gas decommissioning project activities, the dependencies between oil and gas decommissioning project activities, and stakeholder interactions during oil and gas decommissioning. There is, then, a considerable opportunity for further development of the initial stakeholder-oriented critical paths to expand the existing body of industry and academic knowledge, and to offer a more holistic picture of the management of oil and gas decommissioning and stakeholders. Part 2 of this chapter will follow on from Part 1 to discuss the emerging findings from the development of the robust stakeholder-oriented critical paths.

7.2 – Part 2: Development of Robust Stakeholder-Oriented Critical Paths

This part of the chapter will present the findings from the iterative process of conducting semi-structured interviews and modifying the initial stakeholder-oriented critical paths for both the UK and Australian parts of the research. As mentioned in ***Chapter 5: Research Methodology*** (see page 180), and also in **Section 7.0.1** (see page 261) of this chapter, the research will be conducted in the United Kingdom prior to Australia. This is because, as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 113), the United Kingdom is a much more mature hydrocarbon landscape, which suggests that the UK oil and gas decommissioning landscape has much more experience and expertise. Thus, it would be better to tap into the experience and expertise in the UK landscape before moving on to the Australian landscape.

As mentioned in ***Chapter 5: Research Methodology*** (see page 180), for each landscape, an iterative process of conducting semi-structured interviews and modifying the stakeholder-oriented critical paths will be done until saturation is achieved and the robust stakeholder-oriented critical paths are produced. As reproduced from ***Chapter 5: Research Methodology*** (see page 180), **Figure 7-4** (below illustrates the iterative process for developing the robust stakeholder-oriented critical paths.

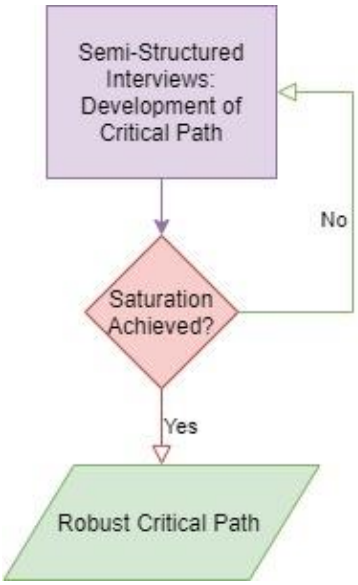


Figure 7-4 – Iterative Process of Developing the Robust Stakeholder-Oriented Critical Paths

As also mentioned in ***Chapter 5: Research Methodology*** (see page 181), saturation is said to be achieved for the stakeholder-oriented critical paths when there are less than two changes recommended by interviewees for each of the four types of information required to design the stakeholder-oriented critical paths (*List of project activities, Duration of Project Activities, Dependencies between Activities,, and Milestones and Deliverables*). The decision regarding the criteria for achieving saturation, as mentioned in ***Chapter 5: Research Methodology*** (see page 181), is based on Ashby's Law of Requisite Variety (Ashby 1964). More details regarding the iterative process and achieving saturation can be found in ***Chapter 5: Research Methodology*** (see page 181).

For the Australian part of the research, as mentioned in ***Chapter 5: Research Methodology*** (see page 167), and also in **Section 7.0.1** (see page 261) of this chapter, there is no case study and no initial stakeholder-oriented critical paths design process because there will be an existing robust stakeholder-oriented critical path at the end of the UK part of the research. The robust stakeholder-oriented critical path(s) from the UK part of the research will be used as the initial stakeholder-oriented critical path design in the Australian part of the research.

The author acknowledges that this procedural decision assumes that the UK and Australian stakeholder-oriented critical paths are similar. However, in the event that there are considerable differences between the UK and Australian critical paths, it is unlikely that it will result in significant changes to the research procedure. However, it does mean that more iterations are likely to be required before saturation is achieved for the development of the robust stakeholder-oriented critical path(s) during the Australian part of the research.

7.2.1 – Snowball Sampling

Largely due to concerns that interviewees in the oil and gas industry can be hard to reach (Hardwicke-Brown 1996; Kaiser & Yu 2010), snowball sampling was chosen as the sampling technique for this research. As mentioned in ***Chapter 5: Research Methodology*** (see page 179), the snowball sampling method has been mentioned in research methodology literature as an effective sampling technique for hard-to-reach scenarios (Atkinson & Flint 2001; Waters 2015).

7.2.1.1 – Obtaining Interviewees within the United Kingdom Oil and Gas Industry

This first interviewee in the United Kingdom was selected based on experience, seniority and recognition in the industry, and connections in the UK oil and gas decommissioning community. This is because, as mentioned in ***Chapter 5: Research Methodology*** (see page 179), starting the snowballing process from an interviewee with wider connections can make the snowball sampling method more effective (Biernacki & Waldorf 1981; Goodman 1961; Heckathorn 2011).

In general, the author found that snowball sampling is very effective within the UK oil and gas industry. As seen in **Table K-1** (see page 615) in **K**, a total of 13 semi-structured interviews were conducted in October 2018 alone. One possible reason why snowball sampling is effective is that Aberdeen, the city where all the interviewees are based in is a small, close-knit community with a population of about 200,000 (Office of National Statistics 2020). As discovered by the author, many interviewees know one another on a personal basis in addition to just a business relationship. This suggests that snowball sampling is more effective when targeting smaller communities.

The author also found that interviewees are extremely eager to participate in the research, share information and provide opinions, which contradict the “hard to get” label often associated with the oil and gas industry (Hardwicke-Brown 1996; Kaiser & Yu 2010). One possible reason is that there is a mutual interest between the interviewer and the interviewees in extending the existing body of knowledge in oil and gas decommissioning. An interviewee with more

than 30 years' experience in multiple operating and contracting roles in the oil and gas decommissioning industry commented that the interviewee hopes that the author's research can:

> *Produce something that the industry would get great value from because there is lots of stuff here that is huge distance away from being optimal…, and provide people with…a roadmap, a REAL roadmap on how to decommission. Not something that someone dreamt out in two months, which is what we got so far.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

This indicates that existing frameworks have limitations, and that there are considerable opportunities to extend the existing body of knowledge of oil and gas decommissioning. From a research methodology perspective, this finding suggests that interviewees' interest in extending the body of knowledge can influence their willingness to participate in research.

7.2.1.1.1 – Top Management Teams

Table 7-5 – Project Manager and Stakeholder Group Representation in the United Kingdom (Within the Oil and Gas Industry)

Stakeholder Group	Is there any Interviewee(s) representing the Stakeholder Group?
Project Manager	Yes
Top Management Teams	No
Joint-Venture Partners / Other Operators	Yes
Onshore and Offshore Employees	Yes
Governmental (Regulatory)	Yes
Governmental (Legislative)	Yes
Industrial Representative Body	Yes
Contractors	Yes
Transport and Logistic Stakeholders	Yes

As noted in ***Chapter 5 – Research Methodology*** (see page 185), the original intention for Step 6 was to at least have at least one interviewee representing each of the respective stakeholder groups. As presented in **Table 7-5** (above), the only stakeholder group that is not covered is top management teams. Project managers generally require the approval of top management teams before making changes to the oil and gas decommissioning project or

programme (Chen, Liu & Tjosvold 2005; West & Anderson 1996; Ackermann & Eden 2011). From a perspective of a project manager, top management teams can be considered as a stakeholder because they can have an influence on the decisions made by the project manager.

There was considerable difficulty in approaching top management teams because most top management teams of UK operating organisations are not based in the United Kingdom, due to them being foreign-based independent oil companies. For example, the top management team of Canadian National Resources (CNR) is based in Calgary, Canada. Similarly, the top management team of Chevron is based in San-Ramon, California, United States.

Interestingly, when interviewees mentioned significant interactions between project managers and top management teams, the top management teams are always based outside of the United Kingdom. For example, a retired decommissioning manager with 40 years' experience in multiple roles in the oil and gas industry recounted two events where the interviewee had significant interactions with top management teams. The first event involves the Maureen case, where the interviewee recounted interactions between the project management team, based in Aberdeen, United Kingdom, and the top management team from Phillips, based in Bartlesville, Oklahoma, United States:

> *In Bartlesville, they were absolutely scared at the thought of us holding a public process on such a delicate subject, so far away from them. Phillips is a small company, and to them, external relations, stakeholder engagement was about investor relations. It was about keeping financial organisation sweet. So the thought of us roaming around Europe talking with all sorts of people, stirring up a hornet's nest about decommissioning was just greeted with such alarm. And Jim Mulva, CEO, was on the top of that list.*
>
> *– A retired decommissioning manager with more than 40 years' experience in multiple roles in the oil and gas industry*

The second event involves the Murchison case, where the interviewee recounted intense interaction between the project management team, based in Aberdeen, United Kingdom, and the top management team from CNR, based in Calgary, Canada:

On the Murchison project, and I wrote the stakeholder dialogue for Murchison, and the project execution plan was written by the four of us. We clearly stated what the permit and regulatory framework was that we have to comply with. They [CNR] sent in over the Head of Regulatory Affairs from Calgary to Aberdeen…and he [Head of Regulatory Affairs for CNR] ranted and rave on in his cowboy boots about how they [CNR in Calgary] would kick back against the regulators, how in Canada they [CNR] could get away with stuff because they [CNR] are big in Canada, and they will just kick back at the regulator.

And I let him rant on for a while, and my boss John Allen who was the Project Director at CNR is just nodding away, because this [Head of Regulatory Affairs] was one of his big bosses. And then I said: "That's all good, that is fine, and do you have friends in the UN?" And he said: "I don't understand what you are talking about, boy." And I said: "Have you got friends in the UN? It is quite a simple question." And he said: "What's the UN got to do with it?" And I said: "Well that is why you have to go and do your research, mate. Because if you think you are going to get away with challenging OSPAR, you are going to end up in the UN which is going to take you 20 years to change the legislation.

– A retired decommissioning manager with more than 40 years' experience in multiple roles in the oil and gas industry

This finding suggests that interactions between project managers and top management teams could be some of the most intense throughout the lifecycle of an oil and gas decommissioning project or programme. This finding also suggests that the reason for the intense interactions is the differences in interests and goals between the project management team and the top management team.

7.2.1.2 – Obtaining Interviewees outside the United Kingdom Oil and Gas Industry

Obtaining interviewees from stakeholder groups outside the UK oil and gas decommissioning industry, however, was found to be more difficult. As noted in ***Chapter 5 – Research Methodology*** (see page 185), the original intention for Step 6 was to have at least one interviewee representing each of the respective stakeholder groups, as identified from the literature review. **Table 7-6** (below) shows the list of stakeholder groups categorised as outside the oil and gas industry.

Table 7-6 – Stakeholder Group Representation in the United Kingdom (Outside the Oil and Gas Industry)

Stakeholder Group	Is there any Interviewee(s) representing the Stakeholder Group?
Marine Science Stakeholders	Yes
Environmental NGOs	No
Commercial Fishing Stakeholders	Yes
Recreational Fishing Stakeholders	No
Tourism Stakeholders	No

7.2.1.2.1 – Environment Non-Governmental Organisations

There were many difficulties in obtaining interviews, in particular with eNGOs (environmental non-governmental organisations) such as Greenpeace and Friends of the Earth. Attempts to contact these eNGOs were greeted with the response that they are currently focusing their efforts on other areas rather than decommissioning. This seems to be in contrary to what might be expected (due to Greenpeace being a major public stakeholder during the events of Brent Spar).

One possible explanation for this phenomenon is that eNGOs are only interested in specific oil and gas decommissioning projects and programmes and not oil and gas decommissioning activities as a whole. According to a regulator who has been regulating oil and gas decommissioning activities since 2006:

RSPB [Royal Society for the Protection of Birds] are only interested in renewables, they are not interested in us. WWF [World Wide Fund for Nature] are only interested in the Brents, they are not interested in any of the other ones. Greenpeace again, mostly the Brents, maybe Dunlin, and only on those specific areas. We have this yearly, we go down to London to have a meeting with eNGOs like Whale and Dolphin Society, and Greenpeace, and all those, about 18 eNGOs, we do half of it on oil and gas, half of it on renewables, there is a small bit to do with decommissioning, because most of them are only interested in seismic and stuff like that, they are not really interested in decommissioning. In fact, the last one I did, most people are actually on their phone, they weren't interested in listening to me. So, that shows you how much interest they have in decommissioning.

– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom

A revisit to the Brent Field and Greater Dunlin Area decommissioning proposals finds that both oil and gas facilities proposals involve leaving hydrocarbon storage tanks in place in the marine environment (Fairfield Energy 2018; Shell 2017d). As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 104), the Brent Spar was used to store hydrocarbon before the hydrocarbons were loaded onto oil tankers to be brought onshore. Interestingly, as noted in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 107), the 1995 and 2019 protests by Greenpeace is concerned on the Brent Spar oil storage unit and the Brent Field hydrocarbon storage tanks, respectively (Dickson & McCulloch 1996; Elkington &Trisoglio 1996; Grolin 1998; Thomas 2019; Zyglidopoulos 2002). This suggests that the current interests of eNGOs are primarily focused on oil and gas structures that function as storage units for hydrocarbons.

Towards the end of the research, in early 2020, a decision was made by EnQuest to temporarily leave the hydrocarbon storage tanks of Thistle Alpha on the seabed prior to removing them at a later date (EnQuest 2020). While there are concerns as to whether the temporary solution of leaving hydrocarbon storage tanks on the seabed may become a permanent solution, there has not yet been a protest by any eNGOs. (EnQuest 2020). As Brent Field is a much larger oil and gas facility (Shell 2017d), this phenomenon may

be explained by the fact that unless the decommissioning project is large and newsworthy, eNGOs have a low interest in decommissioning.

This observation seems to contradict the extant literature such as Bennie (1998), Desiatnik (1994), Eden (2004), Gueterbock (2004), and Stafford and Hartman (2001), which shows that eNGOs have been significantly interested in oil and gas activities since the 1990s. Greenpeace, for example, has been actively campaigning against oil and gas activities globally since the 1990s (Bennie 1998).

The observation also appears to contradict recent events such as the recent September 2019 global climate strikes (de Moor et al. 2020). The September 2019 climate strikes was a series of international public protests demanding actions from organisations and governments to address climate change (de Moor et al. 2020). It was during the September 2019 climate strikes that the Brent Field decommissioning protest took place (Thomas 2019). Similarly, in Australia, environmental activists formed blockades in front of the offices of Chevron and Woodside, disrupting their business operations (Hunt 2019).

Overall, the findings suggests that it is possible that eNGOs are by now satisfied with how decommissioning is conducted except where it involves leaving infrastructures potentially filled with hydrocarbons and other potentially polluting chemicals in place in the marine environment.

7.2.1.2.2 – Recreational Fishermen and Tourism Stakeholders

There were also difficulties in obtaining interviews from organisations that represent recreational fishermen and tourism stakeholders. This suggests that the size of representation for recreational fishermen and tourism stakeholders is much smaller than for other stakeholder groups such as commercial fishermen.

One reason for the difficulty in obtaining interviews from organisations that represent recreational fishermen and tourism stakeholders is that the offshore environment of the UK Continental Shelf is harsh, resulting in very little recreational fishing and diving tourism in the North Sea environment.

This finding regarding the North Sea environment is in significant contrast to the situation in the Gulf of Mexico and Australia's North-West Shelf, where there is a significant presence of recreational fishermen and tourism stakeholders (Bills 2018; Kaiser, Shively & Shipley 2020). Thus when considering the stakeholder landscape in the context of decommissioning it is important to note that they differ according to location.

7.2.1.3 – Obtaining Interviewees within the Australian Oil and Gas Industry

Similar to the UK part of the research, this first Australian interviewee was selected based on experience, seniority and recognition in the industry, and connections in the Australian oil and gas decommissioning community. Similar criteria were used in selecting the first interviewee in order to ensure consistency in methodology. The author finds that in general, obtaining interviewees using snowball sampling is more challenging in Australia than in the United Kingdom. Only a total of 10 interviewees participated during the Australian part of the research, compared with 30 interviewees in the UK part of the research.

An interesting finding is that most interviewees in the Australian part of the research are unsure as to whether their input would be useful to this research. An interviewee who had just become a project manager in late 2019 stated at the beginning of the interview session that:

> *We have been doing plenty of studies to this point, so the execution, and planning for engaging with stakeholders still hasn't happened yet. It is something we are figuring out how to approach now. So I am not sure how much I can help…*
>
> *– A newly appointed project manager with 17 years' experience in multiple roles in the oil and gas industry*

It is possible that difficulty in obtaining interviewees was because most industrial representatives in the Australian oil and gas industry felt that they might not be able to contribute to the research.

It must also be noted that the Australian part of the research was conducted in the 2019 to 2020 period, during events of the COVID-19 pandemic. Several social distancing measures were put in place by the Australian government to prevent the spread of the COVID-19 virus (Australian Government – Department of Health 2020). A decision was made as part of the pandemic plan to stop conducting interviews entirely as there is already sufficient interview data for analysis from both the UK and Australian parts of the research. Despite the difficulty in obtaining interviewees, sufficient coverage of

most of the stakeholder category within the Australian oil and gas industry was obtained, as illustrated in **Table 7-7** (below).

Table 7-7 – Project Manager and Stakeholder Group Representation in the Australia (Within the Oil and Gas Industry)

Stakeholder Group	Is there any Interviewee(s) representing the Stakeholder Group?
Project Manager	Yes
Top Management Teams	No
Joint-Venture Partners / Other Operators	Yes
Onshore and Offshore Employees	Yes
Governmental (Regulatory)	Yes
Governmental (Legislative)	Yes
Industrial Representative Body	Yes
Contractors	Yes
Transport and Logistic Stakeholders	Yes

7.2.1.4 – Obtaining Interviewees outside the Australian Oil and Gas Industry

Similar to Step 6, as noted in ***Chapter 5 – Research Methodology*** (see page 189), the original intention for Step 9 is to at least have at least one interviewee representing each of the respective stakeholder groups, identified based on the literature review. However, obtaining interviewees from stakeholder groups outside the Australian oil and gas decommissioning industry was found to be difficult. Only 1 public stakeholder was interviewed in the Australian part of the research.

As mentioned in **Section 7.2.1.3** (see page 288), even interviewees within the Australian oil and gas industry are unsure as to whether their input would be useful for the research. It is entirely possible that representatives from outside the Australian oil and gas industry felt the same way as well, hence impacting their decision to participate in the research. **Table 7-8** (below) shows the list of the stakeholder groups outside the oil and gas industry represented in this research.

Table 7-8 – Stakeholder Group Representation in the Australia (Outside the Oil and Gas Industry)

Stakeholder Group	Is there any Interviewee(s) representing the Stakeholder Group?
Marine Science Stakeholders	Yes
Environmental NGOs	No
Commercial Fishing Stakeholders	No
Recreational Fishing Stakeholders	No
Tourism Stakeholders	No

7.2.1.4.1 – Opportunities for Future Research

The author acknowledges that the lack of coverage of environmental NGOs, commercial fishing stakeholders, recreational fishing stakeholders, and tourism stakeholders in the Australian landscape is a limitation in this research. However, this indicates that there is an opportunity to explore oil and gas decommissioning from the perspective of each of the stakeholder groups

7.2.2 – The First, Second, and Third Semi-Structured Interviews

Table 7-9 (below) presents the details of the first, second, and third semi-structured interviews that were conducted in the United Kingdom.

Table 7-9 – Details on the First, Second, and Third Semi-Structured Interviews

Type of Company	Current Job Role	Date of Interview	Interview Duration	Experience in Multiple Roles
Oil and Gas Research Centre	Executive Management	Thursday, 16 August 2018	46 mins	Operator, Contractor
Engineering Consultancy	Discipline Engineering	Thursday, 6 September 2018	52 mins	Contractor
Small Operator	External Relations	Thursday, 17 September 2018	73 mins	Operator, Contractor

As mentioned in ***Chapter 5: Research Methodology***, the original intention was to conduct the first round of semi-structured interviews in order to develop the stakeholder-oriented critical paths by:

- Validating and confirming the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* obtained from the case study.
- Obtaining additional information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in secondary data.
- Obtaining recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust stakeholder-oriented critical paths.

The procedural decision made in ***Chapter 5: Research Methodology*** was based on the assumption that the entire one-hour interview session would be spent on developing the stakeholder-oriented critical paths. Much research literature indicated that it is unlikely that an interview session will be completed in less than one hour (Saunders, Lewis & Thornhill 2016).

However, based on the first three interviews, only an average of 20 minutes was spent on developing the stakeholder-oriented critical paths. The second interviewee, a discipline engineer with 17 years' experience in the oil and gas industry, even annotated the stakeholder-oriented critical paths to provide recommendations and ideas for improvement prior to the start of the interview session, suggesting that there is a high level of interest by the oil and gas industry in extending the existing body of knowledge in oil and gas decommissioning. As noted by Saunders, Lewis and Thornhill (2016), ending an interview session early is a sign of poor time management, and it may also give negative signals to the interviewees. A quick decision was made on the spot to move on to the list of questions originally intended for the second round of semi-structured interviews.

Additionally, as seen in **Table 7-9** (above, page 291), two out of three of the interviewees have experience in multiple roles. The first interviewee, for example, has experience working as a decommissioning project manager for an oil and gas operator, and as an engineering contractor for a contracting company who is a stakeholder in an oil and gas decommissioning project or programme. The interview data obtained from the first interviewee also covered the perspective of both an operator and a contractor.

Overall, findings from the first three interviews indicate that it is more practical to execute Steps 4, 5, and 6 (See **Figure 7-1**, page 258) in parallel with each other rather than sequentially. Furthermore, due to the limited timeframe of one year per landscape, conducting the steps in parallel can also ensure that there will be sufficient interviews to cover the entire oil and gas decommissioning landscape.

Thus, the decision was made to execute Step 4, Step 5 and Step 6 in parallel with each other for the UK part of the research. Similarly, Step 7, Step 8 and Step 9 (See **Figure 7-1**, page 258) are to be executed in parallel with each other during the Australian part of the research in order to ensure consistency in research methodology.

7.2.3 – Preparing and Conducting the Semi-Structured Interviews

Formal requests for an interview session and the information sheet are sent to all potential interviewees for the research. A sample of the information sheet can be found in ***Appendix I***.

As mentioned in ***Chapter 5: Research Methodology*** (see page 178), only interviewees who have experience in the management of oil and gas decommissioning projects and/or stakeholders will be asked to:

- Validate and confirm the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* deduced from the case study data.
- Obtain additional information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in secondary data.
- Obtain recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust stakeholder-oriented critical paths.

Hence, only confirmed interviewees who have experience in the management of oil and gas decommissioning projects and/or stakeholders were sent copies of the stakeholder-oriented critical paths prior to the interview session. As noted by Saunders, Lewis and Thornhill (2016), supplying information to interviewees prior to the interview session can provide the interviewees with a sense of purpose and direction, hence improving the data collection process.

In order to abide by the Data Protection Act 1998 of the United Kingdom and the Privacy Act 1988 (Cth) and/or the Australian Privacy Principles of Australia, each interviewee is given a consent form to be signed prior to the commencement of the interview session. A copy of the consent form can be found in ***Appendix J*** (see page 614).

As mentioned in ***Chapter 5: Research Methodology*** (see page 180), the stakeholder-oriented critical paths were used as an engagement tool during the semi-structured interviews in order to obtain more insightful data from the interviewees. Interviewees were therefore encouraged to annotate and work on the stakeholder-oriented critical paths.

7.2.4 – Findings from the Semi-Structured Interviews

A considerable number of findings have emerged from the semi-structured interviews, both research questions related, and emergent findings. As illustrated in **Table 7-9** (below), the findings from the semi-structured interviews can be summarised into various themes. Due to the number of findings, a multiple chapters approach to present the findings will enable them to be presented in a well-structured and cohesive manner. **Table 7-9** shows the themes that will be covered in each of the chapters.

Table 7-9 – Summary of Findings from the Semi-Structured Interviews

Chapter	Theme	Location in Thesis
Chapter 7: Development of Stakeholder Oriented Critical Paths	Decommissioning Proposals Details	(Section 7.2.4.1)
	Dependencies between Oil and Gas Facilities	(Section 7.2.4.2)
	A Basin-Wide Approach to Decommissioning	(Section 7.2.4.3)
	When does Oil and Gas Decommissioning Begin?	(Section 7.2.4.4)
	The Importance of Asset Stewardship	(Section 7.2.4.5)
	The Emphasis on Late-Life and Ultra-Late-Life	(Section 7.2.4.6)
	Creating Synergies between Different Projects	(Section 7.2.4.7)
	Starting Well Plugging and Abandonment at the Right Time	(Section 7.2.4.8)
	Similarities in Design of Oil and Gas Structures	(Section 7.2.4.9)
	List of Project Activities, Milestones and Deliverables	(Section 7.2.4.10)
	Variation in Duration of Project Activities	(Section 7.2.4.11)
	Overall Length of an Oil and Gas Decommissioning Project or Programme	(Section 7.2.4.12)
	Single or Multiple Proposals?	(Section 7.2.4.13)
Chapter 8: Analysis of Stakeholder Oriented Critical Paths	United Kingdom – Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy	(Section 8.5.2.1)
	United Kingdom – Cluster No. 2 – Comparative Assessment Period	(Section 8.5.2.2)
	United Kingdom – Cluster No. 3 – Simultaneous Operations (SimOps)	(Section 8.5.2.3)
	Australia – Cluster No. 1 – Well Plugging and Abandonment Operations	(Section 8.5.3.1)
	Australia – Cluster No. 2 – Planning for Removal	(Section 8.5.3.2)
	Australia – Cluster No. 3 – Transportation and Disposal of NORMs and Mercury	(Section 8.5.3.3)
	A Comparison between the United Kingdom and the Australian Landscape	(Section 8.6)
Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement	Extent and Depth of Oil and Gas Operators' Knowledge of the Oil and Gas Decommissioning Process	(Section 9.2.1.1)
	Extent and Depth of Supply Chain's Knowledge of Oil and Gas Decommissioning	(Section 9.2.1.2)
	Extent and Depth of Regulators' Knowledge of Oil and Gas Decommissioning	(Section 9.2.1.3)
	Extent and Depth of Public Stakeholders' Knowledge of Oil and Gas Decommissioning	(Section 9.2.1.4)
	Extent of Alignment among Joint-Venture Partners	(Section 9.2.2.1)
	Extent of Alignment between United Kingdom Oil and Gas Operators and the Oil and Gas Authority (OGA)	(Section 9.2.2.2)

Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement	Extent of Alignment between United Kingdom Oil and Gas Operators and the Oil and the Department of Business, Energy and Industrial Strategy (BEIS)	(Section 9.2.2.3)
	Extent of Alignment between United Kingdom Oil and Gas Operators and the Health and Safety Executive (HSE)	(Section 9.2.2.4)
	Extent of Alignment between Oil and Gas Operators and the Supply Chain	(Section 9.2.2.5)
	Extent of Alignment among the Supply Chain	(Section 9.2.2.6)
	Extent of Alignment between Different Regulators in the United Kingdom	(Section 9.2.2.7)
	Extent of Alignment among Environmental NGOs	(Section 9.2.2.8)
	Top Management Team's Philosophy and Attitude towards Stakeholder Engagement	(Section 9.2.3)
	Extent of Engagement Fatigue in the United Kingdom Landscape	(Section 9.2.4.1)
	Extent of Engagement Fatigue in the Australian Landscape	(Section 9.2.4.2)
	Extent of Trust of Regulators on United Kingdom Oil and Gas Operators	(Section 9.2.5.1)
	Extent of Trust of United Kingdom Oil and Gas Operators on the Department of Business, Energy and Industrial Strategy (BEIS)	(Section 9.2.5.2)
	Extent of Trust between Oil and Gas Operators and the Supply Chain in the United Kingdom	(Section 9.2.5.3)
	Extent of Trust between Oil and Gas Operators and the Supply Chain in other Landscapes	(Section 9.2.5.4)
	Extent of Trust between Oil and Gas Operators and Public Stakeholders in the United Kingdom	(Section 9.2.5.5)
	Extensiveness of Early Engagement between Oil and Gas Operators and Regulators	(Section 9.2.6.1)
	Extensiveness of Early Engagement between Oil and Gas Operators and the Supply Chain	(Section 9.2.6.2)
	Extensiveness of Early Engagement between Oil and Gas Operators and Public Stakeholders	(Section 9.2.6.3)
	Regulators' Capacity for Effective Engagement	(Section 9.2.7.1)
	Public Stakeholders' Capacity for Effective Engagement	(Section 9.2.7.2)
Chapter 10: Regulatory Impact on Project Performance	Prescriptive or Goal Setting?	(Section 10.1)
	Conflicting Goals	(Section 10.2)
	The Influence of Liability In-Perpetuity	(Section 10.3)
	Regulatory Uncertainties	(Section 10.4)
	Global Connections	(Section 10.5)

7.2.4.1 – Decommissioning Proposals Details

In ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, it was mentioned that the decommissioning proposal for the Brent Field was significantly longer than the others, with a total of 322 pages (Shell 2017d). A typical length for a decommissioning proposal document is approximately 50 pages.

It was also hypothesised in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** that the reason for the length of the Brent Field decommissioning proposal is to counter the bad publicity Shell had regarding the Brent Spar incident (Gordon, Poot & O'Connor 2019; Sanwoolu et al. 2017; Zyglidopoulos 2002). A retiree and former employee of Shell who was part of the Brent decommissioning project management team, strongly criticised the Brent decommissioning proposal:

> *Go read Shell's Brent Decommissioning Programme[14]. It is absolutely criminal… if you read the Brent Decommissioning Programme, it contradicts itself, all the way through, because it's been produced, at different times, by different people. And they never read the whole thing from start to finish, I guarantee you…Greenpeace may have copies of Shell's Brent decommissioning programme. But to send people 30,000[15] pages to read in 60 days, in an under resourced, small NGO is not a considerate approach…And they [Shell] did it on purpose because they don't want people to examine the detail. But I can tell you that the detail has been examined.*
>
> *– A retiree and former employee at Shell who was part of the Brent decommissioning project management team*

While there might not be an intention by Shell to prevent stakeholders from examining the Brent decommissioning proposals in detail, a lengthy document can indeed be difficult to read and work on.

[14] Decommissioning Programme refers to the decommissioning proposal document in this quotation.
[15] This is approximate number of pages when considering all documents available on the OPRED website and Shell's website (Decommissioning Proposal Documents, Stakeholder Reports, Independent Review Group Report, Technical Documents, Appendices, etc.)

From a stakeholder management perspective, this finding suggests that oil and gas operators should consider the limitations of the stakeholders (both internal and external) when making decommissioning decisions. As the Brent decommissioning proposal involves four oil platforms (Brent Alpha, Brent Bravo, Brent Charlie and Brent Delta), this finding suggests that it could perhaps be much more beneficial for Shell to split the Brent decommissioning proposal into four decommissioning proposals, making it easier for employees to work on the respective proposal, while also making each decommissioning proposal easier for readers to digest.

7.2.4.2 – Dependencies between Oil and Gas Facilities

In the United Kingdom, all 28 interviewees representing oil and gas operators, the supply chain, industry representative bodies, and regulators, acknowledged that the decommissioning of an oil and gas facility cannot be viewed in isolation, and considerations must be given to surrounding oil and gas facilities. This finding validates the information deduced from the case study that there are dependencies between different oil and gas facilities.

According to a contracts lead with more than 17 years' experience in the oil and gas industry:

> *Sullom Voe Terminal is actually owned by a number of companies, not just EnQuest. It just so happens that EnQuest is currently operating it, which was decided by a vote by all the companies that owns it…….all the other operators with decommissioning plans which will affect the pipelines leading into Sullom Voe Terminal will consult with EnQuest.*
>
> *One example that I can give you is the Dunlin Bypass Project, which EnQuest have a very huge interest in. So as you know Dunlin Alpha is going to be decommissioned within the next 10 years, and Dunlin Alpha is actually a hub for many of the North Sea assets.*
>
> *EnQuest have a lot of assets like Magnus, Don and Thistle feeding into Dunlin to get into the production pipelines. Magnus platform actually feeds into Don, which then feeds into Thistle, which then feeds into Dunlin and then enters the production pipeline towards Sullom Voe Terminal.*
>
> *So, once Dunlin Alpha facilities is decommissioned, many of our assets will be left stranded. Thus, EnQuest need the Dunlin Bypass to be constructed, which will be a pipeline from Thistle through towards Cormorant Alpha, and then enter another production pipeline towards Sullom Voe Terminal.*
>
> *– A contracts lead with 17 years' experience in the UK oil and gas industry*

Firstly, this finding validates the finding from the case study that the list of project activities varies depending on the dependencies of neighbouring oil and gas facilities on the oil and gas facility to be decommissioned. The interviewee also mentioned the Dunlin Alpha oil and gas facility, which was also emphasised in ***Chapter 6: Case Studies of Past Oil and Gas***

Decommissioning Projects, which indicates that the Dunlin Alpha oil and gas facility is a prime example of an oil and gas facility with many dependencies.

However, in addition to that, these findings also suggest that the stakeholder landscape also varies depending on how dependent neighbouring oil and gas facilities are on the oil and gas facility to be decommissioned.

When examining the quotation further, the part where the contracts lead mentioned that "*all the other operators with decommissioning plans which will affect the pipelines leading into Sullom Voe Terminal will consult with EnQuest"*, suggests that the dependencies between oil and gas facilities are basin-wide and not just limited to neighbouring oil and gas facilities.

7.2.4.3 – A Basin-Wide Approach to Decommissioning

Building on the idea that the dependencies between oil and gas facilities are basin-wide, a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry suggested that:

> *We need to look at the North Sea like a tree, and consider the longevity of the entire basin. The critical points cannot be cut off. A good example is Dunlin Alpha, where the surrounding platforms now need to be rerouted.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This suggests that a basin-wide approach to decommissioning could be beneficial. A possible approach, as suggested by a former project manager with more than 25 years' experience in the oil and gas decommissioning industry, would be to develop a machine learning algorithm that will determine the order in which the oil and gas facilities in the basin should be decommissioned.

Possible factors that can be considered for the algorithm are installation dates, production start dates, production rates, number of platforms, number of wells, and most importantly, the dependencies between the different oil and gas facilities. A linear regression machine learning algorithm was developed, using R programming language, by the author in collaboration with a data scientist from Robert Gordon University to explore this direction, which is presented in ***Appendix L*** (see page 619). ***Appendix L*** also presents the set of data used in the algorithm, which is based on the secondary data collected from the case studies in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***. Overall, this finding suggests that there are opportunities to explore oil and gas decommissioning using data science and machine learning.

The algorithm predicts the order in which the oil and gas facilities in the basin should be decommissioned. The predicted order in which oil and gas facilities in the basin should be decommissioned in the United Kingdom, considering dependencies between the different oil and gas facilities, is presented in ***Appendix L***. While data testing has been done using existing cases from the

case studies, further improvement can certainly be made in the future to improve the robustness of the machine learning algorithm.

Information regarding the order in which the oil and gas facilities in the basin should be decommissioned could be useful for the industry as a whole. Oil and gas operators can use that information to plan oil and gas decommissioning projects. The supply chain can use that information to support their investment proposals, and ensure that the supply chain has sufficient capacity to meet upcoming demands for their services. Regulators can also use the information as a guide to determine whether oil and gas operators are prematurely decommissioning their facilities.

While a basin-wide approach to decommissioning could be ideal, the former project manager with more than 25 years' experience in the oil and gas decommissioning industry further added that:

> *I believe we should get more into thinking about what I call 'mature basin management' rather than mature asset management…but we are not that sophisticated yet…everybody from what I see is looking at their own platform, and their own set of pipelines, and then deal with them, and there is not much consideration to the platform over there that might be of similar age…we know that we've got individual problems with systems and there are things we have to deal with, but if we were to approach this as looking at the whole of the North Sea with dots on the map that represents the platforms and lines on the map that represents the pipelines…would you have look at this whole process differently?*
>
> *– A former project manager with 25 years' experience in the oil and gas decommissioning in the United Kingdom*

This finding suggests that business strategies tend to focus more on the managing of the organisation's portfolios rather than considering stakeholders. A revisit to the literature finds that the United Kingdom is multi landscape (Huijskes et al. 2017; Carpenter 2018). This means that there are multiple different oil and gas companies, each with its own set of business portfolios and strategies. As noted by Reynolds and Yetton (2015), business strategies can be difficult to align, which suggests that a basin-wide approach to decommissioning can be very difficult to plan and execute in a multi-operator landscape.

A landscape dominated by national oil companies such as Malaysia, which is primarily dominated by PETRONAS (Petroliam Nasional Berhad) (Rusman et al. 2019), and Thailand, which is primarily dominated by PTTEP (PTT Exploration and Production Public Company Limited) (Sirirattanachatchawan et al. 2019), could perhaps have a much easier time planning a basin-wide approach to decommissioning. An attempt at a basin-wide approach to decommissioning was done in Malaysia, where PETRONAS published yearly reports containing detailed information for all oil and gas facilities that were going to cease production and be decommissioned throughout the whole of Malaysia over the next five years (Rusman et al. 2019).

Such an approach could be adopted by Oil and Gas UK in the United Kingdom, and APPEA (Australian Petroleum Production and Exploration Association) in Australia. The annual Decommissioning Insights reports published by Oil and Gas UK, for example, only show the predicted cost of decommissioning, and not specific information regarding which assets are potentially going to be decommissioned (OGUK 2019). The challenging part of adopting such an approach in a multi-operator landscape, as commented on by a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally, is that:

> *Oil companies don't want to share information because…they want to preserve any economic advantage…protect their share price…and sharing information might impact the supply chain.*
>
> *– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

The author, however, finds that the argument made about preserving economic advantage is questionable. As evident from the case studies findings in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, much of the information regarding toil and gas operators' portfolios is already publically available, regardless of whether the oil and gas operator shares the information or not.

A basin-wide approach to oil and gas decommissioning is also part of the United Kingdom's MER (Maximising Economic Recovery) Strategy. The OGA (Oil and Gas Authority) very much sees themselves as being concerned with basin management in terms of the MER Strategy; avoiding premature decommissioning, looking for dependencies, developing a decommissioning strategy, and so on (OGA 2016a). From the perspective of the author, current measures are successful in assisting oil and gas operators and contractors to identify opportunities for collaboration (i.e. stakeholders that can bring benefits to the project).

However, decisions regarding the specific engagement mechanisms (i.e. specific contractual arrangement, the timing of engagements, how to engage contractors etc.) are left to individual organisations. The author finds that it could be useful for the OGA to provide organisations with a guideline detailing recommended mechanisms for effective engagement for collaboration. For example, the guideline could recommend oil and gas operators to provide flexibility in scheduling to lifting contractors, citing past projects such as Murchison as examples that utilised such a mechanism, and the benefits in terms of cost. Such a guideline could promote the use of effective stakeholder engagement mechanisms, possibly increasing the chances of effective engagement, and the extent collaboration, between different organisations.

7.2.4.4 – When does Oil and Gas Decommissioning Begin?

As noted in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** , one of the key findings from examining Decom North Sea's L2P2 framework is that oil and gas decommissioning activities start well before CoP. This suggests that an oil and gas decommissioning project or programmes starts well before an oil and gas facility ceases production.

When questioned regarding the starting point for the stakeholder-oriented critical paths, there is a variation in the responses from the interviewees. For example, a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry stated that:

> *There isn't a time where you kind of start that and say 'Right, we are on this decommissioning journey now'… It has been treated awhile, for a long time that it is just a phase that you go into, you just go into decommissioning. But it is getting really grey now, it is getting really difficult to understand which phase you are at, and that is why this late-life phase evolved over the last little while… it's not just a black and white on/off switch where you say now, we are starting to decommission, because this late-life piece around here around "Is there any economic life left in the field?", that happens every day.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

Another interviewee, a decommissioning consultant with 30 years' experience in multiple operating and contracting roles in the UK oil and gas industry, added to the debate stating that:

> *Decommissioning starts at the very beginning of an oil and gas asset lifecycle. Even during the development and the construction phase, when you are designing the platforms and the wells, considerations must be given to decommissioning. So the planning for decommissioning actually starts way over here [in the development phase of an oil and gas asset lifecycle].*
>
> *– A decommissioning consultant with 30 years' experience in multiple operating and contracting roles in the UK oil and gas industry*

Yet another interviewee, a current decommissioning project manager with 19 years' experience in the oil and gas industry, stated that:

> *For most of the operators, it starts with the decommissioning strategy, for that asset, a decom strategy, or for the company.*
>
> *– A current decommissioning project manager with 19 years' experience in the UK oil and gas industry*

Overall, this finding suggests that there is still a lack of understanding by the oil and gas industry of when, relative to the oil and gas lifecycle, should the planning for its decommissioning should begin.

As noted in **Table H-2** (see page 608) of ***Appendix H***, L2P2 did provide an answer to this, suggesting that planning should start more than 10 years before CoP. However, a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry, stated that:

> *It is unrealistic to kind of put this 10 years, in reality it is just not going to work…because it is at a flick of a switch that people say it is sub-economic.*
>
> *A good example is a company that was a few doors down here, used to be around, called Oilexco, it ultimately become Premier. They had a field called Shelly, they put in a new FPSO [floating production, storage and offloading unit], they put a bunch of subsea facilities on the ground, on the seabed, and started production. They obviously did all the appraiser stuff on the reservoir and said yeah, we are going to produce at about 5,000 barrels a day for 10 years. They bought all the stuff, bought all the equipment, and started producing, and then the reservoir performance fell off the cliff, straight away went downhill very very quickly. Much faster than they build. So, they went from almost doing a capital project, really short production period, I can't remember how long it was, it was two or three years, it wasn't really long at all, and then all of a sudden, they are decommissioning. Literally it was, they P&A [plug and abandon] the wells, they took the FPSO, and they clear the seabed, and it was all gone.*
>
> *And so, that whole development, that whole birth, life and death of that field was less than 10 years.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This finding suggests that the start of an oil and gas decommissioning project or programme, relative to the oil and gas facility's lifecycle, varies depending on the size of the reservoir and the production performance of the oil and gas facility. This finding also suggests that the stakeholder-oriented critical paths will also vary depending on the size of the reservoir and the production performance of the oil and gas facility.

7.2.4.5 – The Importance of Asset Stewardship

Another key finding, as described by eight interviewees representing oil and gas operators, the supply chain, and regulators, is that decisions regarding the maintenance of the platform will have an impact on stakeholder interactions during decommissioning activities. According to a former project manager with 40 years' experience in the oil and gas industry:

> *Shell management for the Brents for 50 years is filled with trouble, issues, and it is abominable. In fact I will give you a straightforward comparison.*
>
> *I have work for Statoil, who is now Equinor on the Statfield Project. Statfield Alpha, very similar GBS [gravity-based structure] to two of the Brents. Over the years, when they access the cells, use it for storage, etc. They [Statoil] have recorded every single input, and every single output from those cells. They [Statoil] have complete records, paper records, and now digitised. So, we could work out what went in, and what came out, what was left behind. Establishing inventory was relatively easy. We then looked at whether can we access the cells without cutting the cells? Yes we can, because the pipeline that was used to pump the liquids backward and forward and everything else, was maintained and still intact. So, we sent down a video camera. We flew it around the inside of the cells.*
>
> *It was pretty boring if you have to look at it, but when we went to SFT [Statens forurensningstilsyn, now called Norwegian Climate and Pollution Agency], which was the Norwegian Environmental Regulator. And they said: "Okay guys, what is in your cells?" and we said: "Well, it is pretty clean actually, and we can even touch the bottom with the probe, there is no sludge, we can touch the bottom." "Oh, prove that" "Well, here is the video". That is Equinor/ Statoil, a good operator, good stewardship, excellent company.*

Shell Brents? "Well you didn't maintain the pipework at all, okay. Oh, because you thought that you are going to leave them in-situ, is that why you didn't maintain the pipework?" "What did you put into the cells?" "Well we have no idea, we never recorded anything" "Oh really, did you use the cells any other way than storage" "Oh ya, we used them as separators, but we couldn't get that to work properly, so we just kind of seal them off and never saw them again" "So they were in there for 30 years. Okay. Right. How clean are your cells?" It is just diabolical.

The last big downturn, operators desperately tried to reduce their operating costs. In Shell's case, what did they do? They [Shell] just stopped maintaining things. That saved money. The place [Brents] then fell to bits. They [Shell] then got a reinforcement order from the HSE in the 1990s, and had a huge thing called the UP project, which was the upgrade project. And that was simple to keep the platforms at the level of stewardship where they can say they [the Brents] were safe. And even then they still managed to kill two guys down at the legs of Brent Bravo, because they hadn't maintain the systems properly. They [Shell] have the worst safety record compared to any other oil company in the North Sea. They are negligent, criminally negligent.

– A former project manager with 40 years' experience in the oil and gas industry

This suggests that proper and continuous maintenance of the oil and gas facility is extremely important, both to minimise the risks involved during oil and gas decommissioning, and to prevent negative stakeholder impact on the oil and gas decommissioning project or programme. A revisit to industry literature finds that the OGA in the United Kingdom has recognised this phenomenon and implemented annual stewardship surveys in order to ensure good stewardship from the oil and gas operators in the United Kingdom (OGA 2017).

During the Australian part of the research, it was found that the Australian regulator recognised the importance of asset stewardship as well. According to a current regulator in Australia with 30 years' experience in multiple roles in the oil and gas industry:

> *We are trying to do the same thing now. Which is maintaining it during the lifecycle, so that you can actually remove it. Because we are beginning to see this problem, where people have not maintaining it, particularly FPSO type structures. And then they are coming to tell us that they can't remove it because it was unsafe to remove. But it was unsafe because operators were not maintaining them properly. That is definitely a concern.*
>
> *– A current regulator in Australia with 30 years' experience in multiple roles in the oil and gas industry*

This suggests that this phenomenon happens in multiple different landscapes. From a regulatory perspective, it could perhaps be beneficial for regulators in emerging oil and gas decommissioning regions to implement policies to ensure good asset stewardship from oil and gas operators in order to mitigate future issues in oil and gas decommissioning.

7.2.4.6 – The Emphasis on Late-Life and Ultra-Late-Life

As illustrated in **Figure 7-5** (below), late-life and ultra-late-life is the period prior to the CoP of the oil and gas facility. It must be noted that the term ultra-late-life only surfaced in industry literature in 2019 when this research was conducted. This indicates that the body of knowledge of oil and gas decommissioning is still expanding and has not yet stabilised.

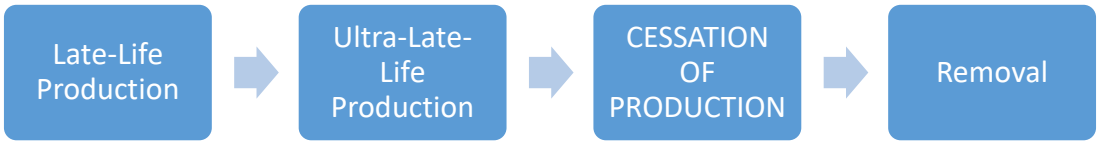


Figure 7-5 – Late-Life and Ultra-Late-Life

In the United Kingdom, all 28 interviewees representing oil and gas operators, the supply chain, industry representative bodies, and regulators, acknowledged that late-life and ultra-late-life activities are extremely important in terms of managing stakeholders. This suggests that a possible critical point on the stakeholder-oriented critical paths could be during the late-life and ultra-late life period. This finding also suggests that engaging stakeholders during late-life and ultra-late-life could be deemed as best practice to manage stakeholders for oil and gas decommissioning activities.

In terms of regulatory engagement, a former decommissioning manager who worked on the Brae decommissioning project or programme recounted the engagement between Marathon Oil and regulatory stakeholders during late-life and ultra-late life:

At Marathon, we ceased production on our first platform of the Brae complex last year [in 2017], and we engaged with the regulators in 2009 to advise them on our thoughts for decommissioning the field.

We started our engagement process very early in order to ensure that we brought the regulator along with us and that when we are submitting our decommissioning programme that they [the regulator] already know what was going to be in it.

And most of the challenges have been discussed verbally, and we were able to address most of them in the decommissioning programme which dramatically reduced the review and approval period for the decommissioning programme

– A former decommissioning manager who worked on the Brae decommissioning project or programme

This finding suggests that interactions with regulatory stakeholders that take place during late-life and ultra-late-life can have an influence on future interactions with regulatory stakeholders further down the stakeholder-oriented critical paths. This finding also suggests that an effective regulatory engagement can have a positive impact on project efficiency.

In terms of engaging the supply chain, the former decommissioning manager who worked on the Brae decommissioning project or programme added that:

What you will find in this removal, is that a lot of the solutions is developed by the supply chain…… if you engage early with the supply chain as an operator, you will have some flexibility of schedule, and one of the most valuable things that you can give to an execution company is flexibility of schedule, because it allows them to optimise the utilisation their people and vessels. A high utilization of their vessels will reduce their cost and allow them to retain their business model.

Personally, I think early engagement with the supply chain during late life should allow for the development of options for engineering preparation and removal, but the decision making and final timing probably give that to the supply chain, and maintain that flexibility of schedule, because the real goal in decommissioning is to ensure that the job is done safely and well, protecting the risks and reputation, but reducing the cost rather than accelerating the schedule.

– A former decommissioning manager who worked on the Brae decommissioning project or programme

This finding suggests that an effective supply chain engagement during late-life and ultra-late-life can have mutual benefits for both the oil and gas operators and the supply chain.

7.2.4.7 – Creating Synergies between Different Projects

As noted by the former decommissioning manager who worked on the Brae decommissioning project or programme in **Section 7.2.4.6** (see page 310), one of the reasons for early engagement is to create synergies between different project schedules. The most interesting finding from the interview data is that when interviewees are discussing creating synergies between different projects, CoP is always mentioned. Firstly, this seems to validate the finding from ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** that CoP is an important milestone. Secondly, this finding suggests that the ability to achieve synergies between different oil and gas decommissioning projects is dependent on the ability to align CoP dates.

A key debate that arises from the interview data on this front is the difference in opinion among oil and gas operators regarding the practicality of shifting CoP dates to create synergies between different oil and gas decommissioning projects. A current decommissioning project manager with 19 years' experience in the oil and gas industry argued that:

> *We just collaborate……what you will do is just bring cessation of production [CoP] dates forward and push other CoP dates back and align the CoP dates for the assets.*
>
> *– A current decommissioning project manager with 19 years' experience in the UK oil and gas industry*

Conversely, a current decommissioning manager, from a different oil and gas operating company, with 22 years' experience in the oil and gas industry globally, stated that:

> *It is very difficult to align the cessation of production [CoP] of the different assets so that you can do decommissioning of the assets in sequences for campaigns and things like that. Because the CoP is dependent on the price of oil. No operator would like to decommission any asset, so the CoP and decommissioning date will be influence by the oil price. So it is very difficult to plan campaigns and do collaborations between different operators, because it is very difficult to predict when the CoP of the different assets is really going to happen.*
>
> *– A current decommissioning manager with 22 years' experience in the oil and gas industry globally*

When this debate was brought to the attention of a decommissioning consultant with 36 years' experience of managing oil and gas decommissioning projects and programmes globally, the decommissioning consultant offered that:

> *It is the function of the individuals. Repsol has a large portfolio. Repsol had some difficulty over the years to actually being able develop a decommissioning strategy. Repsol has some internal conflicts I think in the way they manage their assets. Repsol tend to be more autonomous. So, they probably have some internal difficulties in aligning one asset team with a different asset team.*
>
> *BP has developed quite a strong capability in decommissioning; they have learned a lot from North West Hutton and other projects like Miller that is pushing them towards the direction of collaboration. And I think they have seen some benefits from that.*
>
> *– A decommissioning consultant with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

This finding suggests that to a certain degree, past experiences can have an influence on decisions made during oil and gas decommissioning. This finding also suggests that the primary barrier to creating synergies between different oil and gas decommissioning projects is the effectiveness of interactions among internal stakeholders.

While CoP is one of the most important milestones in oil and gas decommissioning, the author's opinion is that there should be other milestones along the oil and gas decommissioning project or programme lifecycle that can be used as a reference point to create synergies between different oil and gas decommissioning projects. An alternative way to create synergies between oil and gas decommissioning projects could be to align removal execution dates.

Oil and Gas UK have a tool to identify possible synergies between different oil and gas decommissioning projects. The tool overlays the indicative project schedules of different oil and gas decommissioning projects in rows parallel to each other. A point with possible synergies is a point where there are multiple projects taking place around the same time. The author attempted to simulate this same function by overlaying indicative project schedules of the different oil and gas decommissioning projects in rows parallel to each other using Microsoft Excel. Information regarding the indicative project schedules was obtained from the case studies used in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***. The author's version of the tool to identify possible synergies between different oil and gas decommissioning projects can be found in ***Appendix M*** (see page 625).

From the perspective of an oil and gas operator, being able to identify possible projects for which synergies can be created, can help the oil and gas operator identify key stakeholders to engage with. Furthermore, this tool could also be used as a stakeholder mapping tool. Further research can be done on this front to investigate the effectiveness of the synergies identification tool to map stakeholders.

7.2.4.8 – Starting Well Plugging and Abandonment at the Right Time

Another interesting finding from the interview data is that in the United Kingdom, all 18 interviewees representing oil and gas operators and the supply chain agreed that starting well plugging and abandonment at the right time is extremely important. However, there appears to be a debate in the United Kingdom as to whether well plugging and abandonment should start before or after Cop.

Of 18 interviewees representing oil and gas operators and the supply chain in the United Kingdom, 16 of them supported the notion that well plugging and abandonment should start prior to CoP. This suggests that it is better practice to start well plugging and abandonment prior to CoP. However, the two interviewees who support starting well plugging and abandonment after CoP also have considerable experience in oil and gas decommissioning. One of these interviewees has 36 years' experience in the oil and gas industry.

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 14), and again in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, an oil and gas facility can have multiple wells. This means that at one facility, some wells can be plugged and abandoned, while other wells continue to produce. Thus, the start of well plugging and abandonment activities in not dependent on the CoP of the oil and gas facility.

There were many rationales provided by interviewees to justify their choice of the right time to start well plugging and abandonment, which suggests that decisions regarding the start date of well plugging and abandonment are some of the most critical in oil and gas decommissioning. Overall, the rationales can be classified into four main categories:

- Managing Cost Risk (Section 7.2.4.8.1)
- Managing Revenue Risk (Section 7.2.4.8.2)
- Managing Environmental and Safety Risk (Section 7.2.4.8.3)
- Managing Contractual Risk (Section 7.2.4.8.4)

7.2.4.8.1 – Managing Cost Risk

For the 16 interviewees representing oil and gas operators and the supply chain who supported the notion that well plugging and abandonment should

start prior to CoP, the main reason given was to minimise costs for oil and gas decommissioning, specifically the time between CoP and the removal of the facility. According to a current decommissioning manager with 30 years' experience in managing oil and gas decommissioning projects in the United Kingdom and Norway:

> *What we aim to do is that we will aim to complete well plugging and abandonment operations mostly when this platform is still producing. If you are not starting well P&A operations until after you stopped production, essentially what you have done is you have probably doubled the cost. The most significant part of your decommissioning cost, you have probably doubled it.*
>
> *If you don't start well plugging and abandonment until after cessation of production, let's say the well turn out to be really difficult and the rig breaks down, what happens now? It gets even worse. Not starting well plugging and abandonment until after cessation of production is like playing roulette. You are taking an enormous risks. If you plan on 20 days per well, and 20 days per well turn out to be 30 days per well or 40 days per well and the rig breaks down, it gets much longer, and the costs are doubled, because you are carrying the whole burden. You are no longer producing, your best producing wells by that time would have stopped producing. So, you are now sitting there with a very very expensive facility that is getting older, and you are still out there because you have to do plugging and abandonment.*
>
> *– A current decommissioning manager with 30 years' experience in managing oil and gas decommissioning projects in United Kingdom and Norway*

This finding suggests that the longer the delay in starting well plugging and abandonment, the more costly oil and gas decommissioning will be, because it will result in more maintenance costs (i.e. operational and abandonment expenditure) during the period between cessation and production and the removal of the facility.

A current wells contractor with 31 years' experience in the oil and gas industry added to this debate by providing the author with an idea of the cost of maintenance, stating that:

> *One of the costs you want to minimise is the period of time the facility remains out there being maintained after you have stop production. And you'll stopped production at the point when you feel that this isn't making any money anymore. But you have now gone into a phase which is the equivalent of 0 dollars per barrel, because there is no revenue. And it cost about for a major Northern North Sea platform here in the UK sector, it cost about* ***50 million pounds sterling a year*** *to keep that platform maintained, just to keep it standing up. So, that is a lot of cost to add to the decommissioning.*
>
> *– A current wells contractor with 31 years' experience in the oil and gas industry*

Considering that the average cost of decommissioning an oil and gas facility in the UK Northern North Sea sector is approximately 250 million pounds (OGUK 2019), 50 million pounds is a significant amount. This suggests that oil and gas operators should, when planning oil and gas decommissioning activities, pay close attention to the costs associated with maintaining the facility (i.e. operational and abandonment expenditure) during the period between CoP and the removal of the facility.

7.2.4.8.2 – Managing Revenue Risk

With regard to the two interviewees who supported the idea that well plugging and abandonment should start after CoP, their rationale is based on the cash flow diagram of an oil and gas facility lifecycle. **Figure 7-6** (below) illustrates an example of a cash flow diagram of an oil and gas lifecycle.

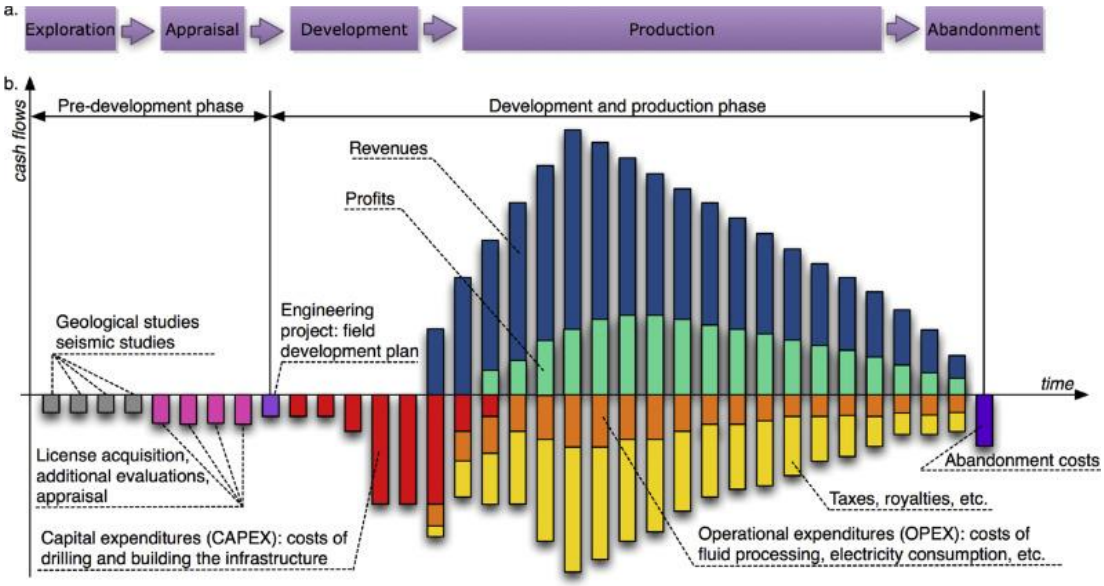


Figure 7-6 – Cash Flow Diagram of an Oil and Gas Lifecycle (Suslick & Furtado 2001)

The revenue from an oil and gas facility comes from the production of hydrocarbons through the wells (Pongsiri 2004; Johnson 2013). Thus, the earlier the wells get plugged and abandoned, the less the revenue will be generated when considering the entire oil and gas facility lifecycle.

According to a decommissioning consultant with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

> *There is a real driver to optimise that period of time between ceasing production where there is no revenue and removing, which again intuitively will tell you that you'll try and abandon as many wells as you can before you cease production, and that would be the rule of thumb I would guess. That would be a good starting point as an assumption.*
>
> *But I would say that it is an assumption that needs to be challenged, because what we see are some platforms that have multiple wells that are producing. So, what you'll do is that you will continue to produce which pushes out the life and extends the date towards cessation of production, then you abandon the well.*
>
> *If you do the economic analysis, it is actually a better answer to keep producing, and not do the plugging and abandonment until you cease production.*
>
> *– A decommissioning consultant with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

This finding suggests that the longer the delay in starting well plugging and abandonment, the more revenue the oil and gas operator will obtain from production.

7.2.4.8.3 – Managing Safety Risk

An interesting insight provided by three interviewees, an oil and gas operator, a wells contractor, and a regulator, is that that well plugging and abandonment should start as soon as possible in order to lower the safety risks to offshore employees on the oil and gas facility. This suggests that offshore employees are potentially influencing stakeholders when it comes to decisions regarding well plugging and abandonment. According to a current decommissioning manager with 30 years' experience of managing oil and gas decommissioning projects in the United Kingdom and Norway:

> *It is not good practice to sit on a platform with 30 idle well slots, because these wells are still connected to the reservoir, and if something corrodes and then fails, you are causing risks to your employees…In fact, the regulator would encourage us to do that because it is safer, we are isolating the reservoir…That is one of the major lessons learnt about decommissioning from our experiences. Not managing down the number of idle wells is one major mistake that people make.*
>
> *– A current decommissioning manager with 30 years' experience in managing oil and gas decommissioning projects in the United Kingdom and Norway*

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 19), failure and corrosion of wells can not only jeopardise the safety of offshore employees, but they can also result in environmental issues (Vrålstad et al. 2019). The fact that only safety risks were mentioned when discussing the timing of well plugging and abandonment suggests that offshore employees are more important to the oil and gas industry than are environmental stakeholders.

The prioritisation of the safety of offshore employees over the concerns of environmental stakeholders could also be a possible explanation as to why well plugging and abandonment activities in the United Kingdom are being primarily regulated by the HSE (Health and Safety Executive) instead of the BEIS (the Department of Business Energy and Industrial Strategy) (formerly the Department of Energy and Climate Change (DECC)). As suggested by the names of the respective regulatory departments, the HSE appears to be more focused on safety while BEIS appears to be more focused on the environment.

7.2.4.8.4 – Managing the Risk of Breach of Contract

Yet another interesting insight mentioned by four interviewees representing both oil and gas operators and the supply chain of the United Kingdom, is that starting well plugging and abandonment earlier will reduce the risk of breach of contract. As commented by a current decommissioning manager with 30 years' experience of managing oil and gas decommissioning projects in the United Kingdom and Norway:

> *Another problem is that assuming you have a contractor that you have awarded the contract to get this vessel, and you promised that he could remove the platform by 2022, if you are not ready by 2022, he is going to charge you. He is going to say 'I have priced that job at 2022, if you want me to come in at 2023 because you are not ready, you have breached the contract, and therefore I want some more money'.*
>
> *One of the major things of a decommissioning project is managing the interfaces between production wells and removal. The removal contractor likes to have, he likes to know when his vessel is needed, because he might be moving from another part of the world, or he might be choosing not to take on additional work because he has made a commitment to you three years in advance. The problem is if you are not ready for his vessel, he doesn't get the revenue that he planned for, because he gets paid only after he does the removal. And he is now left with his vessel unable to work, no revenue for him, and too late to get another work. So, he is going to want to be compensated. So, that will cost you more as well. Some of that could be mitigated through the contract, but it is not good business to not be ready when the contractors are meant to be coming.*
>
> *– A current decommissioning manager with 30 years of experience of managing oil and gas decommissioning projects in the United Kingdom and Norway*

The challenge of managing the interfaces between well plugging and abandonment and facility removal was mentioned as part of the "knock-on effect" described by Gordon, Paterson and Usenmez (2018b). According to Gordon, Paterson and Usenmez (2018b), a typical oil and gas decommissioning project has a suite of contracts:

- Well Plugging and Abandonment
- Dismantling of Topsides
- Heavy Lift and Transportation
- Disposal Onshore
- Ongoing Monitoring

As described by Gordon, Paterson and Usenmez (2018b), a breach in contract for well plugging and abandonment may result in a cascading chain of events in subsequent activities (Dismantling of Topsides, Heavy Lift and Transportation, Disposal Onshore, and Ongoing Monitoring). This is the phenomenon termed a “knock-on effect”.

During the course of this research, in 2019, there were several innovative contractual models that surfaced in industry literature in an attempt to mitigate contractual risks. The various solutions can be summarised by a diagram published by Whittaker, Oudenot and Vasquez (2019), as reproduced in **Figure 7-7** (below, page 323).

Many of the contractual models are newly proposed and as yet untested, and there is currently no right answer as to which contractual model would be best for oil and gas decommissioning. This finding presents an excellent opportunity for further academic research in the area of commercial law, to develop and test contractual models for oil and gas decommissioning.

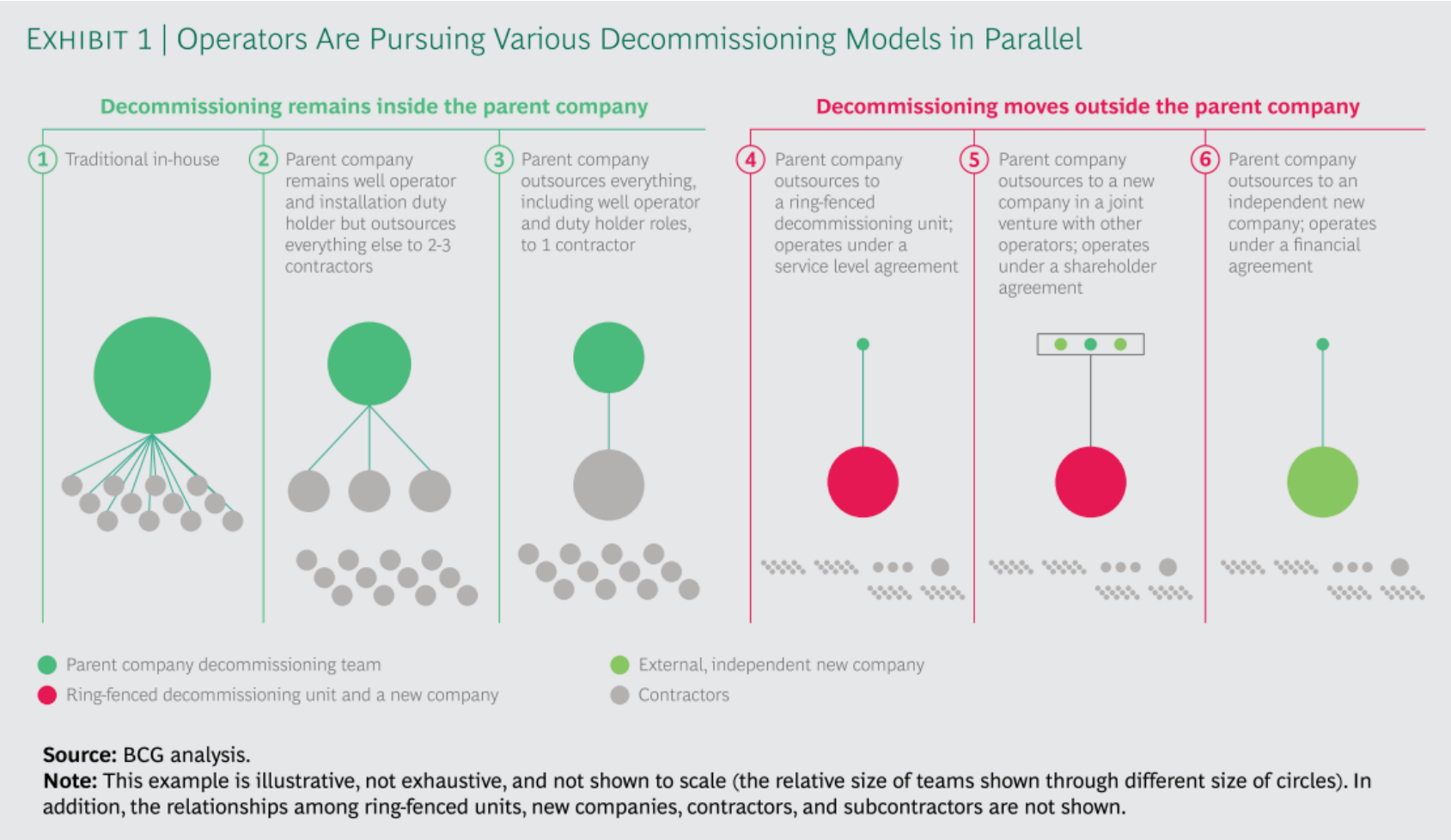


Figure 7-7 – A Summary of Contractual Models Proposed by the United Kingdom Industry for Oil and Gas Decommissioning (Whittaker, Oudenot and Vasquez 2019)

7.2.4.8.5 – Selecting the Right Time to Start Well Plugging and Abandonment

Based on the discussion above **Sections 7.2.4.8.1** to **7.2.4.8.4**, the findings suggest that the right time to start well plugging and abandonment is determined by the management of risks. In order to determine the right time to start well plugging and abandonment for the stakeholder-oriented critical paths, as recommended by an interviewee, simple risk profiles were developed by the author using the qualitative data obtained from the interviews. The risk profiles, as presented in ***Appendix N*** (see pages 626 and 627), compares the risks of starting well plugging and abandonment before and after CoP. The risk profiles can be a useful addition to the stakeholder-oriented critical paths, adding value by showing the possible alternatives to scheduling oil and gas decommissioning activities

While the author acknowledges that the robustness of this risk profile is questionable, because it is done qualitatively rather than quantitatively, it could still serve as a useful guiding tool for future project managers to use when managing oil and gas decommissioning activities. This finding also highlights an opportunity to conduct a risk analysis of all decisions throughout the entire oil and gas decommissioning lifecycle.

By comparing the two risk profiles in ***Appendix N***, it can be seen clearly that the overall risk profile is more favourable if well plugging and abandonment commences prior to CoP. As such, for the stakeholder-oriented critical paths developed in this research, the well plugging and abandonment activities will be scheduled to begin prior to CoP.

When presented with the risk profiles, a current wells contractor with 31 years' experience in the oil and gas industry commented that:

> *You might say that the risk is quite low if you've got a platform derrick, and if you'll have all the facilities on the platform. But you might say that the risk is medium if what I really need is a semi-sub to go and abandon subsea wells.*
>
> *You can't get a semi-sub next year (2019) in the UK. There are no rigs left. You can get a jack-up, there is loads of jack-ups that you can go and get. So, for the shallow water stuff it is not an issue next year. But already there is no semi-subs available for next summer. So, and the year after, by this time next year, I think the situation will be worse, you might have to wait two years to get a rig.*
>
> *- A current wells contractor with 31 years' experience in the oil and gas industry*

This finding suggests that the stakeholder-oriented critical paths will differ depending on the design of the facility and the location of the facility.

From a stakeholder management perspective, this finding suggests that the level of impact and influence of supply chain stakeholders depends on the capacity of the supply chain. Thus, it would be beneficial for oil and gas operators to conduct market research early in order to understand the capacity of the supply chain prior for making decommissioning decisions.

From a regulatory perspective, it can be beneficial for emerging oil and gas decommissioning markets to develop policies for and encourage growth in the capacity of the supply chain in order to meet the growing demand for oil and gas decommissioning products and services.

7.2.4.8.6 – Idle Wells – United Kingdom vs. Australia and South-East Asia

As mentioned by the current decommissioning manager with 30 years' experience of managing oil and gas decommissioning projects in the United Kingdom and Norway, having idle wells is not considered good practice in the industry. However, a very intriguing finding during the Australian part of the research is that the phenomenon idle wells is common not only in Australia, but also throughout South-East Asia.

According to a current project manager with 20 years' experience in the Australian oil and gas industry:

> *Balnaves wells are still there. All the subsea infrastructures are gone, all the FPSOs are gone. They were removed in 2016-2017. But the wells still need to be P&A. So that is another one of the wells we are looking at. So, when and how we are going to P&A those wells is part of our P&A portfolio. We will be doing P&A for Balnaves in the future. We haven't locked in a date for that yet, but again we currently have a project team looking at when we will need to do it and how we are going to do it.*
>
> *– A current project manager with 20 years' experience in the Australian oil and gas industry*

Similarly, a suite of industry literature that surfaced in recent years indicated that idle wells are common in Malaysia (Yusof, Ros & Omar 2018; Jean Christophe, Jimmy & Mohamed Izzat Mohamed 2018; Rusman et al. 2019; Haryanto et al. 2019) and Thailand (Silakorn et al. 2019; Sirirattanachatchawan et al. 2019).

A possible reason for this phenomenon across Australia and South East Asia is the technical issues encountered during well plugging and abandonment operations. A current decommissioning engineer who has 22 years' experience in the Australian oil and gas industry recounted the experience on a well plugging and abandonment campaign in the North-West Shelf region:

"In 2016/17, we brought a jack-up rig to plug and abandon the wells and we had some technical issues at the upper levels. Not the reservoir, the reservoir was fine, but on the upper levels. So, we didn't complete it…it has been left idle till today…we are actually going to start plugging the wells in three days' time…other operators also had technical difficulties on upper level gasses that we had."

– A current decommissioning engineering with 22 years' experience in the Australian oil and gas industry

A revisit to the literature finds that the type of oil and gas reservoir differs depending on location (Ehrenberg, Nadeau & Aqrawi 2007; Rezaee, Ilkhchi & Barabadi 2007; Khalifeh & Saasen 2020). For example, oil and gas reservoirs in the Middle East are typically limestone reservoirs, which are made up of brittle rocks that easily fracture (Ehrenberg, Nadeau & Aqrawi 2007). Shale reservoirs, which are currently in abundance in the United States, have lower porosity and permeability than limestone and sandstone reservoirs, which means that unless shale reservoirs are fractured, fluids are less likely to flow in shale reservoirs (Rezaee, Ilkhchi & Barabadi 2007). Also stated in many well engineering literature, such as Khalifeh and Saasen (2020), different reservoirs have different well plugging and abandonment challenges.

Hydrocarbon reservoirs in Australia and South East Asia contain more dolomite than hydrocarbon reservoirs in the United Kingdom (Rezaee, Ilkhchi & Barabadi 2007). It is possible, then, that wells in Australia and South East Asia could be more difficult to be plug and abandon than wells in the United Kingdom. However, as the oil and gas industry of Australia and South East Asia are much younger (Barrymore & Ballard 2019; Laister & Jagerroos 2018), it cannot be ruled out that the phenomenon of idle wells could be because there is still a lack of experience in well plugging and abandonment in these less mature landscapes.

7.2.4.9 – Similarities in Design of Oil and Gas Structures

Another interesting finding from the interview data is that there appears to be a debate between oil and gas operators and the regulators regarding the similarities in the design of oil and gas structures. According to a current decommissioning engineering manager with 20 years' experience in the UK oil and gas industry:

> *Generally speaking all the assets are very similar. They may be specific differences between the assets, certain assets have a different design so they may look different with regards to the structures. But generally speaking most of the steel piled jackets are all very similar. And most of the topsides are very similar in design*
>
> *Generally speaking in my personal view, steel piled jackets, and normal modularised topsides have the same approach with regards to decommissioning them. They are organisations that pull together all lessons learnt and try to create a more standardised approach to the whole decommissioning market.*
>
> *All assets in the same field are generally similar in design, being installed in a similar manner, and will be removed in a similar manner as well. Environmental data and fishing data within the field are similar for all assets in the field. And probably the Comparative Assessment of will lead to the same outcome.*
>
> *– A current decommissioning engineering manager with 20 years' experience in the UK oil and gas industry*

Firstly, this finding validates the finding from the case studies in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, that the precise decommissioning methodology, in general, is dependent on the type of structure. Secondly, as suggested by the current decommissioning engineering manager with 20 years' experience in the UK oil and gas industry, this raises the question of the need to use multi-criteria decision-making tools to justify the precise decommissioning method if oil and gas decommissioning cases, in general, is dependent on the type of structure. More details regarding the use of multi-criteria decision-making tools to regulate oil and gas decommissioning will be discussed in ***Chapter 10: Regulatory Impact on Project Performance***.

The similarities in the design of oil and gas structures are also evident in the Australian landscape, which suggests that this phenomenon is true across multiple different oil and gas landscapes. According to a current decommissioning engineering with 22 years' experience in the Australian oil and gas industry:

> *Quadrant's assets around Bessieres Island are very similar to Chevron's assets on Thevenard Island…Onshore, again there are similarities between Chevron's onshore assets on Thevenard Island and Quadrant's assets on Airlie Island.*
>
> *– A current decommissioning engineering with 22 years' experience in the Australian oil and gas industry*

While there seems to be a consensus among oil and gas operators globally that oil and gas structures are similar, when the was put forward by the author to the regulators, a regulator with six years' experience of regulating oil and gas decommissioning activities in the United Kingdom commented that:

> *Operators may say that, but that is not necessarily true…I know operators are making these claims, but they maybe only have done one or two programme. But by all means that is not correct… If they can find us a pipeline that is identical to each other, or platforms that are identical to each other. I have not seen one and I have been doing this for six years…No programme is the same. Even a pipeline from start to finish is not exactly the same. Sometimes it's buried. Sometimes it is on the seabed. That is certainly not something that we would accept…We have been quite clear with them [operators], but obviously they [operators] are not listening.*
>
> *– A regulator with six years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

The most important thing to note is that when the oil and gas operators commented on this phenomenon, they used the word "similar". The regulators, however, used the word "identical". This suggests that there is a difference in opinion regarding the acceptable level of similarity of oil and gas structures for them to have precisely the same decommissioning method.

As suggested by the quotation from the regulator with six years' experience of regulating oil and gas decommissioning activities in the United Kingdom, regulators have more experience of being involved in multiple oil and gas decommissioning projects with multiple different oil and gas operators. However, the oil and gas operators themselves are the ones that understand their oil and gas facilities the best because they are the ones who operate those oil and gas facilities. This means that while regulators have much more experience regulating oil and gas decommissioning, oil and gas operators have much more knowledge of the design and specification of the oil and gas structures themselves.

This finding highlights an opportunity for co-creation of knowledge between oil and gas operators and regulators in order to enhance their mutual understanding of the relationship between the design of oil and gas structures and the precise method of their decommissioning. If there is a clear relationship between the design of oil and gas structures and the precise method of their decommissioning, such information could be used to streamline the regulatory process for oil and gas decommissioning. If there is no distinct relationship between the design of oil and gas structures and the precise method of their decommissioning, such information could also be useful for oil and gas operators to justify to their top management teams of the need to conduct additional surveys and studies.

7.2.4.10 – List of Project Activities, Milestones and Deliverables

All 16 interviewees representing oil and gas operators and the supply chain from the United Kingdom, agreed that with regard to the process of decommissioning the oil and gas facility itself, in general, the main project activities, milestones and deliverables, are the same. This suggests that it is highly likely that the three initial stakeholder-oriented critical paths can be combined into one single design. This finding could also explain why L2P2, the OGA Decommissioning Roadmap, and the OGUK Work Breakdown Structure, have just one design. This finding will be taken into consideration when modifying the stakeholder-oriented critical paths.

During the Australian part of the research, where semi-structured interviews were conducted to develop the robust Australian stakeholder-oriented critical paths from the robust UK stakeholder-oriented critical paths, all nine interviewees representing oil and gas operators and the supply chain from both UK and Australian landscapes stated that the stakeholder-oriented critical paths will differ between the UK and Australian landscapes due to difference in the regulatory process. According to a current decommissioning manager with 33 years' experience in both the UK and Australian oil and gas industries:

> *In general, the main activities will be the same. But from my experience, the stakeholder-oriented critical paths for UK and Australia will be different…….I believe a main part is regulations. The regulations are very different here in Australia. You have a Commonwealth system, and the state system. For example, the Comparative Assessment is a requirement for decommissioning to be approved in the UK, whereas here in Australia it is only a guideline. So, that may results in a change in activities.*
>
> *– A current decommissioning manager with 33 years' experience in both the UK and Australian oil and gas industries*

This suggests that regulatory stakeholders are impactful and influential as they can affect the list of project activities, milestones and deliverables of an oil and gas decommissioning project or programme. This means that governments should consider how policies influence the cost, schedule, and scope of oil and gas decommissioning projects or programmes when implementing policies. More details on how regulations and guidelines influence oil and gas

decommissioning projects will be discussed in ***Chapter 10: Regulatory Impact on Project Performance***.

7.2.4.11 – Variation in Duration of Project Activities

There is no consensus among the 28 interviewees representing oil and gas operators and the supply chain of both the United Kingdom and Australia with regard to the duration of any of the project activities. This suggests that there is a very high level of uncertainty when it comes to an oil and gas decommissioning project or programme schedule. This also suggests that several assumptions must be made when designing the stakeholder-oriented critical paths.

A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry commented on this phenomenon, stated that:

> *It is very difficult…we are very bad at standardising things offshore. Everybody's platform is different, everybody has a different way of doing stuff. So, they are all different.*
>
> *I would say a year, if you speak to Interviewee A, he may say six months. If you speak to Interviewee B, he may say 18 months.*
>
> *It is just because people have different experience in doing things and the way they approach things. So, there is no right answer here, and I don't think there is.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This suggests that the stakeholder-oriented critical paths differ depending on the experience and corporate process of the oil and gas company. This also suggests that decommissioning decisions are highly influenced by past experiences.

7.2.4.11.1 – Duration of the OSPAR Consultation Period

One of the most mentioned issues, which was raised by six of the interviewees representing oil and gas operators and the supply chain of the United Kingdom is that there is major uncertainty regarding the duration of the OSPAR consultation period. As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning***, any oil and gas decommissioning proposal that wishes to apply for derogation would be subjected to OSPAR consultation. According to Paragraph 8 in Annex 3 of OSPAR Decision 98/3:

> *The competent authority of the relevant Contracting Party may take a decision to issue a permit at any time after:*
>
> *a. the end of 16 weeks from the date of despatch of the copies under paragraph 2, if there are no objections at the end of that period;*
>
> *b. the end of 22 weeks from the date of despatch of the copies under paragraph 2, if any objections have been settled by mutual consultation under paragraph 4;*
>
> *c. the end of 24 weeks from the date of despatch of the copies under paragraph 2, if there is no request for a special consultative meeting under paragraph 5;*
>
> *d. receiving the report of the special consultative meeting from the chairman of that meeting.*
>
> *– Paragraph 8, Annex 3, OSPAR Decision 98/3*

This suggests that there is no fixed duration of the OSPAR consultation period. However, according to the six interviewees, reasons for the uncertainty in the duration of the OSPAR consultation period are due much more to the queue system for derogation review rather than the risk of potential objections by other OSPAR contracting parties. According to a decommissioning engineering manager with 30 years' experience in the oil and gas industry:

In actual fact, it will be significantly more than that. Because there is this funnel that you need to go into. So, you got to queue. So, the Brent decommissioning programme was just submitted to OSPAR for approval. So, if we submit Cormorant Alpha now, we will need to wait for Brent to get approved, or rejected, before our 120 days of approval period begins

– A decommissioning engineering manager with 30 years' experience in the oil and gas industry

A queue system in the regulatory process will increase the risk of oil and gas decommissioning proposals not being approved when the oil and gas facilities are ready to be removed. As mentioned earlier in **Section 7.2.4.8.1** (see page 316), the cost of maintaining oil and gas facilities during the time between CoP and the removal of the facility is extremely expensive. This means that a queue system in the regulatory process drives up the overall oil and gas decommissioning spending in the region. It would, therefore, be a significant improvement if derogation cases could be reviewed in parallel rather than sequentially by the OSPAR committee.

A possible explanation for a queue system is that the OSPAR committee has limited capacity to review derogation cases throughout the North-East Atlantic. This suggests that it is important for regulators to ensure that they have sufficient capacity to manage the increase in oil and gas decommissioning activities in their jurisdiction.

7.2.4.12 – Overall Length of an Oil and Gas Decommissioning Project or Programme

Another debate that arose from the interview data is the disagreement regarding the overall length of an oil and gas decommissioning project or programme. According to a current decommissioning manager with 20 years' experience in the UK oil and gas industry:

> *10 years is maximum for a decommissioning project. Any project that takes more than 10 years becomes a nuclear industry project.*
>
> *– A current decommissioning manager with 20 years' experience in the UK oil and gas industry*

This suggests that a lengthy schedule is not ideal for an oil and gas decommissioning project or programme. However, a more senior industry representative, with 40 years' experience in oil and gas decommissioning globally, commented that:

> *For a traditional construction project, it is all about schedule, because you have "first oil", so you are willing to pay a lot of money to get it quicker.*
>
> *Whereas in decommissioning, it is better to allow it to take longer, so that it can save you money, or accelerate it.*
>
> *It is all about schedule optimisation with a view to reduce cost as opposed to schedule optimisation to minimise overall time. So that is one thing that we realise is that the real driver for the project changes.*
>
> *Traditional project is "schedule", "cost" in the Tornado Chart is probably number five or six.*
>
> *– A project manager with 40 years' experience in oil and gas decommissioning globally*

This suggests that the schedule is not a good key performance indicator for the measurement of the success of an oil and gas decommissioning project or programme. From a regulatory perspective, this suggests that placing an obligation on oil and gas operators to decommissioning their oil and gas facilities within a specific timeframe could potentially drive up the cost of decommissioning.

Another interviewee added another dimension to the debate, stating that

> *I have done a project from start to finish in 18 months. That was 10 years ago. For whatever reason now, we are struggling to do things in that time. We really struggle, we take three years, four years, because everybody has got an opinion, everybody wants to know about all the stuff, everybody tries to demonstrate what they could add to the value of the project, everybody got an opinion.*
>
> *But, all the talking talking talking that's a lot of time. And then when they decide what to do, and then only they do it. But the problem there is the whole other value lost in NPV [net present value] terms in all that talking phase. The company that I was working for at the time was just worried about getting money in the door, because every day lost is a day lost in NPV.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This suggests that over engaging stakeholders can have a negative impact on a project. This finding also highlights the importance of stakeholder mapping and prioritisation, such that organisations can ensure efforts are placed on engaging the right stakeholders.

7.2.4.13 – Single or Multiple Proposals?

Another interesting finding from the interview data is that most oil and gas decommissioning projects or programmes in the United Kingdom adopt a single proposal approach, whereas most oil and gas decommissioning projects or programmes in Australia adopted a multiple proposals approach.

One possible explanation, as mentioned by a current decommissioning engineering with 22 years' experience in the Australian oil and gas industry, is that:

> *If you can guarantee that everything is going to go smoothly, it is better to do it together. But as our well plugging and abandonment has illustrated. Doing it together has high risk. Because if something doesn't go right, you won't have any lag time before you have to go into your next package because you already started on your next package. We would have been in a lot of pain if we would have done it all together.*
>
> *– A current decommissioning engineering with 22 years' experience in the Australian oil and gas industry*

This suggests that the preference for a multiple-proposals approach is also due to the management of risks. As explained earlier in **Section 7.2.4.8** (see page 315), the management of risks is often linked to the management of stakeholders. The management of safety risks, for example, as discussed in **Section 7.2.4.8.3** (see page 320), can be linked to the management of offshore employees. It is possible, then, that the difference in preference in approach between the United Kingdom and Australia is due to the difference in stakeholder landscapes.

Another comment by a current decommissioning manager with 33 years' experience in both the UK and Australian oil and gas industries, was that:

> *I know one client, they only done the well plugging proposal by itself, because you are allowed to do that in Australia. Whereas in the UK, you must submit it as an entire programme including well plugging and abandonment and decommissioning.*
>
> *– A current decommissioning manager with 33 years of experience in both the UK and Australian oil and gas industries*

From a stakeholder management perspective, this finding suggests that regulatory stakeholders are the most influential when it comes to making the decision whether to undertake the oil and gas decommissioning project using a single or multiple proposals approach. From a regulatory perspective, this finding suggests that regulations and guidelines have a definite influence on the decisions made by oil and gas operators when managing oil and gas decommissioning projects or programmes. It also suggests that regulators could learn from experience in other jurisdictions as to whether their current way of doing things is necessarily the best.

7.2.5 – Modifying the Stakeholder Oriented Critical Paths – United Kingdom

Taking into consideration the modifications, rationales, and recommendations from the interviewees who worked on the stakeholder-oriented critical paths, the initial stakeholder-oriented critical paths were modified using Microsoft Project in order to develop the robust stakeholder-oriented critical path for the United Kingdom. A stakeholder-oriented critical paths modification log can be found in ***Appendix O*** (see page 628)**.** By the end of the development process, the three initial stakeholder-oriented critical paths were combined into a single design. At the end of the development process, one robust stakeholder-oriented critical path was produced to represent the UK oil and gas decommissioning landscape. The robust UK stakeholder-oriented critical path can be found in ***Appendix P*** (see pages 634 to 639).

7.2.5.1 – Combining the Three Initial Stakeholder Oriented Critical Paths into a Single Design

As mentioned earlier in **Section 7.2.4.10** (see page 331), all 16 interviewees representing oil and gas operators and the supply chain in the United Kingdom, agreed that with regard to the process of decommissioning the oil and gas facility itself, in general, the main project activities, milestones and deliverables are the same. In addition, four of the interviewees, representing the oil and gas operators and the supply chain in the United Kingdom, immediately criticised the idea of having multiple initial stakeholder-oriented critical paths based on the precise decommissioning option. For example, according to a current stakeholder manager:

> *There is no such thing as a full leave in place, and not everything can be removed either. Basically, on all platforms, the topsides have to come off, and you have to clean up everything. Pipelines, generally Leave-In-situ.*
>
> *So, it is only Partial Leave-In-situ, or Partial Removal. So, it is only this one*
>
> *– A current stakeholder manager with 10 years in the oil and gas industry*

Consequently, a decision was made by the author to combine the three initial stakeholder-oriented critical paths into a single design.

As mentioned in ***Chapter 5: Research Methodology*** (see page 160), the stakeholder-oriented critical paths are a research artefact for project managers. Having one single design would make the framework simpler and easier to use by the project managers. Furthermore, having a single design would also make the framework consistent with the existing industry frameworks such as L2P2, the OGA Decommissioning Roadmap, and the OGUK Decommissioning Work Breakdown. As noted in the literature, consistency can make the result more acceptable to the targeted audience (Beck, Rose & Hensher 2013; Gabbay, Rodrigues & Russo 2010). Hence, having the same number of designs as existing industry frameworks can improve their acceptability.

7.2.5.2 – Finalising the List of Project Activities, Milestones and Deliverables

The list of project activities, milestones and deliverables stabilised by the third interview. Approximately 80% of the list of project activities, milestones and deliverables deduced from the case studies are included in the final list of project activities, milestones and deliverables. This suggests that the information found in the case studies is approximately 80% accurate.

There were some project activities, milestones and deliverables that were removed. For example, a stakeholder manager with 10 years' experience in the oil and gas industry removed one activity:

> *All topsides have to come off. A Comparative Assessment is not required. It is just not required for the Offshore Decommissioning Unit.*
>
> *– A stakeholder manager with 10 years' experience in the oil and gas industry*

There were also new project activities, milestones and deliverables that were added. For example, a current decommissioning manager with 20 years' experience in the UK oil and gas industry added two activities:

> *The decommissioning strategy right at the beginning…and an area decommissioning plan…that is a requirement from Oil and Gas Authority that you need to do that*
>
> *– A current decommissioning manager with 20 years' experience in the UK oil and gas industry*

In terms of the number of project activities, milestones and deliverables, the total has increased to 98, as illustrated in **Table 7-10** (below):

Table 7-10 – A Comparison of Lists of Project Activities, Milestones and Deliverables between the Initial and Robust Stakeholder-Oriented Critical Paths of the United Kingdom

Stakeholder Oriented Critical Path	**No. of Project Activities, Milestones and Deliverables**
Initial – Leave-In-Place	70
Initial – Partially Leave-In-Place	72
Initial – Complete Removal	72
Robust – United Kingdom	98

This finding suggests that homogeneity of the stakeholder-oriented critical path can be achieved at a more detailed level than was originally thought when conducting the case studies. This finding also suggests that approximately 26% of project activities, milestones and deliverables that take place in an oil and gas decommissioning project or programme are not found in the decommissioning proposal documents. Future research in oil and gas decommissioning should bear this in mind when considering the use of case studies.

As mentioned in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** (see page 254), several assumptions have to be made when deducing the list of project activities, milestones, and deliverables for the modelling of the initial stakeholder-oriented critical paths. Hence the list of assumptions made when deducing the list of project activities, milestones, and deliverables for the modelling of the initial stakeholder-oriented critical paths to be carried forward for modelling the robust stakeholder-oriented critical path for the United Kingdom. The list of assumptions can be found in ***Appendix E*** (see page 589).

7.2.5.3 – Finalising the Duration of Project Activities

As mentioned in **Section 7.2.4.11** (see page 332), there is no consensus among all 28 interviewees from both the United Kingdom and Australia regarding the duration of project activities. Hence, stabilisation was not achieved for the duration of project activities. This suggests that there is a high level of uncertainty when it comes to the schedule of an oil and gas decommissioning project or programme.

So, several assumptions had to be made based on the interview data in order for the stakeholder-oriented critical path to be modelled. The assumptions were made by selecting the most mentioned response by the interviewees. For example, as 30 days was the most mentioned duration by the interviewees for the time required for the plugging and abandoning of one well, 30 days is assumed to be the total duration of the plugging and abandonment of one well in the robust stakeholder-oriented critical path for the United Kingdom.

7.2.5.4 – Finalising the Dependencies between Project Activities

Similar to the list of project activities, milestones, and deliverables, the dependencies between project activities also stabilised by the third interview. This suggests that many of the deductions made during the case studies are correct.

As mentioned in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, several assumptions have to be made when deducing the dependencies between project activities. Hence the list of assumptions made when deducing the dependencies between project activities for the modelling of the initial stakeholder-oriented critical paths are carried forward for the modelling the robust stakeholder-oriented critical path for the United Kingdom. The list of assumptions can be found in ***Appendix E*** (see page 589).

7.2.6 – Modifying the Stakeholder-Oriented Critical Path – Australia

Taking into consideration the modifications, rationales, and recommendations from the interviewees who worked on the stakeholder-oriented critical paths, the robust UK stakeholder-oriented critical path was modified using Microsoft Project in order to develop the robust stakeholder-oriented critical path for Australia. A stakeholder-oriented critical paths modification log can be found in ***Appendix O*** (see page 628). At the end of the development process, a robust stakeholder-oriented critical path was produced to represent the Australian oil and gas decommissioning landscape. The robust Australian stakeholder-oriented critical path can be found in ***Appendix P*** (see pages 634 to 639).

7.2.6.1 – Finalising the List of Project Activities, Milestones and Deliverables

The list of project activities, milestones and deliverables had stabilised by the second interview. As observed in **Appendix W** (see page 658), this was because there was an interviewee who worked on the stakeholder-oriented critical path for a total of 240 minutes.

Overall, the only modifications made were the removal of regulatory engagement activities not applicable in Australia. This suggests that the difference between the UK and Australian landscapes, in terms of oil and gas decommissioning, is primarily regulatory.

An example from the list of project activities, milestones and deliverables that were removed is the regulatory engagement activities related to the MER Strategy. According to a semi-retired decommissioning consultant with 40 years' experience working in the oil and gas industry in multiple locations globally:

We don't have MER here in Australia, so many of these activities like engaging the OGA for collaboration doesn't happen here in Australia, neither is this Area Decommissioning Plan needed.

– A semi-retired decommissioning consultant with 40 years' experience working in the oil and gas industry in multiple locations globally

Due to the removal of several regulatory-related activities, the total number of project activities, milestones and deliverables, has decreased from 98 to 86, as illustrated in **Table 7-11** (below).

Table 7-11 – A Comparison of List of Project Activities, Milestones and Deliverables between the Robust United Kingdom and Australian Stakeholder-Oriented Critical Paths

Stakeholder Oriented Critical Path	Number of Project Activities, Milestones and Deliverables
United Kingdom	98
Australia	86

As these 12 activities are related to regulatory engagement activities, this finding suggests that regulatory stakeholders are perhaps less influential and impactful on decommissioning decisions in Australia than they are in the United Kingdom. More details regarding the robust stakeholder-oriented critical paths will be discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***.

The list of assumptions made when deducing the list of project activities, milestones and deliverables for the modelling the robust stakeholder-oriented critical path for the United Kingdom, minus the ones related to Maximising Economic Recovery, were also used for modelling the robust stakeholder-oriented critical path for Australia. Additional assumptions were also made in order to consider the regulatory differences in the Australian landscape. A list of these assumptions can be found in ***Appendix E*** (see page 589).

7.2.6.2 – Finalising the Duration of Project Activities

The starting point for the duration of project activities is based on the assumption that they are the same for both the UK and Australian stakeholder landscape. This is because the starting point for the Australian part of the research is the robust UK stakeholder-oriented critical path.

The duration of project activities is then modified, if necessary, based on the modifications, rationales, and recommendations from the interviewee. For example, a lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries, lengthened the schedule for ongoing waste management:

> *I know for the UK, some materials can be transported to Norway. UK also have more disposal sites to deal with NORMs and asbestos…*
>
> *In Australia, we have a lot of NORMs, and in the Timor Sea, it is the second hot spot for mercury after Thailand…*
>
> *In Thailand, because mercury is a big issue even during drilling and exploration, Thailand already have a proper industry set up to deal with the issue of mercury. So, Thailand have a lot of facilities that can deal with mercury. But Thailand is not taking in another country's mercury.*
>
> *So, for Australia, you got to find a country that is willing to accept the mercury. Then you are going to have to work out on how to get the mercury from Australia to that country. So, you got two challenges. Finding someone who is willing to take it, and how to actually get it there…*
>
> *For Australia, we essentially only have France and the United States when it comes to disposal of NORMs[16]…*
>
> *For Balnaves decommissioning, we need to get the radioactive materials from Australia…to the United States…We spent four to five months negotiating permission to bring it into Singapore just for six hours…and the materials have to go through the Suez Canal to the east coast of the United States.*
>
> *– A lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas Industries*

[16] Naturally Occurring Radioactive Materials (NORM) are naturally existing materials found in produced fluids during oil and gas operations.

From a stakeholder management perspective, this finding suggests that the supply chain can have an influence on oil and gas decommissioning decisions. From a project management perspective, it suggests that the capacity of the supply chain can have an influence on the schedule and schedule-related cost of an oil and gas decommissioning project or programme.

Many governments have recognised the issue of lack of capacity and have implemented measures to promote the growth of the oil and gas decommissioning supply chain. For example, the United Kingdom has implemented the Supply Chain Action Plan in 2017 (OGA 2017). Similarly, in Australia, National Energy Resources Australia (NERA) implemented updated their sector competitiveness plan to include oil and gas decommissioning in 2017 (Taylor 2017). Other emerging landscapes such as Malaysia are also following suit, with the establishment of a decommissioning working group within the Malaysian Oil and Gas Services Council, in order to develop local services and expertise (Na et al. 2013).

Overall, information regarding the duration of project activities had stabilised by the second interview. As observed in **Appendix W**, this was because there was an interviewee that worked on the stakeholder-oriented critical path for a total of 240 minutes. Approximately 80% of project activities retained the same duration as the robust UK stakeholder-oriented critical paths. This suggests that in general, the schedule for decommissioning the same oil and gas facility will remain largely the same regardless of location.

7.2.6.3 – Finalising the Dependencies between Project Activities

Information regarding the dependencies between project activities had also stabilised by the second interview. The changes made were to compensate for the reduction in project activities, milestones and deliverables. This suggests that the process of decommissioning an oil and gas facility, in general, is the same regardless of location.

As mentioned in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects***, several assumptions have to be made when deducing the dependencies between project activities. The same list of assumptions was made when modelling the robust stakeholder-oriented critical path for the United Kingdom. Hence, the same list of assumptions is also used for the modelling of the robust stakeholder-oriented critical path for Australia. The list of assumptions made when deducing the dependencies between project activities for the modelling the robust stakeholder-oriented critical path for the United Kingdom, minus the ones related to Maximising Economic Recovery, was also used for the modelling the robust stakeholder-oriented critical path for Australia. Additional assumptions were also made in order to consider the regulatory differences in the Australian landscape. The list of assumptions can be found in ***Appendix E*** (see page 589).

7.2.7 – Addressing the Research Questions

As mentioned in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** (see page 255), Research Questions 1 and 2 will be addressed in this chapter.

7.2.7.1 – Can Stakeholder-Oriented Critical Path(s) be Modelled?

As mentioned in **Sections 7.2.6** (see page 344) and **7.2.7** (see page 349), two robust stakeholder-oriented critical path were produced at the end of the development process, one representing the United Kingdom, and the other representing Australia. This means that stakeholder-oriented critical paths can be modelled.

7.2.7.2 – At What Level of Granularity can Homogeneity for each of the Stakeholder-Oriented Critical Path(s) be achieved?

As mentioned in **Sections 7.2.6** and **7.2.7**, homogeneity can only be achieved for the UK and Australian stakeholder-oriented critical paths when a significant number of assumptions are made. This means that at a highly detailed level (low level of granularity), the stakeholder-oriented critical path will always be different, and homogeneity cannot be achieved.

However, at a lower level of detail (high level of granularity), homogeneity can be achieved for the stakeholder-oriented critical paths, because as mentioned in **Section 7.2.4.10** (see page 331), the process of decommissioning the oil and gas facilities is, in general, the same. This answer is also evident by the ability to produce one stakeholder-oriented critical path each that represents the UK and Australian landscapes respectively. This answer is also supported by the existence of industry frameworks, such as L2P2, the OGA Decommissioning Roadmap, and the OGUK Work Breakdown Structure that strive to represent all oil and gas decommissioning projects or programmes in the United Kingdom.

7.2.8 – Conclusion

Overall, this chapter, in both Part 1 and Part 2, has detailed the findings and recommendations from the development of the stakeholder-oriented critical paths, through case studies and semi-structured interviews. The findings and recommendations in this chapter are summarised into **Tables 7-12** and **7-13** respectively (below, pages 351 to 357)

Table 7-12 – Summary of Findings in Chapter 7: Development of Stakeholder Oriented Critical Paths

Type of Findings	**Description**	**Section in this Chapter where this Finding is Discussed**
Project Management Findings	Activities that takes place prior to the start of a decommissioning project or programme, can also have an influence on the performance of the decommissioning project or programme.	Section 7.1.4.1
	The bulk of oil and gas decommissioning project activities actually begins before the oil and gas facility ceases production.	Section 7.1.4.1
	The onshore dismantling and disposal part of the oil and gas decommissioning project or programme is often overlooked by oil and gas operators.	Section 7.1.4.3
Schedule Management Findings	There is still a lack of understanding by the oil and gas industry of when, relative to the oil and gas lifecycle, should the planning for its decommissioning begin.	Section 7.2.4.4
	The start of an oil and gas decommissioning project or programme, relative to the oil and gas facility's lifecycle, varies depending on the size of the reservoir, and the production performance of the reservoir.	Section 7.2.4.4
	Proper and continuous maintenance of the oil and gas facility is extremely important to minimise the risks involved during oil and gas decommissioning.	Section 7.2.4.5
	The ability to achieve synergies between different oil and gas decommissioning projects is dependent on the ability to align cessation of production dates.	Section 7.2.4.7
	The primary barrier to creating synergies between different oil and gas decommissioning projects is the effectiveness of interactions among internal stakeholders.	Section 7.2.4.7
	It is better practice to start well plugging and abandonment prior to cessation of production.	Section 7.2.4.8
	The longer the delay in starting well plugging and abandonment, the more costly oil and gas decommissioning will be, because it will results in more maintenance cost (i.e. operational and abandonment expenditure) during the period between cessation and production and the removal of the facility.	Section 7.2.4.8.1
	The longer you delay starting well plugging and abandonment, the more revenue the oil and gas operator will obtained from the production.	Section 7.2.4.8.2
	The right time to start well plugging and abandonment is determined by the management of risks.	Section 7.2.4.8.5
	There is a very high level of uncertainty when it comes to oil and gas decommissioning project or programme schedule.	Section 7.2.4.11
	A lengthy schedule is not ideal for an oil and gas decommissioning project or programme.	Section 7.2.4.12
	The schedule is not a good key performance indicator for the measurement of the success of an oil and gas decommissioning project or programme.	Section 7.2.4.12
	In general, the schedule for decommissioning the same oil and gas facility will remain largely the same regardless of location.	Section 7.2.7.2
Scope Management Findings	The process of decommissioning an oil and gas facility is, in general, the same regardless of location.	Section 7.2.7.3
	The list of project activities varies depending on the dependencies of neighbouring oil and gas facilities on the oil and gas facility to be decommissioned.	Section 7.2.5.2
	Cessation of Production is an important milestone for an oil and gas decommissioning project or programme.	Appendix W

Stakeholder Management Findings	When considering the stakeholder landscape in the context of decommissioning it is important to note that they differ depending on location.	Section 7.2.1.2.2
	The stakeholder landscape differs depending on the how dependent neighbouring oil and gas facilities are on the oil and gas facility to be decommissioned.	Section 7.2.4.2
	Proper and continuous maintenance of the oil and gas facility is extremely important to prevent negative stakeholder impact on the oil and gas decommissioning project or programme.	Section 7.2.4.5
	Engaging stakeholders during late-life and ultra-late-life could be deemed as best practice to manage stakeholders for oil and gas decommissioning activities.	Section 7.2.4.6
	Over-engaging stakeholders can have negative impacts on a project.	Section 7.2.4.12
	Oil and gas operators should consider the limitations of the stakeholders (both internal and external) when making decommissioning decisions.	Section 7.2.4.1
Internal Stakeholder Management Findings	Interactions between project managers and top management teams could be some of the most intense throughout the lifecycle of an oil and gas decommissioning project or programme.	Section 7.2.1.1.1
	The reason for the intense interactions between project managers and top management teams is the differences in interests and goals between project management teams and top management teams.	Section 7.2.1.1.1
	Offshore employees are potentially influencing stakeholders when it comes to decisions regarding well plugging and abandonment.	Section 7.2.4.8.3
	Offshore employees are more important to the oil and gas industry than are environmental stakeholders.	Section 7.2.4.8.3
Regulatory Stakeholder Management Findings	An effective regulatory engagement can have a positive impact on project efficiency.	Section 7.2.4.6
	Regulatory stakeholders are more concerned about regulatory engagements than the actual execution of the oil and gas decommissioning process itself.	Section 7.1.4.2
	Regulatory stakeholders are impactful and influential on an oil and gas decommissioning project or programme.	Section 7.2.4.10
	Regulatory stakeholders are the most influential when it comes to making the decision whether to undertake the oil and gas decommissioning project using a single or multiple proposals approach.	Section 7.2.4.13
	Regulatory stakeholders are perhaps less influential and impactful to decommissioning decisions in Australia than in the United Kingdom.	Section 7.2.7.1
	In the United Kingdom, engaging regulatory stakeholders alone could already be challenging because of the multiple operator-regulator interfaces that must be managed.	Section 7.1.4.2
	While regulators have much more experience of regulating oil and gas decommissioning, oil and gas operators have much more knowledge of the design and specification of the oil and gas structures themselves.	Section 7.2.4.9
Supply Chain Stakeholder Management Findings	Effective supply chain engagement during late-life and ultra-late-life can have mutual benefits for both the oil and gas operators and the supply chain.	Section 7.2.4.6
	How impactful and influential supply chain stakeholders are depends on the capacity of the supply chain.	Section 7.2.4.8.5
	The capacity of the supply chain can have an influence on the schedule and schedule related cost of an oil and gas decommissioning project or programme.	Section 7.2.7.2

Public Stakeholder Management Findings	eNGOs are only interested in specific oil and gas decommissioning projects and programmes.	Section 7.2.1.2.1
	The current interests of eNGOs are primarily focused on oil and gas structures that functions as storage units for hydrocarbons.	Section 7.2.1.2.1
	Unless the decommissioning project is large and newsworthy, eNGOs have a low interest in decommissioning.	Section 7.2.1.2.1
	There is some form of alliance between oil and gas companies and commercial fishing representative bodies in the United Kingdom.	Appendix W
Regulatory Findings	A queue system in the regulatory process will increase risk of oil and gas decommissioning proposals not being approved when the oil and gas facilities are ready to be removed.	Section 7.2.4.10.1
	A queue system in the regulatory process will drive up the overall oil and gas decommissioning spending in the region.	Section 7.2.4.10.1
	It is important for regulators to ensure that they have sufficient capacity to manage the increase in oil and gas decommissioning activities in their jurisdiction.	Section 7.2.4.10.1
	Placing an obligation on oil and gas operators to decommission their oil and gas facilities within a specific timeframe could potentially drive up the cost of decommissioning.	Section 7.2.4.12
	The difference between the United Kingdom and Australian landscape, in terms of oil and gas decommissioning, is primarily regulatory.	Section 7.2.7.1
	There is no fixed duration for the OSPAR consultation period.	Section 7.2.4.10.1
Implications for this Research	The initial stakeholder-oriented critical paths are not far from achieving saturation.	Section 7.1.4.3
	It is possible to combine the three initial stakeholder-oriented critical paths into one single design at a higher level of granularity.	Section 7.1.3, Section 7.1.4.1, Section 7.1.4.2, Section 7.1.4.3, Section 7.1.4.4, Section 7.2.4.10
	The stakeholder-oriented critical paths will vary depending on the size of the reservoir and the production performance of the oil and gas facility.	Section 7.2.4.4
	The stakeholder-oriented critical paths will differ depending on the design of the facility and the location of the facility	Section 7.2.4.8.5
	The stakeholder-oriented critical paths differs depending on the experience and corporate process of the oil and gas company	Section 7.2.4.11
	Several assumptions must be made when designing the stakeholder-oriented critical paths.	Section 7.2.4.11
	A possible critical point on the stakeholder-oriented critical paths could be during the late-life and ultra-late life period.	Section 7.2.4.6
	Interactions with regulatory stakeholders that takes place during late-life and ultra-late-life can have an influence future interactions with regulatory stakeholders further down the stakeholder-oriented critical paths.	Section 7.2.4.6
	A matrix presentation format could perhaps be the preferred presentation format for frameworks in the oil and gas industry.	Section 7.1.4.2, Section 7.1.4.4,
	It may be beneficial to categorise the list of project activities, milestones and deliverables in the initial stakeholder-oriented critical paths into different work scopes in order to improve ease of navigating them.	Section 7.1.4.3
	It could be beneficial for a text document published in order to explain the features the stakeholder-oriented critical paths, and supporting them.	Section 7.1.4.3
	The information found in the case studies is approximately 80% accurate.	Section 7.2.6.2
	Approximately 26% of project activities, milestones and deliverables, that takes place in an oil and gas decommissioning project or programme are not found in the decommissioning proposal documents. Future research in oil and gas decommissioning should bear this in mind when considering the use of case studies.	Section 7.2.6.2

	There is a great opportunity for the stakeholder-oriented critical paths, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding on stakeholder interactions during oil and gas decommissioning. Additionally, as there are no frameworks in academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge on the same front.	Section 7.1.4, Section 7.1.4.1, Section 7.1.4.4
	There is an opportunity for the stakeholder-oriented critical path, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding on the dependencies between oil and gas decommissioning project activities. Additionally, as there are no frameworks in academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge on the same front.	Section 7.1.4, Section 7.1.4.3, Section 7.1.4.4
	There is an opportunity for the stakeholder-oriented critical path, developed in this research, to combine and expand upon the existing body of knowledge from all three industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Decommissioning Work Breakdown Structure), in order to highlight and enhance the industry's understanding on the duration of each oil and gas decommissioning project activity. Additionally, as there are no frameworks in academic literature, the stakeholder-oriented critical paths can also extend the theoretical body of knowledge on the same front.	Section 7.1.4, Section 7.1.4.4
Implications for Future Research	Microsoft Project is very user friendly software. Future research may want to consider using Microsoft Project as a research tool.	Section 7.1.1
	There is an opportunity to compare and contrast different project management software packages and evaluate their effectiveness when used to manage oil and gas decommissioning activities.	Section 7.1.1
	Snowball sampling is more effective when targeting smaller communities.	Section 7.2.1.1
	Interviewees' interest in extending the body of knowledge can influence their willingness to participate in researches.	Section 7.2.1.1
	One possible reason why interviewees refuse to participate in research could be a perception that they might not be able to contribute to the research.	Section 7.2.1.3
	The body of knowledge in oil and gas decommissioning is still expanding and has not yet stabilised.	Section 7.2.4.6
	There are opportunities to explore oil and gas decommissioning using data science and machine learning. A possible approach is to develop a machine learning algorithm that will determine the order in which the oil and gas facilities in the basin should be decommissioned. Possible factors that can be considered in the algorithm are installation dates, production start dates, production rates, number of platforms, number of wells, and most importantly, the dependencies between the different oil and gas facilities. The linear regression machine learning algorithm developed, using R programming language, by the author in collaboration with a data scientist from Robert Gordon University, presented in **Appendix L**, could be a good starting point.	Section 7.2.4.3
	There is an excellent opportunity for further academic research in the area of commercial law, to develop and test contractual models for oil and gas decommissioning.	Section 7.2.4.8.4
	There is an opportunity to conduct a risk analysis of all decisions throughout the entire oil and gas decommissioning lifecycle.	Section 7.2.4.8.5
	There is an opportunity for co-creation of knowledge between oil and gas operators and regulators in order to enhance their mutual understanding of the relationship between the design of oil and gas structures and the precise method of their decommissioning. If there is a clear relationship between the design of oil and gas structures and the precise method of their decommissioning, such information could be used to streamline the regulatory process for oil and gas decommissioning. If there is no distinct relationship between the design of oil and gas structures and the precise method of their decommissioning, such information could also be useful for oil and gas operators to justify to their top management teams the need to conduct additional surveys and studies.	Section 7.2.4.9

Other Findings	There is a high level of interest by the oil and gas industry in extending the existing body of knowledge of oil and gas decommissioning.	Section 7.2.2
	Business strategies of oil and gas operators tend to focus more on the managing of the organisation's portfolios rather than considering stakeholders	Section 7.2.4.3
	To a certain degree, past experiences can have an influence on decisions made during oil and gas decommissioning.	Section 7.2.4.7
	The precise decommissioning methodology, in general, is dependent on the type of oil and gas structure.	Section 7.2.4.9
	There is a difference in opinion regarding the acceptable level of similarity of oil and gas structures for them to have precisely the same decommissioning method.	Section 7.2.4.9
	There is much more oil and gas decommissioning expertise and experience in the supply chain.	Appendix W
	There are dependencies between different oil and gas facilities	Section 7.2.4.2
	The Dunlin Alpha oil and gas facility is a prime example of an oil and gas facility with many dependencies.	Section 7.2.4.2
	The dependencies between oil and gas facilities are basin wide and not just limited to neighbouring oil and gas facilities.	Section 7.2.4.2
	A basin wide approach to decommissioning could be beneficial when considering the dependencies between different oil and gas facilities	Section 7.2.4.2
	A basin wide approach to decommissioning can be very difficult to plan and execute in a multi-operator landscape such as the United Kingdom.	Section 7.2.4.3
	Oil and Gas UK has a tool that overlays the indicative project schedules of different oil and gas decommissioning projects in rows parallel to each other, which can be useful for identifying possible synergies between different oil and gas decommissioning projects.	Section 7.2.4.7
	It is entirely possible that the absence of information on the OGA Decommissioning Roadmap regarding the duration of project activities is due to uncertainties regarding the duration of project activities.	Section 7.1.3.2
	The OGUK Decommissioning Work Breakdown Structure offers the most complete picture of the entire oil and gas decommissioning process.	Section 7.1.3.3
	The selection of the approach to oil and gas decommissioning (Single or Multi-Proposals Approach) is also due to the management of risks	Section 7.2.4.13
	It is possible the differences in preference in approach (Single or Multiple Proposals) to oil and gas decommissioning between the United Kingdom and Australia are due to the difference in stakeholder landscape.	Section 7.2.4.13
	The Australia's oil and gas operators, in general, have less experience in oil and gas decommissioning than those in the United Kingdom.	Appendix W
	Idle wells are common in Australia and South East Asia.	Section 7.2.4.8.6
	It is possible that wells could be more difficult to be plug and abandon in Australian and South East Asia than the United Kingdom. However, it cannot be ruled out that the phenomenon of idle wells could be because there is still a lack of experience in well plugging and abandonment in these younger landscapes.	Section 7.2.4.8.6

Table 7-13 – Summary of Recommendations in Chapter 7: Development of Stakeholder Oriented Critical Paths

Type of Recommendations	**Description**	**Section in this Chapter where this Finding is Discussed**
Recommendations to Operators	It could perhaps be more advantageous for oil and gas operators to engage the supply chain and tap into their expertise and experience when planning for oil and gas decommissioning.	Appendix W
	It would be beneficial for oil and gas operators to conduct market research early in order to understand the capacity of the supply chain prior to making decommissioning decisions.	Section 7.2.4.8.5
	The Brent decommissioning proposals involve four oil platforms (Brent Alpha, Brent Bravo, Brent Charlie, and Brent Delta) It could perhaps be much more beneficial for Shell to split the Brent decommissioning proposal into four decommissioning proposals, making it easier for employees to work on the respective proposal, while also making each decommissioning proposal easier for readers to digest.	Section 7.2.4.1
Recommendations to Regulators	It could perhaps be beneficial to reduce the number of operator-regulator interfaces in order to improve the efficiency of the regulatory processes.	Section 7.1.4.2
	It could perhaps be beneficial for the OGA to develop a flowchart that shows the dependencies between different regulatory engagements activities listed in the OGA Decommissioning Roadmap. Such information could be useful for oil and gas operators for them to optimise their resources and engage the regulators more effectively. One possible avenue could be to expand upon OPRED Installation and Pipeline Pathways.	Section 7.1.4.2
	It could perhaps be beneficial for regulators in emerging oil and gas decommissioning regions to implement policies to ensure good asset stewardship from oil and gas operators in order to mitigate future issues in oil and gas decommissioning.	Section 7.2.4.5
	It can be beneficial for emerging oil and gas decommissioning markets to develop policies for and encourage growth in the capacity of the supply chain in order to meet the growing demand for oil and gas decommissioning products and services.	Section 7.2.4.8.5
	Governments should consider how policies influence the cost, schedule, and scope of oil and gas decommissioning projects or programmes when implementing policies.	Section 7.2.4.10
	It would be much more beneficial if derogation cases could be reviewed in parallel rather than sequentially by the OSPAR committee.	Section 7.2.4.10.1

In terms of schedule management, it was found that the schedules of oil and gas decommissioning projects or programmes are primarily determined by management of risks. The management of risks was found to be often linked to the management of stakeholders, and the level of impact and influence of stakeholders on oil and gas decommissioning projects or programmes, was found to vary depending on various factors including, but not limited to: location of the oil and gas facility, capacity of the supply chain, and stakeholders' goals and interests. It was also found that there is a high level of uncertainty when it comes to the schedule of an oil and gas decommissioning project or programme. Furthermore, as it was found that the management of risks may result in a lengthier schedule, schedule alone is not a good indicator for defining the success of an oil and gas decommissioning project or programme.

In terms of scope management, it was found that in general, the processes of oil and gas decommissioning projects or programmes are similar. However, at a detailed level, the scope of an oil and gas decommissioning project or programme will differ, largely due to the relationship between the oil and gas facility to be decommissioned, and other oil and gas facilities. It was also found that CoP is a critical milestone for oil and gas decommissioning projects or programmes, often used as a measurement for the level of potential synergies that can be achieved between different oil and gas decommissioning projects or programmes.

In terms of stakeholder management, it was found that stakeholder impacts are not necessarily negative. The supply chain, for example, was found to have more oil and gas decommissioning expertise and experience, which can potentially positively impact an oil and gas decommissioning project or programme. It was also found that different stakeholders have different concerns, interests, goals, levels of influence, and levels of impact on project decisions and the performance of the projects. These findings highlight the importance of stakeholder management.

In terms of managing oil and gas decommissioning stakeholders, it was found that the actions of the oil and gas operator throughout the lifecycle of the oil and gas facility have an influence on the level of impact and influence of

stakeholders during the decommissioning process, which highlighted the importance of good asset stewardship.

From a regulatory perspective, regulatory stakeholders were found to be one of the most influential and impactful stakeholder groups on an oil and gas decommissioning project. As such, governments should consider how policies and regulatory processes influence the cost, schedule, and scope of oil and gas decommissioning projects or programmes.

In terms of answering the research questions, this chapter concluded that stakeholder-oriented critical paths can be modelled. However, a significant list of assumptions must be made in order for the stakeholder-oriented critical paths to be modelled. At a highly detailed level (low level of granularity), the stakeholder-oriented critical path will always be different, and homogeneity cannot be achieved. However, at a lower level of detail level (high level of granularity), homogeneity can be achieved on the stakeholder-oriented critical paths.

Overall, this chapter highlighted that the current body of knowledge in oil and gas decommissioning has not yet stabilised, and there is a strong interest by the oil and gas industry in extending the existing body of knowledge in oil and gas decommissioning. This chapter also highlighted several opportunities for future research in various different disciplines including data science, commercial law, and risk management. More collaboration between the various disciplines should be encouraged in order to accelerate academic and industry research in oil and gas decommissioning, in order to further enhance the understanding of management oil and gas decommissioning.

Following the development of the robust stakeholder-oriented critical paths, these robust stakeholder-oriented critical paths are now ready to be analysed in order to address the research questions. The next chapter, ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths*** will continue by discussing the observations and findings from the analysis of the robust stakeholder-oriented critical paths.

Chapter 8: Analysis of Stakeholder-Oriented Critical Paths

8.0 – Chapter Abstract

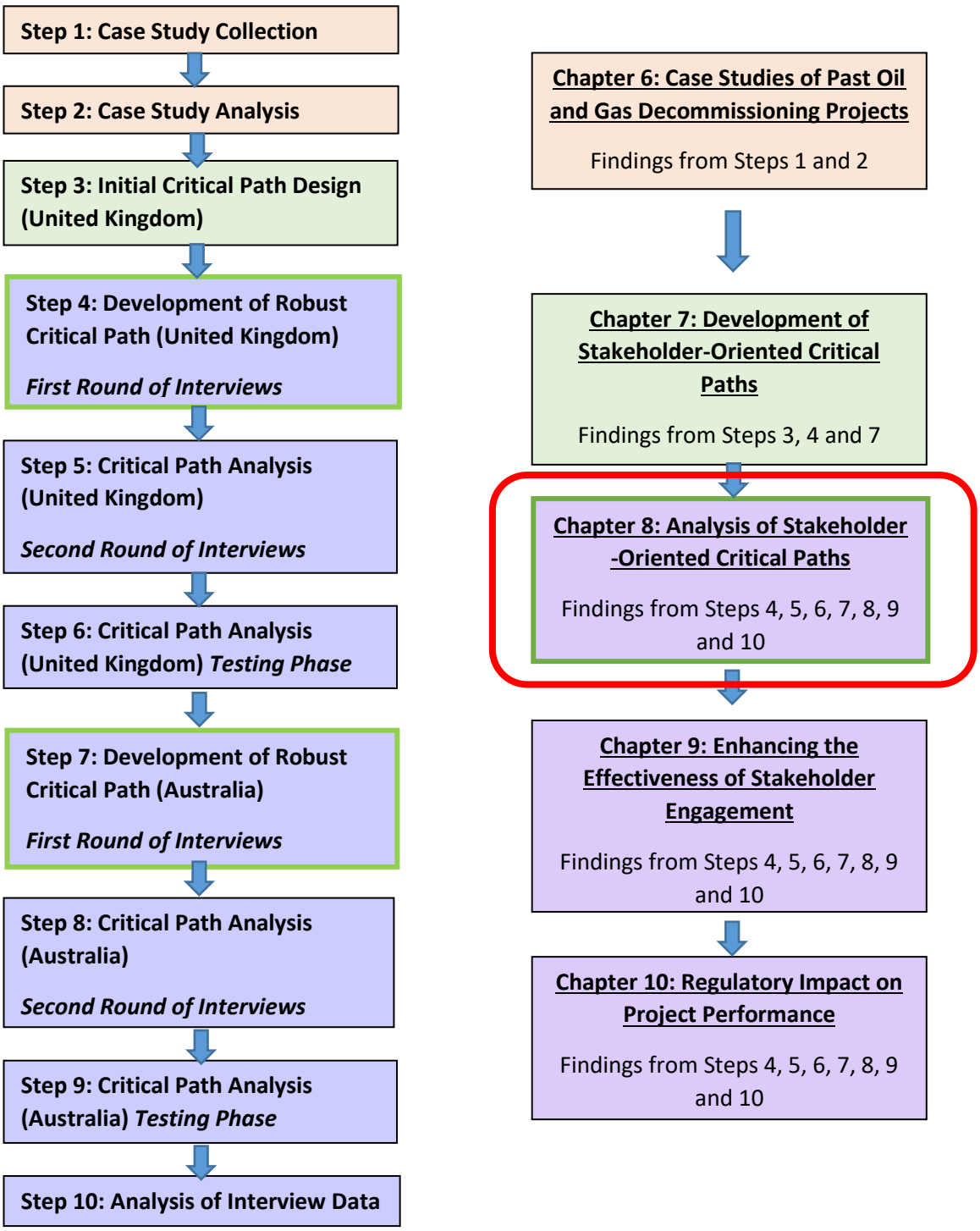


Figure 8-1 – The Third Results Chapter – Analysis of Stakeholder-Oriented Critical Paths

At the end of ***Chapter 7: Development of Stakeholder Oriented Critical Paths***, two robust stakeholder-oriented critical paths were produced, one representing the UK oil and gas decommissioning landscape, and the other representing the Australian oil and gas decommissioning landscape. This chapter will continue from that point to present and reflect upon the findings from the analysis of stakeholder-oriented critical paths.

As mentioned in ***Chapter 5: Research Methodology*** (see page 178), after the development of the robust stakeholder-oriented critical paths, they will be analysed through a second round of semi-structured interviews in Steps 5 and 8 for the UK and Australian parts of the research, respectively. The same set of interviewees was interviewed because they have worked on the critical paths before and will be more familiar with the critical paths, leading to a more efficient interview session. Speer and Wagner (2009) note that interviewees who are more knowledgeable generally have a higher sense of purpose and direction during the interview sessions, which can help the researcher obtain greater detail from the interviewees.

In addition, as mentioned in ***Chapter 5: Research Methodology*** (see page 187), semi-structured interviews will also be conducted with stakeholders in Steps 7 and 9 for the UK and Australian parts of the research, respectively, to understand stakeholder interactions from the perspective of the stakeholders. Understanding the perspective of the stakeholders is important because, as demonstrated in the literature review, decommissioning is viewed differently depending on the stakeholder and their objectives. Additionally, these differences and their ramifications can overlay the stakeholder-oriented critical paths to assist project managers in the management of oil and gas decommissioning projects

However, as detailed in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, there were changes made to the research procedure during the first round of semi-structured interviews. The original research methodology design was based on the assumption that an entire one-hour interview session will be spent on developing the stakeholder-oriented critical paths. However, it was discovered out that interviewees had only spent an

average of 20 minutes on developing the stakeholder-oriented critical paths. As noted by(Saunders, Lewis and Thornhill (2016), ending an interview session early is a sign of poor time management, and it may also give negative signals to the interviewees. A quick decision was made on the spot to move on to the list of questions originally intended for the second round of semi-structured interviews.

Steps 4, 5, and 6 were then executed in parallel with each other instead of sequentially during the UK part of the research. Similarly, Steps 7, 8, and 9 were also executed in parallel with each other during the Australian part of the research in order to ensure consistency in research methodology across both landscapes.

This chapter will start off by providing an overview of the UK and Australian stakeholder-oriented critical paths and discuss the differences between the two. The chapter will then move on to discuss the process of identifying the critical points on the stakeholder-oriented critical paths. Following this, the chapter will go more in-depth to discuss each of the critical points[17] in terms of who was involved in the interactions, the reasons for the interactions, possible solutions to deal with the interests, and current best practices.

Overall, the findings presented in this chapter provide insight into stakeholder interactions throughout an oil and gas decommissioning project or programme lifecycle.

[17] Critical points are project activities in the stakeholder oriented critical path that are potentially subjected to considerable stakeholder impacts.

8.1 – The Robust Stakeholder-Oriented Critical Paths

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 62), the critical path of the project is determined by identifying the activity pathway with the longest total duration (Kelley Jr & Walker 1959). A stakeholder-oriented critical path considers the level of stakeholder influences and impacts on project activities rather than the duration of the activities, although stakeholder influences and impacts can have an influence on the duration of the activities.

The stakeholder-oriented critical paths for this research were developed using a mixed-method methodology of case studies and semi-structured interviews. Observations and findings from the development of the stakeholder-oriented critical paths were discussed in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** and ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***. Two robust stakeholder-oriented critical paths were produced at the end of the development process, one representing the UK oil and gas decommissioning landscape, and the other representing the Australian oil and gas decommissioning landscape. The robust stakeholder-oriented critical paths can be found in ***Appendix P*** (see pages 634 to 639).

8.1.1 – The United Kingdom Stakeholder Oriented Critical Path

The robust UK stakeholder-oriented critical path, which can be found in ***Appendix P*** (see pages 634 to 639), covers the entire lifecycle of a typical oil and gas decommissioning project or programme in the United Kingdom, starting from the establishment of the decommissioning philosophy and strategy, to post-decommissioning monitoring, a lifecycle spanning approximately 10 years. It contains details regarding the list of project activities, milestones and deliverables, the duration of each of the project activities, and the dependencies between project activities.

It must be noted that, as mentioned in ***Chapter 7: Development of the Stakeholder-Oriented Critical Paths***, several assumptions were required to be made in order for the robust UK stakeholder-oriented critical path to be modelled. This indicates that there are a lot of uncertainties when it comes to oil and gas decommissioning.

In terms of presentation, the robust UK stakeholder-oriented critical path is presented in a Gantt chart format. The Gantt chart format was used because, as mentioned in ***Chapter 7: Development of the Stakeholder-Oriented Critical Paths***, it is the best available format to present all of the four types of information (*list of all project activities, duration of each activity, dependencies between activities, and milestones and deliverables*), while maintaining the capacity to allow audiences to see the entire stakeholder-oriented critical path. However, as evident by the multiple A3 size pages required to present the robust UK stakeholder-oriented critical path, this suggests that an oil and gas decommissioning project or programme is complex and extensive.

8.1.1.1 – The Main Work Scopes of the United Kingdom Stakeholder Oriented Critical Path

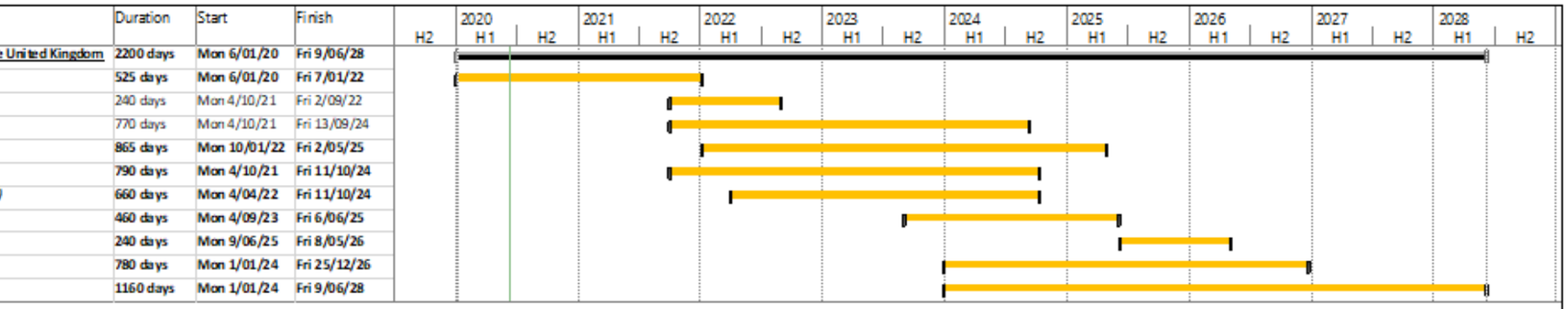
One of the new features added to the robust UK stakeholder-oriented critical path is that the project activities, milestones and deliverables, are organised according to the 10 work scopes as listed below:

- Late-Life and Decommissioning Philosophy and Strategy
- MER (Maximizing Economic Recovery) Strategy Obligations
- Well Plugging and Abandonment Planning
- Well Plugging and Abandonment Execution
- Decommissioning Planning (Engineering)
- Decommissioning Planning (Public Consultation and Approval)
- Safety Case Change and Hydrocarbon Cleaning and Flushing
- Decommissioning Execution
- Waste Management
- Ongoing Monitoring

The work scope categories were determined inductively based on the analysis of interview data and the author's level of knowledge of the oil and gas decommissioning process. The main reason for organising the project activities, milestones and deliverables inductively is to prevent any bias from academic and industry literature. Using Microsoft Project, the project activities, milestones and deliverables, can be collapsed into their respective work scope

categories, producing a simplified version of the UK stakeholder-oriented critical path as seen in **Figure 8-2** (below, page 365).

ID	Task Name	Duration	Start	Finish
0	Critical Path for the Decommissioning of Offshore Facilities in the United Kingdom	2200 days	Mon 6/01/20	Fri 9/06/28
1	*1 Late-Life and Decommissioning Philosophy & Strategy*	525 days	Mon 6/01/20	Fri 7/01/22
20	*2 Maximizing Economic Recovery (MER) Strategy Obligations*	240 days	Mon 4/10/21	Fri 2/09/22
30	*3 Well Plugging and Abandonment Planning*	770 days	Mon 4/10/21	Fri 13/09/24
46	*4 Well Plugging and Abandonment Execution*	865 days	Mon 10/01/22	Fri 2/05/25
56	*5 Decommissioning Planning (Engineering)*	790 days	Mon 4/10/21	Fri 11/10/24
77	*6 Decommissioning Planning (Public Consultation & Approval)*	660 days	Mon 4/04/22	Fri 11/10/24
94	*7 Safety Case Change & Hydrocarbon Cleaning & Flushing*	460 days	Mon 4/09/23	Fri 6/06/25
101	*8 Decommissioning Execution*	240 days	Mon 9/06/25	Fri 8/05/26
111	*9 Waste Management*	780 days	Mon 1/01/24	Fri 25/12/26
118	*10 Ongoing Monitoring*	1160 days	Mon 1/01/24	Fri 9/06/28



Project: Critical Path for the Dec
Date: Thu 11/06/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

Page 1

Figure 8-2 – The United Kingdom Stakeholder-Oriented Critical Path when Project Activities, Milestones and Deliverables are collapsed into their various Work Scope Categories)

8.1.2 – The Australian Stakeholder-Oriented Critical Path

Similar to the robust UK stakeholder-oriented critical path, the robust Australian stakeholder-oriented critical path, which can be found in ***Appendix P*** (see pages 634 to 639), covers the entire lifecycle of a typical oil and gas decommissioning project or programme in Australia, starting from the establishment of the decommissioning philosophy and strategy and going through to post-decommissioning monitoring, spanning approximately 10 years

It must note that, as mentioned in ***Chapter 7: Development of the Stakeholder Oriented Critical Paths***, several assumptions were required to be made in order for the robust Australian stakeholder-oriented critical path to be modelled. This indicates that there are a lot of uncertainties when it comes to oil and gas decommissioning.

In terms of presentation, the robust Australian stakeholder-oriented critical path is presented in a Gantt chart format. The Gantt chart format was used because, for the same reasons described earlier in **Section 8.1.1** (see page 363), regarding the robust UK stakeholder-oriented critical path.

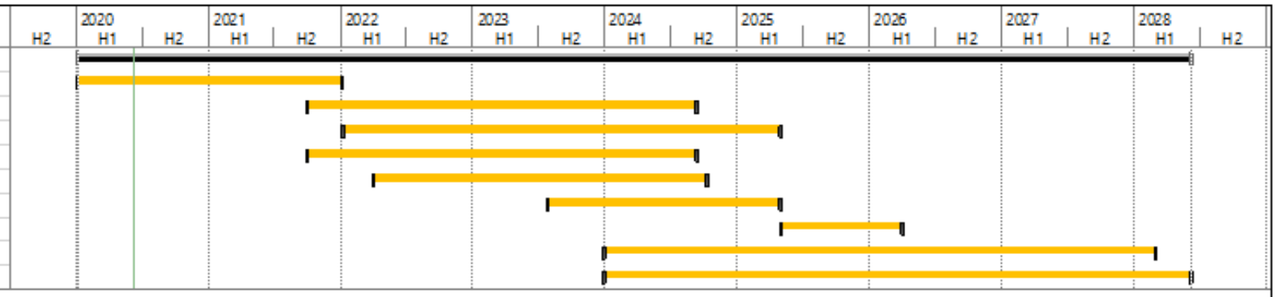
8.1.3.1 – The Main Work Scopes of the Australian Stakeholder-Oriented Critical Path

As with the robust UK stakeholder-oriented critical path, the project activities, milestones and deliverables on the robust Australian stakeholder-oriented critical path, are organised into different work scopes:

- Late-Life and Decommissioning Philosophy and Strategy
- Well Plugging and Abandonment Planning
- Well Plugging and Abandonment Execution
- Decommissioning Planning (Engineering)
- Decommissioning Planning (Public Consultation and Approval)
- Safety Case Change and Hydrocarbon Cleaning and Flushing
- Decommissioning Execution
- Waste Management
- Ongoing Monitoring

As with the robust United Kingdom stakeholder-oriented critical path, the work scope categories were determined inductively based on the analysis of interview data and the author's level of knowledge on the oil and gas decommissioning process. Also, with the UK stakeholder-oriented critical path, the main reason for organising the project activities, milestones and deliverables inductively is to prevent any bias from academic and industry literature. Using Microsoft Project, the project activities, milestones and deliverables can be collapsed into their respective work scope categories, producing a simplified version of the Australian stakeholder-oriented critical path, as seen in **Figure 8-3** (below, page 382).

ID	Task Name	Duration	Start	Finish
0	Critical Path for the Decommissioning of Offshore Facilities in the Australia	2200 days	Mon 6/01/20	Fri 9/06/28
1	1 Late-Life and Decommissioning Philosophy & Strategy	525 days	Mon 6/01/20	Fri 7/01/22
22	2 Well Plugging and Abandonment Planning	769 days	Mon 4/10/21	Thu 12/09/24
37	3 Well Plugging and Abandonment Execution	865 days	Mon 10/01/22	Fri 2/05/25
47	4 Decommissioning Planning (Engineering)	770 days	Mon 4/10/21	Fri 13/09/24
68	5 Decommissioning Planning (Public Consultation & Approval)	660 days	Mon 4/04/22	Fri 11/10/24
81	6 Safety Case Change & Hydrocarbon Cleaning & Flushing	460 days	Mon 31/07/23	Fri 2/05/25
89	7 Decommissioning Execution	240 days	Mon 5/05/25	Fri 3/04/26
99	8 Waste Management	1090 days	Mon 1/01/24	Fri 3/03/28
106	9 Ongoing Monitoring	1160 days	Mon 1/01/24	Fri 9/06/28



Project: Critical Path for the Dec
Date: Thu 11/06/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

Page 1

Figure 8-3 – The Australian Stakeholder-Oriented Critical Path when Project Activities, Milestones and Deliverables are collapsed into their various Work Scope Categories)

8.1.3 – A Comparison between the Robust United Kingdom and Australian Stakeholder-Oriented Critical Paths

Table 8-1 (below) summarises the key differences between the robust UK and Australian stakeholder-oriented critical paths developed in this research.

Table 8-1 – A Comparison between the Robust United Kingdom and Australian Stakeholder Oriented Critical Paths

Type of Robust Stakeholder Oriented Critical Path	United Kingdom	Australia
Total No. of Project Activities, Milestones and Deliverables	98	86
Total No. of Work Scopes	10	9
Total Duration (Approximately)	10 years	10 years
Total Duration for Waste Management	790 days	1090 days

In terms of the list of project activities, milestones and deliverables, as already explained in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, the 12 additional project activities, milestones and deliverables on the robust UK stakeholder-oriented critical path are related to regulatory engagements in order to fulfil MER (Maximising Economic Recovery) Strategy obligations. Similarly, the additional work scope on the United Kingdom stakeholder-oriented critical path, is MER Strategy obligations. This finding suggests that it is possible that there are more stakeholder interactions in the UK oil and gas decommissioning landscape because of the implementation of the MER Strategy.

While there are additional project activities and work scope on the robust UK stakeholder-oriented critical path, the overall durations for both robust stakeholder-oriented critical paths are approximately the same. This is because while in the Australian landscape, less time is spent on fulfilling regulatory obligations, the overall duration for waste management is approximately 30% longer. The main reason for this phenomenon, as indicated by six interviewees representing oil and gas operators, contractors, and regulators in Australia, is that there is extremely limited waste disposal sites in Australia, especially when it comes to disposing NORMs (Naturally Occurring Radioactive Materials) and mercury. As commented by a lifting contractor with

27 years' experience in the Australian, South-East Asian, and Chinese oil and gas Industries:

> *Australia has one NORM disposal site. But it currently costs $2 million just to open the gates, and it is costly. So, essentially Australia does not have a way of disposing of NORMs or other radioactive materials within Australia…*
>
> *For Australia, we essentially only have France and the United States when it comes to disposal of NORMs.*
>
> *– A lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas Industries*

While NORM is also present in the UK landscape, there are considerably more disposal sites in the United Kingdom than in Australia. Augean PLC, for example, has six radiologically permitted sites across the United Kingdom (Augean 2020). This suggests that the cost and schedule of an oil and gas decommissioning project or programme is dependent on the capacity of the supply chain. Thus, it would be beneficial for the Australian government to invest heavily in developing waste disposal capabilities for oil and gas decommissioning, considering that the estimated cost for decommissioning oil and gas facilities in Australia was recently revised upwards by Wood Mackenzie from USD 39 billion to USD 49 billion (Wood Mackenzie 2018, 2020).

8.1.4 – Complementing and Extending Existing Frameworks from Industry Literature

As mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, there are three existing industry frameworks that were identified from industry literature that have similar functions to the robust stakeholder-oriented critical paths developed in this research. The three identified industry frameworks are:

- Decom North Sea's Late-Life Planning Portal (L2P2) (Esson 2017)
- The Oil and Gas Authority's Decommissioning Roadmap (OGA 2016a)
- The Oil and Gas UK's Decommissioning WBS (Work Breakdown Structure) (OGA 2016a; OGUK 2019)

As mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths*** (see page 285), none of the three industry frameworks provided explicit information regarding the duration of each project activity, nor do any of the three industry frameworks present information regarding the dependencies between project activities. The robust stakeholder-oriented critical paths, however, extend the three existing industry frameworks by elaborating more on the duration of project activities and dependencies between project activities in the field of oil and gas decommissioning.

The stakeholder-oriented critical paths also extend the three existing industry frameworks by elaborating on the differences in project activities, milestones and deliverables, duration of project activities, and dependencies between project activities, between the UK and Australian oil and gas decommissioning landscapes.

The stakeholder-oriented critical paths can also serve as a useful research artefact, complementing the three existing industry frameworks, informing audiences on the duration of project activities, dependencies between project activities, and the differences between the UK and Australian landscape. Such information can be useful for project managers for the management of oil and gas decommissioning projects or programmes. Regulators can also use the

stakeholder-oriented critical paths as a guidance tool when developing policies for oil and gas decommissioning. Additionally, the wider audience can use the stakeholder-oriented critical paths to gain insight into the oil and gas decommissioning landscape.

8.2 – Identifying Critical Points using Semi-Structured Interviews

As mentioned in ***Chapter 5: Research Methodology***, the robust stakeholder-oriented critical paths are to be used in the second round of semi-structured interviews and the interviews (Step 5 during the UK part of the research and Step 8 during the Australian part of the research). The same set of interviewees was interviewed because they have worked on the critical paths before and will be more familiar with the critical paths, leading to a more efficient interview session. Speer and Wagner (2009) note that interviewees who are more knowledgeable generally have a higher sense of purpose and direction during the interview sessions, which can help the researcher obtain greater detail from the interviewees.

In addition, as mentioned in ***Chapter 5: Research Methodology*** (see page 187), semi-structured interviews will also be conducted with stakeholders in Steps 7 and 9 for the UK and Australian parts of the research, respectively, to understand stakeholder interactions from the perspective of the stakeholders. Understanding the perspective of the stakeholders is important because, as demonstrated in the literature review, decommissioning is viewed differently depending on the stakeholder and their objectives. Additionally, these differences and their ramifications can be overlaid on the stakeholder-oriented critical paths to assist project managers in the management of oil and gas decommissioning projects.

As mentioned in ***Chapter 5: Research Methodology*** (see page 190), both the second round of semi-structured interviews and the interviews with stakeholders during the testing phase will cover the set of questions, which are:

- Where is/are the Critical Point(s)? i.e. Where on the Stakeholder Oriented Critical Path does Stakeholder Interaction Exists?
- Which Stakeholder(s) are Involved at the Critical Point(s)?
- How Impactful was/were the Stakeholder(s) at the Critical Points?
- Which Critical Point is the Most Important? And Why?
- Why were the Stakeholder(s) Impactful at the Critical Points?
- What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?
- What was/were the Reason(s) for the Decision(s) made to manage the Stakeholder(s)?
- How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?
- How differently would Project Managers manage the Stakeholders if given Hindsight?
- How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?

8.2.1 – Conducting the Second Round of Semi-Structured Interviews and Interviews with Stakeholders in Parallel with the First Round of Semi-Structured Interviews

As detailed in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, there were changes made to the research procedure during the first round of semi-structured interviews. The original research methodology design was based on the assumption that an entire one-hour interview session would be spent on developing the stakeholder-oriented critical paths.

However, it was discovered by the author that interviewees only spent an average of 20 minutes on developing the stakeholder-oriented critical paths. As noted by Saunders, Lewis and Thornhill (2016), ending an interview session early is a sign of poor time management, and it may also give negative signals to the interviewees. Consequently, a quick decision was made on the spot to move on to the list of questions originally intended for the second round of semi-structured interviews.

8.2.2 – Observations from the Second Round of Semi-Structured Interviews and Interview with Stakeholders

The second round of semi-structured interviews and the interview with stakeholders were conducted in parallel with the first round of semi-structured interviews. Thus, observations and findings from the sampling and interview processes for the second round of semi-structured interviews and the interview with stakeholders were discussed together with the first round of semi-structured interviews in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***.

For both the UK and Australian parts of the research, snowball sampling was found to be an effective sampling technique for obtaining interviewees from within the oil and gas industry. Interviewees from within the oil and gas industry were found to be extremely eager to participate in the research, share information and provide opinions, which suggests that there is considerable interest by the oil and gas industry interviewees in extending the existing body of knowledge.

For both the UK and Australian parts of the research, obtaining interviewees from outside the oil and gas industry was found to be more difficult due to lack of access and possibly also due to a lack of interest. This suggests that it is possible that in general, stakeholders are by now satisfied with how decommissioning is conducted.

The interviewee demographics, and more details regarding the findings and observations from the sampling and interview processes, can be found in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***.

8.2.3 – Identifying and Analysing the Critical Points on the Stakeholder-Oriented Critical Path

The critical points were determined qualitatively by analysing the interview data using a thematic analysis approach. Different *a priori* codes were created, based on the research questions and the location on the stakeholder-oriented critical paths referred to by the interviewees during the interviews.

The different *a priori* codes were included in a codebook which was used to code all the interview transcripts. Intercoder reliability testing was also done by having the author and two academic researchers code three transcripts using the same codebook. On average, there was a 73% agreement, which is above the 70% threshold adopted in this research for intercoder reliability testing. The 70% threshold was adopted because the coding process can be said to be of high reliability when there is an agreement of more than 70% (Burla et al. 2008; Campbell et al. 2013).

After the coding process, recurring themes and patterns were identified using the four triangulation techniques mentioned by Denzin (2017): data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. Triangulation was used because it is a well-known qualitative data analysis technique (Almajali & Dahalin 2011; Decrop 1999; Jack & Raturi 2006; Jonsen & Jehn 2009). In addition, triangulation has also been stated by many scholars to improve the validity and credibility of the research (Altrichter et al. 2008; Cohen, Manion & Morrison 2000; O'Donoghue & Punch 2003).

8.2.4 – The Critical Points on the United Kingdom Stakeholder Oriented Critical Path

Based on the analysis of the interview data, a total of 39 project activities were identified as having the potential to be subjected to considerable stakeholder impacts, which can be grouped into three main themes, or clusters, which are, in chronological order:

1. Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy
2. Cluster No. 2 – Comparative Assessment Period
3. Cluster No. 3 – Simultaneous Operations (SimOps)

Cluster No. 1, highlighted in orange on the robust UK stakeholder-oriented critical path in ***Appendix P*** (see page 634), centres on the development of a late-life and decommissioning philosophy and strategy for the oil and gas facility. While it only consists of six project activities, the project activities in Cluster No. 1 are critical because it is the part throughout the entire stakeholder-oriented critical path, where interactions between project management teams and top management teams are the most intense. In addition to top management teams, external stakeholders such as joint-venture partners, contractors and regulators can also be influential and impactful depending on the specific contractual agreements and regulatory obligations related to the oil and gas facility to be decommissioned.

Furthermore, how impactful stakeholders are on project activities found in Cluster No. 2 and Cluster No. 3 seems to be influenced by the decisions made by the project manager during critical points found in Cluster No 1. This suggests that it is important to ensure stakeholders are managed well during the critical points in Cluster No. 1 in order to mitigate future stakeholder impacts further down the oil and gas decommissioning project or programme lifecycle.

Cluster No. 2, highlighted in pale blue on the robust UK stakeholder-oriented critical path in ***Appendix P*** (see page 634), largely takes place during the CA (Comparative Assessment) Period. Project activities in Cluster No. 2 are considered critical because they involve the highest number of stakeholder

groups, including internal stakeholders, other oil and gas operators, the supply chain, regulatory stakeholders, and public stakeholders. This suggests that the management of stakeholders during the CA Period could be at its most challenging because of the wide range of stakeholders involved.

Cluster No. 3, highlighted in green on the robust UK stakeholder-oriented critical path in ***Appendix P*** (see pages 634 to 639), takes place during the period between CoP (cessation of production) and the physical removal of the oil and gas facility (i.e. Simultaneous Operations). While Cluster No. 3 only consists of six project activities, project activities in the cluster are considered critical because interactions between oil and gas operators, contractors, sub-contractors, and the HSE (Health and Safety Executive) are the most intense throughout the entire stakeholder-oriented critical path. Any schedule delays to the project activities in this cluster, due to stakeholder impacts, were stated to have a drastic impact on the overall cost of the project or programme. This suggests that the better stakeholders are being managed during SimOps (simultaneous operations), the better the performance of the oil and gas decommissioning project or programme will be.

As Clusters No. 1, No. 2 and No. 3 are numbered according to their chronological order in the oil and gas decommissioning project or programme lifecycle, the findings suggest that the impact and influence of stakeholder changes as the project or programme progresses. For example, the level of interaction between oil and gas operators and contractors, appears to gradually increase in intensity from Cluster No. 1 to Cluster No. 3. Overall, this finding supports findings from the literature, such as Eskerod and Vaagaasar (2014), which suggest that the stakeholder management plans should be fluid rather than fixed in order to take into account the evolving stakeholder influences and impacts throughout the lifecycle of a project.

8.2.5 – The Critical Points on the Australian Stakeholder-Oriented Critical Path

Based on the analysis of the interview data, a total of 30 project activities were identified as having the potential to be subjected to considerable stakeholder impacts. The 30 project activities on the robust Australian stakeholder-oriented critical path were grouped into the following three clusters, based on the thematic analysis process. The three clusters of critical points, listed in chronological order, are:

1. Cluster No. 1: Well Plugging and Abandonment Operations
2. Cluster No. 2: Planning for Removal
3. Cluster No. 3: Transportation and Disposal of NORM[18]s and Mercury[19]

Cluster No. 1, highlighted in orange on the robust Australian stakeholder-oriented critical path in ***Appendix P*** (see page 637), centres around the actual well plugging and abandonment execution. While it involves only three project activities, these activities are considered critical because of the intense interactions between oil and gas operators, joint-venture partners, and contractors, largely due to frequent and unexpected changes in well plugging and abandonment scope, schedule, and cost. As mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, idle wells, which are common in Australia, can result in technical issues during well plugging and abandonment operations. This suggests that the proper management of well stocks throughout an oil and gas lifecycle is important to improve the management of well plugging and abandonment operations, and its associated stakeholders.

Cluster No. 2, highlighted in green on the robust Australian stakeholder-oriented critical path in ***Appendix P***, centres around the planning process for the physical removal of the oil and gas facility. Project activities in this cluster are considered critical because they involve the highest number of stakeholder

[18] Naturally Occurring Radioactive Material (NORM) are naturally existing materials that can be found in hydrocarbons produced during oil and gas operations. Residual NORM may remain on the surfaces of oil and gas facilities used to produce, process, store, or transport hydrocarbon fluids, even after cleaning.

[19] Mercury is not radioactive, hence it is not considered a NORM. However, Mercury is still toxic and must be disposed of properly.

groups, including internal stakeholders, other oil and gas operators, the supply chain, regulatory stakeholders, and public stakeholders. This suggests that the management of stakeholders during planning for removal, could be the most challenging throughout an oil and gas decommissioning project or programme lifecycle, because of the wide range of stakeholders involved.

Cluster No. 3, as highlighted in pale blue on the robust Australian stakeholder-oriented critical path in ***Appendix P***, centres around the transportation and disposal of NORMs and mercury. While only consisting of four project activities, this point is considered critical because of the intense interactions between oil and gas operators and contractors due to the unexpected changes in waste management scope, schedule, and cost. As mentioned in ***Chapter 7: Development of the Stakeholder Oriented Critical Paths***, there is a lack of capacity for the disposal of NORMs and mercury in Australia. This suggests that the level of influence and impact of contractors are higher when there is a lack of capacity in the supply chain.

Overall, the critical points on the Australian stakeholder-oriented critical paths appear to all involve contractors. This suggests that the supply chain, or contractors, are the most influential and impactful stakeholders in the Australian oil and gas decommissioning landscape.

8.2.6 – A Comparison between the United Kingdom and Australian Critical Points

Table 8-2 – Number of Critical Points Identified using Semi-Structured Interviews

No. of Critical Points on the United Kingdom Stakeholder Oriented Critical Path	No. of Critical Points on the Australian Stakeholder Oriented Critical Path
39	30

As observed in **Table 8-2** (above), the robust Australian stakeholder-oriented critical path has 30% less critical points than the United Kingdom stakeholder oriented critical path. Assuming the probability of stakeholder impacts occurring remains the same for both critical paths, this finding suggests that oil and gas decommissioning projects or programmes in Australia are less likely to be subjected to considerable stakeholder impacts overall. Further investigation can be done in the future to explore quantitatively the probability of stakeholder impacts at each of the critical points identified, expanding existing works in the field of critical path uncertainty such as Mazlum & Güneri (2015) and Laslo & Gurevich (2001).

As mentioned in **Section 8.1.3** (see page 369), the main difference between the robust UK and Australian stakeholder-oriented critical path is the lack of MER-related activities in the robust Australian stakeholder-oriented critical path. This suggests that the introduction of MER obligations is one possible reason for the additional stakeholder interactions in the UK oil and gas decommissioning landscape.

8.3 – An Alternative Method for Identifying Critical Points - The Critical Path Method

An alternative method of determining the critical points is by using Microsoft Project's simulation function, which is based on the critical path method developed by Kelley Jr and Walker (1959). The critical points identified using Microsoft Project's simulation function can be found in ***Appendix Q*** (see pages 640 to 646).

The critical points identified using this alternative method using Microsoft Project did not consider any uncertainties. The purpose of this step is solely to demonstrate that stakeholder interactions can occur on project activities outside the standard critical path rather than investigating how the uncertainties influence the standard critical path. As such, considering uncertainties when using the Microsoft Project simulation function is considered beyond the scope of this thesis.

However, as discussed earlier, a list of assumptions (reflecting the various uncertainties of an oil and gas decommissioning project) was required in order to create the stakeholder-oriented critical path. The list of assumptions can be found in Appendix E. Based on the literature review, there are literature exploring ways of quantifying project uncertainties and the degree of influence they have on the standard critical pathway of the project (Williams 2017; Mazlum & Güneri 2015; Laslo & Gurevich 2001). As such, future work can utilise the list of assumptions in Appendix E as an uncertainty metric in order to begin quantifying oil and gas decommissioning uncertainties and the degree of influence they might have on the standard critical path.

8.3.1 – The Critical Points on the United Kingdom Critical Path

Based on the critical path determined by Microsoft Project's simulation function, the critical points, which are highlighted in pale orange in **Figure Q-1**, **Figure Q-2**, and **Figure Q-3** of ***Appendix Q*** (see pages 640 to 642), are:

- Interactions with Internal and Industry Stakeholders during Late-Life and Decommissioning Philosophy and Strategy.
- Interactions with Regulatory Stakeholders during Well Plugging and Abandonment Planning.
- Interactions with Internal and Industry Stakeholders during Decommissioning Planning (Engineering)

- Interactions with Health and Safety Executive during Decommissioning Planning (Public Consultation and Approval)
- Interactions with Supply Chain Stakeholders during Safety Case-Change and Hydrocarbon Cleaning and Flushing.
- Interactions with Internal and Supply Chain Stakeholders during Decommissioning Execution.
- Interactions with Regulatory Stakeholders during Ongoing Monitoring.

8.3.2 – The Critical Points on the Australian Critical Path

Based on the critical path determined by Microsoft Project's simulation function, the critical points, which are highlighted in pale orange in **Figure Q-4**, **Figure Q-5**, **Figure Q-6,** and **Figure Q-7** of ***Appendix Q*** (see pages 643 to 646), are:

- Interactions with NOPSEMA and/or State Regulators during Well Plugging and Abandonment Planning.
- Interactions with Regulatory Stakeholders during Ongoing Monitoring.

8.3.3 – A Comparison between the United Kingdom and Australian Critical Points

Based on the results obtained by using Microsoft Project, it can be deduced that there are considerably more stakeholder interactions for oil and gas decommissioning activities in the United Kingdom than in Australia. However, as mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, the schedule is not an accurate reflection of the success of an oil and gas project or programme. This means that stakeholders can still be impactful on an activity, regardless of the duration of the activity.

8.4 – The Significance of Stakeholder-Oriented Critical Paths

Table 8-3 (below) shows the differences between the number of critical points identified using the critical path method in Microsoft Project's simulation function, and the number of critical points identified using semi-structured interviews and qualitative analysis:

Table 8-3 – Number of Critical Points Identified using Microsoft Project and Semi-Structured Interviews

Identification Methodology	No. of Critical Points on the United Kingdom Stakeholder Oriented Critical Path	No. of Critical Points on the Australian Stakeholder Oriented Critical Path
Critical Path Method using Microsoft Project	7	2
Semi-Structured Interviews and Qualitative Analysis	39	30

As shown in **Table 8-3** (above), there are a lot of critical points (i.e. project activities that are potentially subject to considerable stakeholder impacts) that the critical path method was not able to identify. As the critical path method largely depends on the duration of project activities (Kelley Jr & Walker 1959), this means that the duration of a project activity is not an accurate representation of the level of stakeholder impact on that project activity.

This finding also suggests that there is a limitation to the critical path method when it comes to stakeholder management. There is therefore an opportunity for the stakeholder-oriented critical paths and the critical points identified in this research to contribute to the oil and gas decommissioning industry by enhancing the industry's understanding of evolution of stakeholder impacts throughout an oil and gas decommissioning project or programme lifecycle.

The concept, development process, and use of stakeholder-oriented critical paths can also be a useful contribution to theoretical knowledge in the field of project management, extending the existing body of knowledge of the critical path method developed by Kelley Jr and Walker (1959), by explicitly putting

front and centre stakeholders who can substantially impact on the success or otherwise of a project, rather than schedule.

8.5 – Analysis of Stakeholder-Oriented Critical Path

The analysis of stakeholder-oriented critical paths will be carried out by analysing each cluster of critical points found on the robust UK and Australian stakeholder-oriented critical paths. Each cluster of critical points will be presented and reflected upon in the light of the research question, by discussing the:

- Key stakeholder Interaction(s)
- Stakeholder(s) involved in the interaction(s)
- Reason(s) for the interaction(s)
- Current best practice(s) to deal with the interaction(s)
- Other possible solution(s) to deal with the interaction(s)

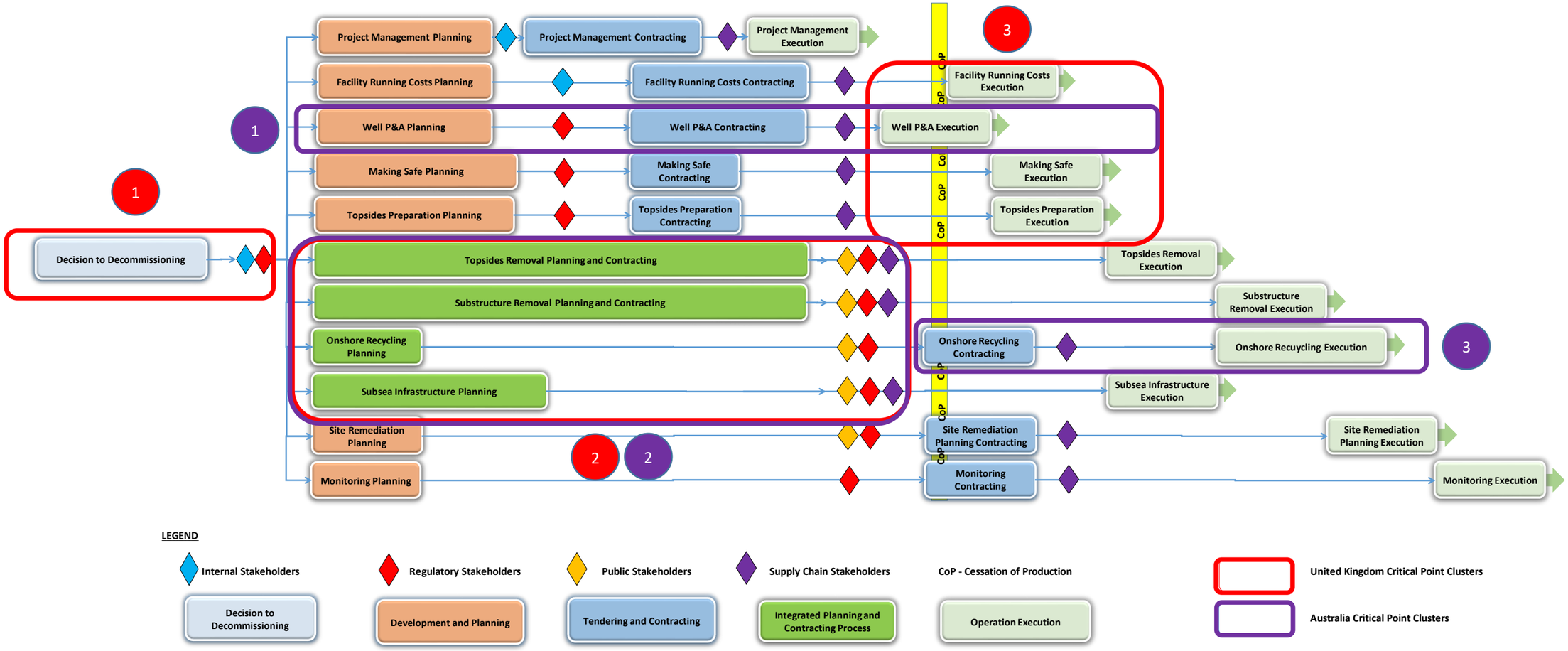
The clusters of critical points will be discussed chronologically to demonstrate how decisions made by project managers earlier on in the stakeholder-oriented critical path influence stakeholder interactions further down the critical paths, and vice-versa.

8.5.1 – Illustrating the Critical Points to the Wider Audience

One of the challenges that arose when writing this thesis was to create a conceptual framework to better illustrate the critical points to the wider audience, who may not be familiar with Gantt charts and other project management tools. Furthermore, 20% of the interviewees have expressed their desire for a simple conceptual framework in addition to the stakeholder-oriented critical paths that summarises the findings from the stakeholder-oriented critical paths.

In the light of this, Marathon Oil has kindly offered their phased transition diagram for the retirement of oil and gas facilities to assist in the development of the simple conceptual framework. Marathon Oil's phased transition diagram for the retirement of oil and gas facilities can be found in ***Appendix R*** (see page 715). Using Marathon Oil's phased transition diagram as a based

template, modifications were made according to findings from this research, producing the conceptual framework seen in **Figure 8-4** (below, page 387).



1	**Cluster No. 1: Late-Life and Decommissioning Philosophy and Strategy**	**(Section 8.5.2.1)**
2	**Cluster No. 2: Comparative Assessment Period**	**(Section 8.5.2.2)**
3	**Cluster No. 3: Simultaneous Operations (SimOps)**	**(Section 8.5.2.3)**

1	**Cluster No. 1: Well Plugging and Abandonment Operations**	**(Section 8.5.3.1)**
2	**Cluster No. 2: Planning for Removal**	**(Section 8.5.3.2)**
3	**Cluster No. 3: Transportation and Disposal of NORMs and Mercury**	**(Section 8.5.3.3)**

Figure 8-4 – The Conceptual Framework for the Stakeholder-Oriented Critical Paths (Tung 2020b)
(Credit goes to Marathon Oil for Providing the Based Template for the Conceptual Framework)

8.5.2 – Analysis of the United Kingdom Stakeholder-Oriented Critical Path

As shown in **Figure 8-4** (above, page 387), and mentioned earlier in Section 8.2.4, the 39 critical points identified on the UK stakeholder-oriented critical path can be grouped into three clusters:

1. Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy
2. Cluster No. 2 – Comparative Assessment Period
3. Cluster No. 3 – Simultaneous Operations (SimOps)

Recognising that readers of this thesis are from a wide variety of disciplines, the following sections provide a summary of the important points for each of the critical point cluster. A detailed version of the analysis of each critical point cluster is available in **Appendix X** for readers who want to understand the various stakeholder interactions in more detail.

8.5.2.1 – Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy

Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy was identified as the most critical cluster throughout the entire United Kingdom stakeholder-oriented critical path. This is because according to 56% of interviewees, decisions made during Cluster No. 1 can significantly impact the volume of stakeholder interactions throughout the remainder of the project. For example, as presented in **Appendix X**, the misinterpretation of the Brent decommissioning strategy by internal stakeholders influenced the volume of engagements between Shell and its stakeholders. As such, it is highly recommended that stakeholder management efforts be prioritised on the critical points identified in Cluster No. 1 in order to ensure effective decommissioning.

93% of interviewees indicated that regulatory instruments also influence the volume of stakeholder interaction when developing the late-life and decommissioning philosophy and strategy. As illustrated in **Appendix X**, MER Strategy obligations appear to significantly increase the volume of stakeholder interactions among operators and contractors in the United Kingdom. While

some stakeholder interactions can bring about positive stakeholder impacts on the project, others may negatively impact project performances (Olander & Landin 2008; Ackermann & Eden 2011; de Oliveira & Rabechini Jr. 2019). As such, it can be argued that there is a need for governmental organisations to consider how legislation, regulations and guidelines influence the volume of stakeholder interactions when implementing them.

8.5.2.2 – Cluster No. 2 – Comparative Assessment Period

Cluster No. 2 – Comparative Assessment Period has been stated by 83% of interviewees as critical because of the involvement of a large quantum of stakeholder groups. Examples of stakeholder groups involved in this critical point cluster include, but not limited to regulators, contractors, fishing stakeholders, and environmental non-governmental organisations (eNGOs) (see **Appendix X**).

Among the various interactions, 14 interviewees indicated a need for much earlier engagement between oil and gas operators and the supply chain to improve the effectiveness of stakeholder interactions between them. According to a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry, there were many missed opportunities for positive stakeholder impacts because of the late engagement between oil and gas operators and the supply chain. This suggests that there is a need for project managers to engage the supply chain much earlier in the project than Cluster No. 2 to maximise positive stakeholder impact.

8.5.2.3 – Cluster No. 3 – Simultaneous Operations (SimOps)

SimOps (i.e. executing different project activities in parallel) appears to be the preferred option by United Kingdom operators as compared to executing them in series. According to two project managers from a different operating companies, the primary reason for this is that SimOps minimises the overall duration of the project, hence reducing the total cost of decommissioning by minimising operating and abandonment expenditures (OPEX and ABEX). While SimOps can be beneficial from a cost and schedule management perspective (Shi 2005). According to a regulator with 30 years' experience in the United Kingdom oil and gas industry, SimOps greatly limits the amount of

time to ensure effective stakeholder engagement, increasing the risk of stakeholder impacts on the project. As such, there is a need for project managers to balance between minimising overall cost and minimising the risk of stakeholder impacts.

8.5.2.4 – Summary

One observation from the three clusters of critical points on the robust UK stakeholder-oriented critical path, is that the stakeholders involved seem to be mostly internal in Cluster No. 1, and mostly external in Cluster No. 2 and Cluster No. 3. As mentioned in **Section 8.2.4** (see page 377), the three clusters of critical points are numbered according to their chronological order on the robust UK stakeholder-oriented critical path. This suggests that the nature of stakeholder interactions moves from primarily internal to primarily external as the project progresses.

According to a former project manager with 40 years' experience in the oil and gas industry, stakeholder engagement for oil and gas decommissioning is:

> *…like concentric circles. You will start with the inner circle, which is that you have to convince your own management on what you are doing. Then you will have to convince your workforce and take samples with your workforce on what they think should be done, and tap into their expertise. Then you will move out to the partnership. Then you will move out to what I call the statutory consultees, and the most important of those is obviously the UK government. And then you will move out to the others like the HSE. Then you will move out to non-statutory but significant consultees.*
>
> *– A former project manager with 40 years' experience in the oil and gas industry*

This suggests that using a concentric circle template might be an effective method of mapping stakeholders for projects. Based on the idea by the former project manager with 40 years' experience in the oil and gas industry, the author identified a new stakeholder mapping method. **Figure 8-5** (below, page 391) shows an example of the use of the new stakeholder mapping method, using oil and gas decommissioning projects in the UK oil and gas decommissioning landscape as an example.

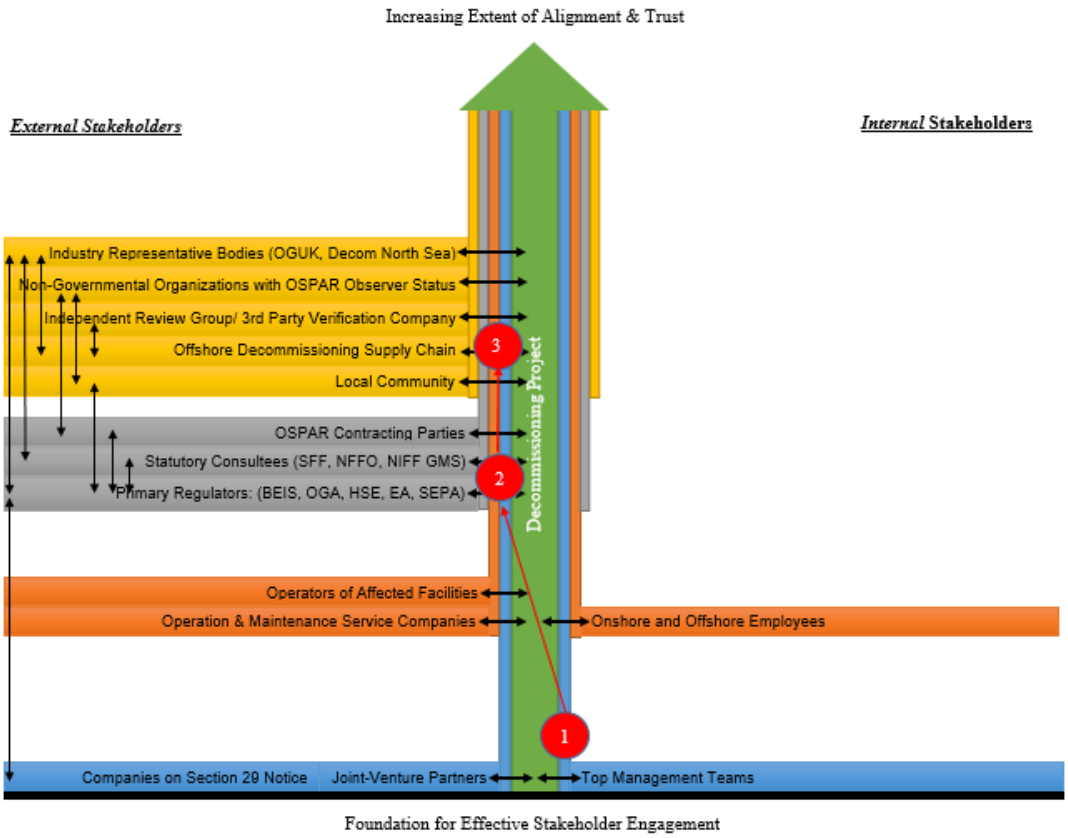


Figure 8-5 – An Example of Stakeholder Mapping for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom

Organisations can use this new approach to organise stakeholders depending on the chronological order of the interactions throughout the project lifecycle. Stakeholders who will be engaged earlier on in the project lifecycle are placed lower down in the diagram, while stakeholders who will be engaged later on in the project are placed higher up in the diagram. For example, as seen in **Figure 8-5** (above), top management teams, which are engaged earlier on in the robust stakeholder-oriented critical path, is placed in the bottom-most part of the diagram.

Stakeholder management efforts can then be prioritised accordingly. More resources can be allocated to engaging the stakeholders in the inner-most circle earlier on in the project lifecycle, while more resources can be allocated to engage stakeholders in the outer-most circle later on in the project lifecycle. Using **Figure 8-5** (above) as an example, more resources can be allocated to engage joint-venture partners earlier on the oil and gas decommissioning

project lifecycle. Then later on in the project lifecycle, more resources can be allocated to engage the local community.

In comparison with traditional stakeholder mapping tools such as the power-interest grid (Ackermann & Eden 2011; Mitchell, Agle & Wood 1997) and the salience model (Mitchell, Agle & Wood 1997), this new stakeholder mapping tool could be a better approach for projects as it is able to illustrate how stakeholder interactions changes over time throughout a project lifecycle.

8.5.3 – Analysis of the Australian Stakeholder-Oriented Critical Path

As observed in **Figure 8-4** (above, page 387, and mentioned earlier in Section 8.2.4, the 30 critical points identified on the Australian stakeholder-oriented critical path can be group into three clusters:

1. Cluster No. 1: Well Plugging and Abandonment Operations
2. Cluster No. 2: Planning for Removal
3. Cluster No. 3: Transportation and Disposal of NORMs and Mercury

8.5.3.1 – Cluster No. 1 – Well Plugging and Abandonment Operations

40% of interviewees indicated that there is a large volume of stakeholder interactions that occur throughout well plugging and abandonment operations. As illustrated in Appendix X, the reason for the interactions is that there is a regulatory obligation for Australia's oil and gas operators to consult public stakeholders prior to executing well plugging and abandonment activities. In the United Kingdom landscape, however, there is no such requirement (see **Appendix X**). The differences in regulatory arrangements between the UK and Australia suggests that there may be a need for the Australian government to consider the impact of their legislation, regulation and guidelines on the volume of stakeholder interactions. Due to regulatory obligations, these additional stakeholder interactions may be the cause of stakeholder engagement fatigue in the Australian landscape, which is stated by interviewees as a common phenomenon despite the landscape being much younger than the UK in terms of maturity.

8.5.3.2 – Cluster No. 2 – Planning for Removal

80% of interviewees indicated that Cluster No. 2 - Planning for Removal is critical due to the large quantum of stakeholders involved. As illustrated in Figure 8-4, this critical point cluster appears to be exactly the same as the United Kingdom's Cluster No. 2 – Comparative Assessment Period. This suggests that there is some form of homogeneity on the stakeholder-oriented critical path across different decommissioning landscapes.

According to 60% of interviewees, there is a greater lack of alignment between oil and gas operators and regulators in the Australian landscape than the United Kingdom landscape. For example, according to a decommissioning

engineer with 22 years' experience in the oil and gas industry, there is a clear difference in opinion between oil and gas operators and NOPSEMA regarding the applicability of the UK's Comparative Assessment framework as a decision-making tool. The lack of alignment between oil and gas operators and regulators in the Australian landscape can also be further evidenced by the numerous interactions between Woodside Energy and NOPSEMA on the Echo Yodel, Nganhurra, and Northern Endeavour decommissioning projects (Milne 2020).

8.5.3.3 – Cluster No. 3 – Transportation and Disposal of NORMs and Mercury

Cluster No. 3 – Transportation and Disposal of NORMs and Mercury was identified as the most critical point cluster throughout the entire Australian stakeholder-oriented critical path. As indicated by 30% of the interviewees, there is a lack of disposal facilities in the Australian landscape, resulting in the increase in the volume of stakeholder interactions in order to seek alternative solutions for the disposal NORMs and Mercury. As such, particularly for younger decommissioning landscapes such as Australia, developing accessible disposal facilities could be a solution to lower the volume of stakeholder interactions for oil and gas decommissioning activities.

8.5.3.4 – Summary

One observation from the three clusters of critical points on the robust Australian stakeholder-oriented critical path, is that the stakeholders involved appear to be primarily external rather than internal. There was no mention of intense interactions between the project management team and top management team, for example. This suggests that perhaps, external stakeholders are more influential and impactful on oil and gas decommissioning decisions in the Australian landscape.

Regulations and guidelines were mentioned as the reason for interactions between oil and gas operators and stakeholders. Therefore, Australian

regulators should consider how policies impact stakeholder interactions as they develop their oil and gas decommissioning legislation[20].

8.6 – A Comparison between the United Kingdom and the Australian Landscapes

As mentioned in ***Chapter 5: Research Methodology***, one of the research questions, specifically Research Question 14, sets out to identify the differences between the UK and Australian oil and gas decommissioning landscapes. This section of the chapter will attempt to address Research Question 14. The differences were identified through a thematic analysis approach. Different *a priori* codes, were created, based on the category of comparison.

The different *a priori* codes were included in a codebook which was used to code all the interview transcripts. Intercoder reliability testing was also done by having the author and two academic researchers code three transcripts using the same codebook. On average, there was a 73% agreement, which is above the 70% threshold adopted in this research for intercoder reliability testing. The 70% threshold was adopted because the coding process can be said to be of high reliability when there is an agreement of more than 70% (Burla et al. 2008; Campbell et al. 2013).

After the coding process, recurring themes and patterns were identified using the four triangulation techniques mentioned by Denzin (2017): data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. Triangulation was used because it is a well-known qualitative data analysis technique (Almajali and Dahalin 2011; Decrop 1999; Jack & Raturi 2006; Jonsen & Jehn 2009). In addition, triangulation has also been stated by many scholars to improve the validity and credibility of the research (Altrichter et al. 2008; Cohen, Manion & Morrison 2000; O'Donoghue & Punch 2003).

[20] Australia was still in the process of drafting its oil and gas decommissioning legislations by the time this thesis was submitted for examination.

Overall, there were three differences between the UK and Australian landscapes:

1) Regulations (Section 8.6.1)
2) Corporate Culture (Section 8.6.2)
3) Stakeholders' Interests in Rigs-to-Reefs (Section 8.6.3)

8.6.1 – Differences in Regulations

A total of five interviewees from both the UK and Australian landscapes mentioned regulatory differences. According to a decommissioning manager with 33 years' experience in the UK and Australian oil and gas industries:

> *The regulations are very different here in Australia. You have the Commonwealth systems, and the state system. I would suggest that you take a look at some case studies for the Australian landscape as well.*
>
> *In terms of regulations, the Comparative Assessment for example is a requirement for decommissioning to be approved, whereas here in Australia it is only a guideline.*
>
> *I know one client, they only done the well plugging proposal by itself, because you are allowed to do that in Australia. Whereas in the UK, you must submit it as an entire programme including well plugging and abandonment and decommissioning.*
>
> *– A decommissioning manager with 33 years' experience in the UK and Australian oil and gas industries*

As discussed earlier in **Sections 8.5.2.1.4**, **8.5.2.1.5**, **8.5.2.2.1**, **8.5.2.3.1**, **8.5.3.1.1**, **8.5.3.2.1** and **8.5.3.2.3**, regulations can have an influence on the level of stakeholder influence and impacts on an oil and gas decommissioning project or programme. Hence, governments may want to consider how their policies influences stakeholder influence and impact on an oil and gas decommissioning project or programme.

8.6.2 – Differences in Corporate Culture

Regarding culture, there appears to be a debate as to whether there is a cultural difference between oil and gas operators in the United Kingdom and Australia. A total of eight interviewees from both the UK and Australian landscape commented on this topic.

Six out of eight interviewees that commented on this topic, indicated that they believe there is a cultural difference between oil and gas operators in the UK and Australian landscapes. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

> *You got the different of culture [between UK and Australia]. I think they [Australians] are more willing to have an open discussion on what the best answer is.*
>
> *I think in the UK we are more likely to say: "we are going to land to that answer and that is it".*
>
> *So, I think Australia is more the mindset of the Gulf of Mexico. That is the impression I get.*
>
> *They [Australian] are also more willing to have a reasonable discussion.*
>
> *I think many of the stakeholders in Europe are fixated on what they think the right answer is. I think they [stakeholders in Europe] are more likely to have a really firm opinion. But that is my opinion, it is just the impression I get.*
>
> *– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

However, there were two interviewees who argued that culturally, there is not much difference between oil and gas operators in the United Kingdom and Australia. According to a decommissioning engineer with 17 years' experience in the oil and gas industry:

Culturally I don't think there are any significant differences. It's generally pretty similar. I think you can tie in corporate processes to the regulatory framework of the country it is in.

For example, the prevalent wisdom in Australia is that if the oil and gas operator goes bust, then the liability for decommissioning goes back to the government. So, I think that drives some behaviour within the operating community.

– A decommissioning engineer with 17 years' experience in the oil and gas industry

This finding suggests that it is possible that regulations may also influence the cultural behaviours of the oil and gas companies in the region. However, it is also possible that the cultural difference might be a function of the company rather than the location.

8.6.3 – Differences in Stakeholders' Interests in Rigs-to-Reefs

A total of four interviewees from both the UK and Australian parts of the research, stated that a key difference between the oil and gas decommissioning landscape is the difference in interest for Rigs-to-Reefs. According to a decommissioning consultant with 27 years' experience in the oil and gas industry:

I think the Rigs-to-Reefs question is there has to be an ultimate end-user or beneficiary from the Rigs-to-Reefs programme. And it is obvious that in the Gulf of Mexico that it is the fishermen, and in Western Australia (WA), it is the fishermen. And it is the recreational fishing industry of WA that is the beneficiary of artificial reefs.

In the North Sea, we don't have the same beneficiary. So there is not an obvious "customer" for those structures.

– A decommissioning consultant with 27 years' experience in the oil and gas industry

Overall, this finding suggests that the interest level of stakeholders differs depending on location.

8.7 – Addressing the Research Questions

As mentioned in ***Chapter 5: Research Methodology***, the research questions to be addressed in this chapter are as follows:

- Research Question 3: Where is/are the Critical Point(s)? i.e. Where on the Stakeholder Oriented Critical Path does Stakeholder Interaction Exists?
- Research Question 4: Which Stakeholder(s) are Involved at the Critical Point(s)?
- Research Question 5: How Impactful was/were the Stakeholder(s) at the Critical Points?
- Research Question 6: Which Critical Point is the Most Important? And Why?
- Research Question 7: Why was/were the Stakeholder(s) Impactful at the Critical Points?
- Research Question 8: What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?
- Research Question 9: What was/were the Reason(s) for Project Managers Decision(s) made to Manage the Stakeholder(s)?
- Research Question 10: How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?
- Research Question 11: How differently would the Project Managers manage the stakeholders if given Hindsight?
- Research Question 12: How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?
- Research Question 13: What is best practice to manage the stakeholder(s) at the Critical Points?

8.7.1 – Addressing Research Questions 3 to 13

Table 8-4 (below) summarises how the findings in this chapter address Research Questions 3 to 13. With regard to Research Question 5, the impacts are assessed qualitatively by analysing the coded interview data using a thematic analysis approach. How impactful the stakeholders are will be addressed by stating the level of impact and probability of impact on the oil and gas decommissioning project or programme. The reason for using the level of impact and probability of impact, is that those are the criteria found on the stakeholder impact/probability matrix, which is a common tool used to assess the impact of stakeholders for projects (Johnson & Scholes 1999; Ward & Chapman 2003; Olander 2007).

Table 8-4 – Addressing Research Questions 3 to 13

Research Qn 3	Research Qn 4	Research Qn 5		Research Qn 6	Research Qn 7	Research Qn 8	Research Qn 9	Research Qn 10	Research Qn 11	Research Qn 12	Research Qn 13
		Level of Impact	Probability of Impact								
UK Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy	Project Management Team (PMT)	High	High	Most important, because it influences future project activities and stakeholder interactions further down the project lifecycle.	Misinterpretation of Decommissioning Strategy	-	-	-	-	Influences future project activities and stakeholder interactions when seeking regulatory approval	Smaller Decommissioning Team Decommissioning Strategy Workshops
	Top Management Team (TMT)	High	High	-	Philosophical Differences regarding Stakeholder Engagement	Improve Extent of Alignment between PMT and TMT on the Stakeholder Engagement Plan	-	Accepted Stakeholder Management Plan of the Stakeholder Manager Under the Condition that TMT are kept informed	-	Influences future stakeholder engagement activities during comparative assessment	Improve Extent of Alignment between PMT and TMT on the Stakeholder Engagement Philosophy
	Joint-Venture Partners (JVP)	High	Medium	-	Disagreement on decommissioning plan	Improve Extent of Alignment among JVP on the Decommissioning Plan	-	-	-	-	Improve Extent of Alignment among JVP on the Decommissioning Plan

	The Oil and Gas Authority (OGA)	High	Low	-	To Agree on Cessation of Production (CoP) Date	Early Engagement with OGA	Reduce Risk of CoP Date Not getting Approved	Approve CoP Date Early	-	-	Early Engagement with OGA
	The Wider Oil and Gas Decommissioning Industry	High	Low	-	Fulfil MER Strategy Obligations	Early Engagement with the Wider Oil and Gas Decommissioning Industry	Fulfil MER Strategy Obligations	Co-Creation of Decommissioning Solutions with the Oil and Gas Operator	-	Influence Project Cost, Schedule, and Scope. Influence future Interaction with the Wider Oil and Gas Decommissioning Industry during Comparative Assessment and Simultaneous Operations (SimOps)	Early Engagement with the Wider Oil and Gas Decommissioning Industry
UK Cluster No. 2 – Comparative Assessment Period	The Department of Business, Energy and Industrial Strategy (BEIS)	High	Low	-	Uncertainties with the Expectation of BEIS	Early Engagement with BEIS	Understand Expectation of BEIS Early	-	-	Influences Comparative Assessment and Public Consultation Activities	Early Engagement with BEIS
	The Supply Chain	High	Medium	-	Positive Supply Chain Influence and Impacts not Maximise	-	-	-	-	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps	Early Engagement with the Wider Oil and Gas Decommissioning Industry during when seeking collaboration to fulfil MER Strategy Obligations.
	The Supply Chain	Low	Low	-	Not Maximising Local Content	Treats Supply Chain Views as Noise	Optimise Project Cost	-	-	-	-
	Commercial Fishing Stakeholders	Medium	Low	-	Discuss about Impact on Safety of Fishermen.	Honest and Transparent Conversation with Commercial Fishing Stakeholders	Improve Extent of Trust between the Oil and Gas Operators and Commercial	Co-operative with Oil and Gas Operators	-	-	Honest and Transparent Conversation with Commercial Fishing Stakeholders

					Fulfil Regulatory Obligations		Fishing Stakeholders				
	Environmental Stakeholders	Medium	Low	-	Disagreement regarding the Evidenced used in the Comparative Assessment	Co-Creation of Knowledge with Environmental Stakeholders	Improve eNGOs Level of Acceptance of Evidenced used in the Comparative Assessment	Co-operative with Oil and Gas Operators	-	-	Co-Creation of Knowledge with Environmental Stakeholders
	Academia and Other Research Institutions	Low	Low	-	Consult to develop decommissioning solutions	-	-	-	-	-	-
UK Cluster No. 3 – Simultaneous Operations (SimOps)	Health and Safety Executive (HSE)	High	High	-	Regulatory engagement for the approval of safety case change	Engage the HSE approximately three months prior to the physical removal of the oil and gas facility	Section 9(2), Offshore Installations (Safety Case) Regulations 2005	Dissatisfaction of the HSE due to the HSE being placed under significant time constraint	Engage the HSE earlier in the oil and gas lifecycle – during the Comparative Assessment Period	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps and Removal	Engage the HSE approximately three months prior to the physical removal of the oil and gas facility
	Contractors and Sub-Contractors	High	High	-	Scope creep and schedule delays	Earlier Interactions with Contractors and Sub Contractors prior to execution Alternative Contracting Models	Ensure Good Working Relationship between Oil and Gas Operator, Contractors, and Subcontractors	Improved Working Relationship between Oil and Gas Operator, Contractors, and Subcontractors	-	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps and Removal	Earlier Interactions with Contractors and Sub Contractors prior to execution Alternative Contracting Models
Australia Cluster No. 1 – Well Plugging and Abandonment Operations	Public Stakeholders	Low	Low	-	Requirements of the Environment Plan	Sent them all Environment Plans and Factsheets	Provide information required for stakeholders to make an informed assessment on the impact of the	Stakeholders engagement fatigue	Initial Consultation with Potential Stakeholders to verify actual stakeholder interests,	Influence Project Scope	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity

							decommissioning activity		needs, and concerns		
	Joint-Venture Partners (JVP)	High	Medium	-	Unexpected issues encountered, and changes in the decommissioning plan	Schedule Project Activities Further Apart	Improving Flexibility of Project Schedule in Consideration of Potential Stakeholder Impacts	Minimum Interactions among JVP	-	-	Schedule Project Activities Further Apart
Australia Cluster No. 2 – Planning for Removal	National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) / State Regulators	High	Medium	-	Difference in opinion between oil and gas operators and regulators in the Australian oil and gas decommissioning landscape regarding the comparative assessment	Early Engagement with Commonwealth/State Regulators	Improve Extent of Alignment on the Environmental Plan Contents	-	-	-	Early Engagement with Commonwealth/State Regulators
	The Supply Chain	Medium	Medium	-	To obtain Input from the supply chain	Early Engagement Depending on the Scale of the Project	Provide sufficient time to evaluate the input to develop the decommissioning plan	-	-	Influence Project Cost, Schedule, and Scope	Early Engagement Depending on the Scale of the Project
	Public Stakeholders	Low	Low	-	Requirements of the Environment Plan	Sent them all Environmental Plans and Factsheets	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity	Stakeholders Engagement Fatigue	Initial Consultation with Potential Stakeholders to verify actual stakeholder interests, needs, and concerns	Influence Project Scope	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity

Australia Cluster No. 3 – Transportation and Disposal of NORMs and Mercury	Disposal Contractor	High	High	Most Important. Due to the Limited Options to Transport and Dispose of NORMs and Mercury in Australia	Unexpected Changes to Project Scope, Schedule, and Cost	Work with disposal contractors to seek alternative solutions	Develop a new solution for the disposal of NORMs and Mercury	Increased Project Scope, Cost and Schedule	Have contingency plans	Influence Project Cost, Schedule, and Scope	Have contingency plans
	Port Authorities	High	High	Most Important. Due to the Limited Options to Transport and Dispose of NORMs and Mercury in Australia	Unexpected Changes to Project Scope, Schedule, and Cost	Work with disposal contractors to seek alternative solutions	Develop a new solution for the disposal of NORMs and Mercury	Increased Project Scope, Cost and Schedule	Have contingency plans	Influence Project Cost, Schedule, and Scope	Have contingency plans

8.7.2 – Addressing Research Question 14

Research Question 14 has been addressed in **Section 8.6**. In summary, the main differences between the UK and Australian landscapes are regulations, corporate culture, and interests in Rigs-to-Reefs. All these factors result in a variation in stakeholder influence and impacts on oil and gas decommissioning projects or programmes across different landscapes, as illustrated in **Figure 8-6** (below):

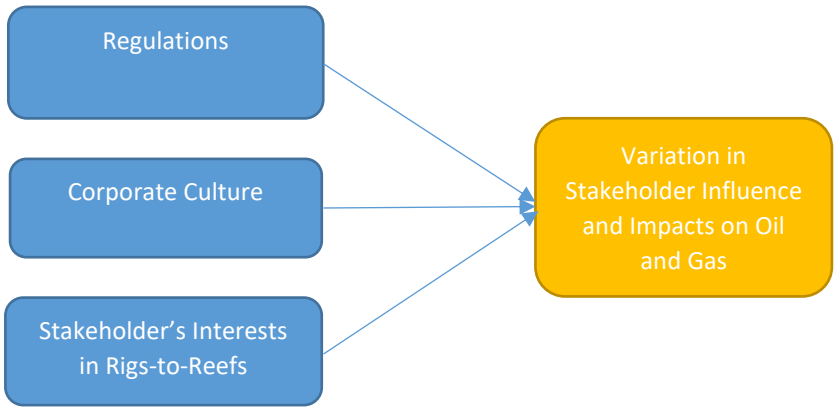


Figure 8-6 – Reasons for the Variation in Stakeholder Influence and Impacts on Oil and Gas Decommissioning across the Different Landscapes

8.8 – Conclusion

Overall, this chapter has detailed the findings and recommendations from the analysis of the stakeholder-oriented critical paths. Findings related to answering the research questions are presented in **Table 8-4** (see page 400) and **Section 8.6** (see page 395), while other emergent findings and recommendations are summarised in **Tables 8-5** and **8-6** (below, pages 406 to 409), respectively.

Table 8-5 – Summary of Findings in Chapter 8: Analysis of Stakeholder Oriented Critical Paths

Type of Findings	**Description**	**Section in this Chapter where this Finding is Discussed**
Well Engineering Findings	The proper management of well stocks throughout an oil and gas lifecycle is important to improve the management of well plugging and abandonment operations.	Section 8.2.5
United Kingdom Landscape Findings	In general, stakeholders are by now satisfied with how decommissioning is conducted.	Section 8.2.2
	There are more stakeholder interactions in the United Kingdom oil and gas decommissioning landscape because of the implementation of the MER Strategy.	Section 8.1.3, Section 8.2.6
	The management of stakeholders during the comparative assessment period/planning for removal could be the most challenging because of the wide range of stakeholders involved.	Section 8.2.4, Section 8.2.5
	There is some alignment between the oil and gas operators and the OGA when it comes to the rationale for ceasing production of the oil and gas facility	Appendix X
	The supply chain can have the potential to positively influence and impact the oil and gas decommissioning project or programme	Appendix X
	The primary concern of commercial fishing stakeholders in the United Kingdom is more for the safety of the fishermen than the fish stock.	Appendix X
	BEIS is influential on decisions made by oil and gas operators regarding the planning and production of the decommissioning proposal, including the comparative assessment process	Appendix X
	The interaction among oil and gas operators and the supply chain is perhaps one of the most talked about interaction in the United Kingdom oil and gas decommissioning community	Appendix X
Australian Decommissioning Landscape Findings	The supply chain, or contractors, is the most influential and impactful stakeholder in the Australian oil and gas decommissioning landscape.	Appendix X
	Oil and gas decommissioning projects or programmes in Australia are 30% less likely to be subjected to considerable stakeholder impacts.	Section 8.2.6
	External stakeholders are more influential and impactful on oil and gas decommissioning decisions in the Australian landscape	Appendix X
	The difference in level of public stakeholder interactions between the United Kingdom and the Australian landscape, when it comes to well plugging and abandonment planning, is because of the difference in regulatory arrangements	Appendix X
	The supply chain can have the potential to positively influence and impact the oil and gas decommissioning project or programme	Appendix X
	There is a perception by oil and gas operators that stakeholders require the environment plan and all factsheets in order to make an informed assessment of possible consequences to the proposed oil and gas activity	Appendix X
	There is some degree of misalignment between oil and gas operators and the regulators in the Australian oil and gas decommissioning landscape regarding the environmental plan contents	Appendix X
	The engagement between oil and gas operators and public stakeholders is perhaps one of the most talked about interaction in the Australian oil and gas decommissioning landscape.	Appendix X
Stakeholder Management Findings	The debate between stakeholder theory and shareholder theory is perhaps still ongoing today.	Appendix X
	Top management teams in oil and gas organisations tend to prioritise investors (i.e. shareholders) over stakeholders	Appendix X
	Stakeholders can still be impactful on a project activity, regardless of the duration of the project activity.	Section 8.3.3
	The duration of a project activity is not an accurate representation of the level of stakeholder impact on that project activity.	Section 8.4
	There is a limitation to the critical path method when it comes to stakeholder management	Section 8.4

	The impact and influence of stakeholders change as the project or programme progresses. The stakeholder interactions moves from primarily internal to primarily external as the project progresses.	Section 8.2.4, Section 8.5.2.4
	The level of influence and impact of contractors is higher when there is a lack of capacity in the supply chain	Appendix X
	The level of stakeholder interactions increases when there is less certainty regarding the expectations of stakeholders	Appendix X
	The higher the level of knowledge of the stakeholder, the more influential and impactful the stakeholder will be on the project or programme	Appendix X
	The same stakeholder group can have different priorities in different locations.	Appendix X
	Transparency is an important factor influencing the level of trust, and the effectiveness of stakeholder management	Appendix X
	Co-creation of knowledge involving stakeholders is an effective way of managing them	Appendix X
	Considering stakeholders when scheduling project activities can minimise stakeholder impacts	Appendix X
	The interests of stakeholders differ depending on location.	Appendix X
Regulatory Findings	Current best practices for regulatory engagement for oil and gas decommissioning took references from past regulatory engagement experiences for oil and gas exploration	Appendix X
	Regulations and guidelines do indeed have an influence on how stakeholders are being managed by oil and gas operators	Appendix X
Implications for this Research	The robust stakeholder-oriented critical paths extends the three existing industry frameworks by elaborating more on the duration of project activities and dependencies between projects activities in the field of oil and gas decommissioning.	Section 8.1.4
	The stakeholder-oriented critical paths also extend the three existing industry frameworks by elaborating on the differences in the list of project activities, milestones and deliverables, duration of project activities, and dependencies between project activities, between the United Kingdom and Australian oil and gas decommissioning landscape.	Section 8.1.4
	The stakeholder oriented critical paths can serve as a useful research artefact, complementing the three existing industry frameworks, informing audiences on the duration of project activities, dependencies between project activities, and the differences between the United Kingdom and Australian landscape. Such information can be useful for project managers for the management of oil and gas decommissioning projects or programmes. Regulators can also use the stakeholder-oriented critical paths as a guide when developing policies for oil and gas decommissioning. Additionally, the wider audience can use the stakeholder-oriented critical paths to gain insight into the oil and gas decommissioning landscape.	Section 8.1.4
	The stakeholder-oriented critical paths and the critical points identified in this research contribute to the oil and gas decommissioning industry by enhancing the industry's understanding of evolution of stakeholder impacts throughout an oil and gas decommissioning project or programme lifecycle.	Section 8.4
	The concept, development process, and use of stakeholder-oriented critical paths can be useful contribution to theoretical knowledge in the field of project management, extending the existing body of knowledge of the critical path method developed by Kelly Jr and Morgan (1959), by explicitly putting front and centre stakeholders who can substantially impact on the success or otherwise of a project, rather than schedule.	Section 8.4
	The newly identified stakeholder mapping method might be an effective way to map stakeholders for projects. The newly identified method in mapping stakeholders could be a better approach for projects as unlike traditional stakeholder mapping tools, such as the power-interest grid (Mitchel et al. 1997; Ackermann & Eden 2011) and the salience model (Mitchell, Agle & Wood 1997), it is able to illustrate how stakeholder interactions change over time throughout a project lifecycle.	Appendix X

Implications for Future Research	Political changes can also have an impact on oil and gas decommissioning decisions, highlighting an opportunity for future academic research to explore the impact of political changes on oil and gas decommissioning decisions. The impact of Brexit on oil and gas decommissioning activities could be possible starting point considering the increase in industry literature on this topic (Phillips 2019; Reddiman 2019)	Appendix X
	It could perhaps be better for future industry literature to use the word “co-creation of effective decommissioning solutions” rather than word “collaboration” in order be more specific with regard to the rationale for engaging other oil and gas operators and contractors when developing the late-life and decommissioning philosophy and strategy	Appendix X
Other Findings	There is considerable interests by the oil and gas industry in extending the existing body of knowledge.	Section 8.2.2
	The main reason for the decision to split the Brent Decommissioning Programme into topside and substructure, is to improve the management of the project schedule.	Appendix X
	The interactions between Shell with Germany, the Netherland, and Greenpeace in late 2019 regarding the gravity based cells (Energy Voice 2019), was primarily due to the misinterpretation of the decommissioning strategy by the project management team when executing the strategy.	Appendix X
	Joint-venture partners are influential when it comes to decisions made regarding the decommissioning plan	Appendix X
	The growth of an oil and gas decommissioning industry may be limited by the lack of input from the supply chain	Appendix X

Table 8-6 – Summary of Recommendations in Chapter 8: Analysis of Stakeholder Oriented Critical Paths

Type of Recommendation	**Description**	**Section in Chapter where this Finding is Discussed**
Recommendations to Operators	The stakeholder management plan should be fluid rather than fixed in order to take into account the evolving stakeholder influences and impacts throughout a lifecycle of a project.	Section 8.2.4
	It would be beneficial for oil and gas operators to engage the supply chain early, in order to maximise the positive influence and impact from the supply chain on the oil and gas decommissioning project or programme	Appendix X
	It might be beneficial for Shell to actively collaborate with Greenpeace to further extend the body of knowledge regarding the concrete based gravity based storage cells of the Brent platforms. Co-creation of knowledge between Shell and Greenpeace can also improve their mutual relationship. Furthermore, involving Greenpeace closely in the knowledge creation process can also convince other stakeholders that the environmental aspect has been thoroughly explored before arriving at the final decision	Appendix X
	It could perhaps be beneficial for oil and gas operators in the Australian decommissioning landscape to adopt the United Kingdom best practice, and engage the regulators early in order to improve the extent of alignment between oil and gas operators and regulators	Appendix X
	It may be beneficial to establish an industry representative body that involves both oil and gas operators and stakeholders, similar to the United Kingdom's Oil and Gas UK and Decom North Sea, in Australia.	Appendix X
	It could perhaps be beneficial for oil and gas operators in the Australian landscape to have an initial consultation with potential stakeholders to confirm their interests, and the information they require to make an informed assessment, before following up by sending them the relevant information they require. Such an approach may minimise unnecessary stakeholder interactions and prevent stakeholders from developing fatigue from engaging oil and gas operators.	Appendix X
Recommendations to Regulators	It would be beneficial for the Australian government to invest heavily in developing waste disposing capabilities for oil and gas decommissioning considering that the estimated cost for decommissioning oil and gas facilities in Australia was recently revised upwards by Wood Mackenzie from USD 39 billion to USD 49 billion (Wood Mackenzie 2017; Wood Mackenzie 2020).	Section 8.1.3
	BEIS should be careful on how their actions impact oil and gas operator's decisions when it comes to the comparative assessment process	Appendix X
	Regulators could perhaps have a look at standardising the data format for each of the criteria and sub-criteria of the comparative assessment process. For example, when assessing the impact of decommissioning on commercial fishing stakeholders, one possible data format for the criteria that can be fixed is fishing hours per year. Similarly when assessing the impact of decommissioning on transport and shipping companies, one possible data format that can be fixed is vessels per year.	Appendix X
	Governments might want to consider implementing measures to retain profits from oil and gas within their own country. From an economics point of view, maximising local content can be favourable as it minimises spending on imported goods and services, hence promoting healthier economic growth, ceteris paribus (Rode 2012; Blanchard, Fischer & Blanchard 1989)	Appendix X
	It could perhaps be beneficial to amend to amend Section 20(1) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015, by removing the word "shorter", and introducing an obligation for continuous engagement between the duty holder (which is usually the oil and gas operator), and the HSE, when it comes to the safety case revision for oil and gas decommissioning activities.	Appendix X
	Australia should consider how policies impact stakeholder interactions as it develops its oil and gas decommissioning legislation.	Appendix X

In terms of well engineering, it was found that wells should be managed down throughout a field life rather than leaving them idle until the CoP of the oil and gas facility. Managing down wells can minimise the cost and schedule of an oil and gas decommissioning project or programme.

In terms of stakeholder management, it was found that the debate between stakeholder theory and shareholder theory is perhaps still ongoing today. It was also found that the impact and influence of stakeholder changes as the project or programme progresses, and stakeholder interactions move from primarily internal to primarily external. The research also identified seven factors, based on the answers to the research questions, which appear to have an influence on the effectiveness of engagement between oil and gas operators and stakeholders, as shown in **Figure 8-29** (below).

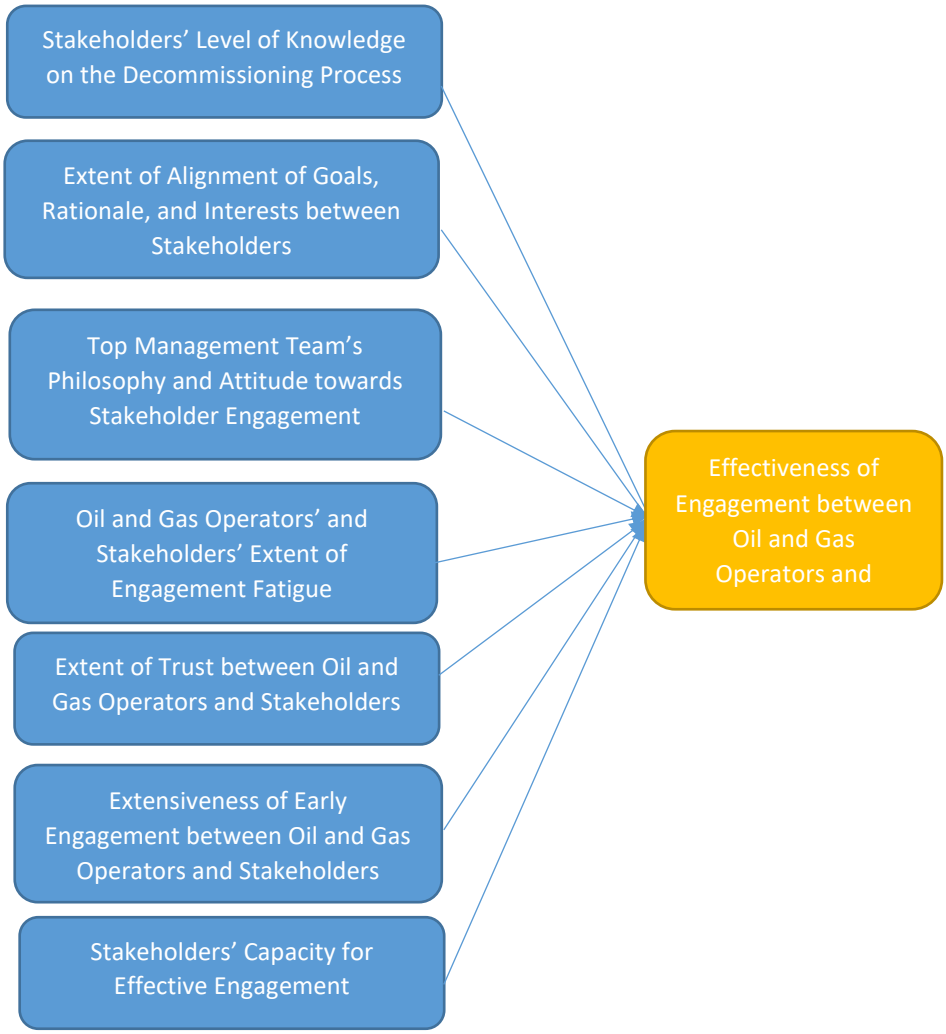


Figure 8-7 – Factors Influencing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders

The next chapter, ***Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement*** will continue on from this chapter by discussing each of the factors presented in **Figure 8-7** (above, page 410) in more detail, thus providing more insight into the management of oil and gas decommissioning stakeholders.

From a regulatory perspective, regulations and guidelines do indeed have an influence on how stakeholders are being managed by oil and gas operators. Largely due to the differences in regulations between the UK and Australian landscapes, findings from the research suggest that oil and gas decommissioning projects or programmes in Australia are 30% less likely to be subjected to considerable stakeholder impacts. Findings from the research also suggest that MER Strategy is the main cause of the higher level of interactions between the oil and gas operator and stakeholders in the United Kingdom

In terms of answering the research questions, Research Questions 3 to 13 have been addressed in this chapter in **Section 8.7**. In summary, stakeholder impacts are highest during the development of a late-life and decommissioning philosophy in the UK landscape, while in the Australian landscape, the level of stakeholder impacts are highest during the transportation and disposal of NORMs and mercury. The differences in regulations, corporate culture, and stakeholders' Interests in Rigs-to-Reefs, could be the reasons for the variation in stakeholder impacts between the UK and Australian landscapes.

In terms of managerial contribution, the author argues that the robust stakeholder-oriented critical paths extend the three existing industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Work Breakdown Structure) by elaborating on the duration of project activities, dependencies between projects activities, and stakeholder impacts throughout an oil and gas decommissioning project or programme, in both the UK and Australian oil and gas decommissioning landscapes. The stakeholder-oriented critical paths can serve as a useful research artefact, complementing the three existing industry frameworks (L2P2, OGA Decommissioning Roadmap, OGUK Work Breakdown Structure), which project managers can use when

management oil and gas decommissioning projects or programmes. Regulators can also use the stakeholder-oriented critical paths as a guide when developing policies for oil and gas decommissioning, and the wider audience can use the stakeholder-oriented critical paths to gain insight into the oil and gas decommissioning landscape.

In terms of theoretical contribution, the author argues that the concept, development process, and use of stakeholder-oriented critical paths can be useful contributions to theoretical knowledge in the field of project management, extending the existing body of knowledge of the critical path method developed by Kelley Jr and Walker (1959), by adding the dimension of stakeholder impacts to the picture.

The author also argues that the proposed column-based stakeholder mapping approach could be a better approach for project management as it offers an additional dimension, illustrating how stakeholder interactions change over time throughout a project lifecycle, in comparison with existing stakeholder mapping tools, such as the power-interest grid (Ackermann & Eden 2011; Mitchell, Agle & Wood 1997) and the salience model (Mitchell, Agle and Wood 1997)

Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement

9.0 – Chapter Abstract

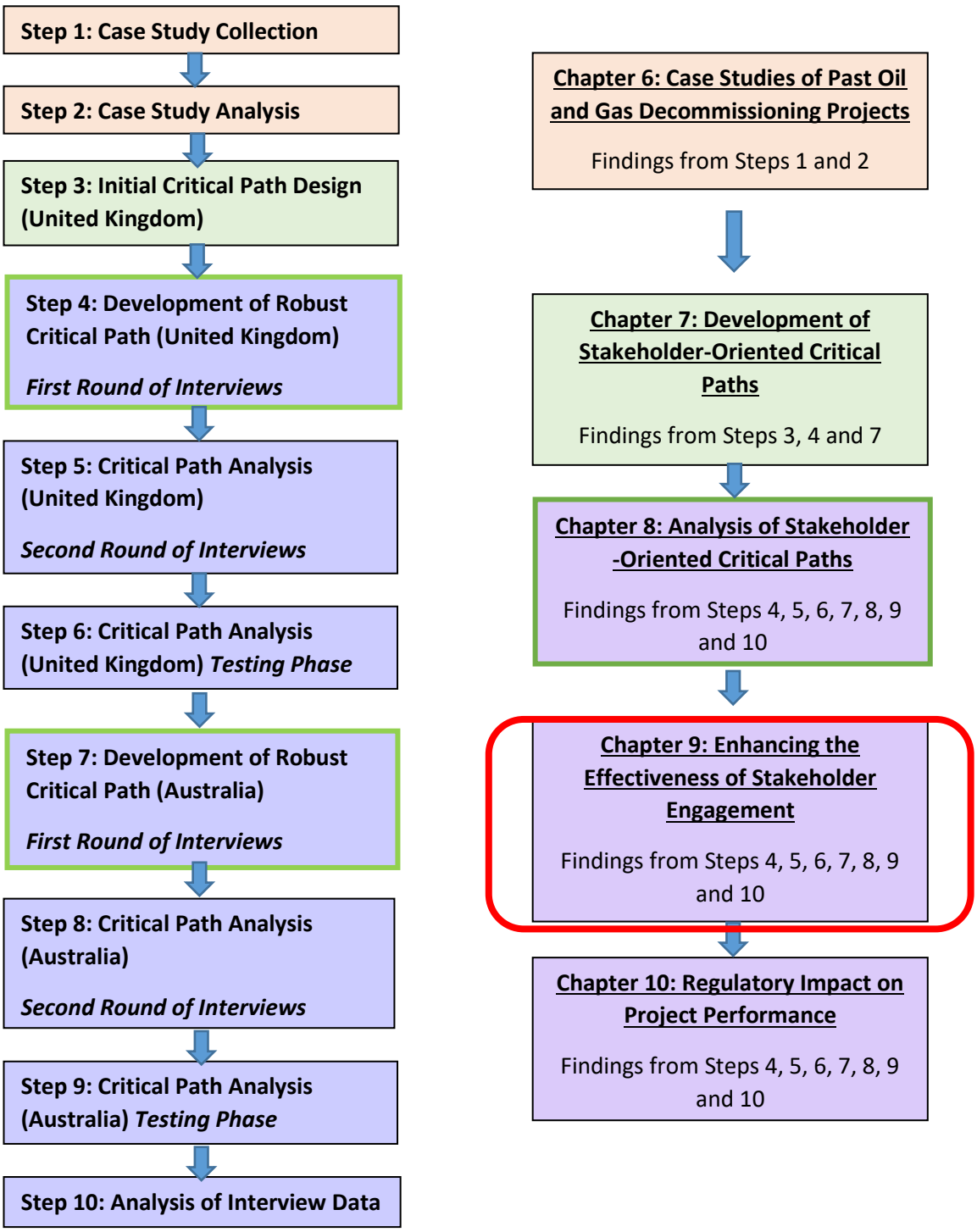


Figure 9-1 – The Fourth Results Chapter – Enhancing the Effectiveness of Stakeholder Engagement

At the end of ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, seven factors were identified, based on the answers to research questions, as the main reasons for the interactions between oil and gas operators and stakeholders during an oil and gas decommissioning project or programme. This chapter will discuss each of these factors in more detail and explain how they influence the effectiveness of engagement between oil and gas operators and stakeholders. The chapter will then move on to demonstrate how findings from this chapter contribute to the existing body of knowledge in the field of stakeholder management.

9.1 – Analysing the Interview Data

The seven factors identified from the answers to the research questions, are used as emergent codes to code all the interview transcripts. Intercoder reliability testing was also done by having the author and two academic researchers code three transcripts using the same codebook. On average, there was a 73% agreement, which is above the 70% threshold adopted in this research for intercoder reliability testing. The 70% threshold was adopted because the coding process can be said to be of high reliability when there is an agreement of more than 70% (Burla et al. 2008; Campbell et al. 2013).

After the coding process, recurring themes and patterns were identified using the four triangulation techniques mentioned by Denzin (2017): data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. Triangulation was used because it is a well-known qualitative data analysis technique (Almajali & Dahalin 2011; Decrop 1999; Jack & Raturi 2006; Jonsen & Jehn 2009). In addition, many scholars have stated triangulation to improve the validity and credibility of the research (Altrichter et al. 2008; Cohen, Manion & Morrison 2000; O'Donoghue & Punch 2003).

9.2 – Factors Influencing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders

9.2.1 – Extent and Depth of Stakeholder's Knowledge of the Oil and Gas Decommissioning Process

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, stakeholders' extent and depth of knowledge of the oil and gas decommissioning process can have an influence on the effectiveness of engagement between oil and gas operators and stakeholders. One example, as discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, is that interactions among joint-venture partners is due to their competency in knowledge of the oil and gas decommissioning process. Joint-venture partners' competency in knowledge of the oil and gas decommissioning process was also mentioned as the reason for the difficulties in achieving alignment on the oil and gas decommissioning plans, suggesting ineffective engagement between different joint-venture partners. The following sections will discuss how stakeholders' level of knowledge of the oil and gas decommissioning process influences the effectiveness of engagement between oil and gas operators and different stakeholder groups.

9.2.1.1 – Extent and Depth of Oil and Gas Operator's Knowledge on the Oil and Gas Decommissioning Process

When coding and analysing the interview data using the "The Extent and Depth of Stakeholders' Knowledge on the Decommissioning Process" as an emergent code, there appears to be a debate among oil and gas operators, the supply chain and regulators regarding oil and gas operator's actual extent and depth of knowledge on the oil and gas decommissioning process. According to a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry:

North-West Hutton, Brent, brilliantly executed projects, really excellent projects, but if you kind of have a coffee with them one day and say did you pay the right price? They will say it took too long, and it is too expensive, and we want to have a different way of doing this with the supply chain to do this kind of decommissioning activity….you need to get out of that greenfield project, construction mentality, and make it more like a salvage kind of activity.

I would say for subsea fields…during construction…putting thing together, installing control systems…they are relatively delicate pieces of equipment…so you need that precision approach…and spend time and money. For decommissioning, whilst you could send a diver down and do everything backwards…you don't need to be as technical, or as advanced.

A good analogy would be a car dealership. When the car is new…the guy in the showroom would be careful when moving the car from inside the garage to outside because he wants to show off his cars to the customers……that same car in the scrapyard……is not going to be treated the same way……you are going to have a big claw, pick the car up, and if something falls off, we will pick it up later. That is like decommissioning.

– A vice-president of decommissioning with 25 years' experience in the United Kingdom oil and gas industry

This suggests that the extent and depth of oil and gas operators' knowledge of the oil and gas decommissioning process is actually limited because they perceive oil and gas decommissioning as a field development project rather than a waste management process. Hence, it could perhaps be beneficial for oil and gas operators to move out of the field development project mind-set and start viewing oil and gas decommissioning as a waste management process. Viewing oil and gas decommissioning from a waste management perspective, as suggested by the vice-president of decommissioning with 25 years' experience in the UK oil and gas industry, may enable the development of more innovative and cost-effective solutions for decommissioning the oil and gas facilities, as illustrated in **Figure 9-2** (below, page 417).

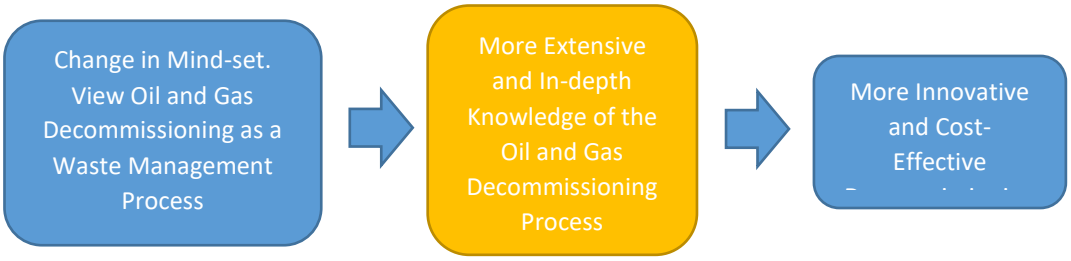


Figure 9-2 – More Innovative and Cost-Effective Decommissioning by Change in Mind-set

According to another comment by a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

> *Operators have only done one or two projects, whereas a consultant, he gets to work on 10 different projects, for 10 different operators. Consultancies are the ones who got the knowledge, and they have been pulled in to the operators to help them because operators haven't got a clue, because nobody has ever done it before, so what do they [operator] know? They don't know, and they probably don't know what they don't know.*
>
> *– A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This suggests that it is possible that the extent and depth of oil and gas operators' knowledge of the oil and gas decommissioning process is actually limited because of their lack of experience of managing oil and gas decommissioning projects or programmes.

From the author's point of view, the comment by a current well contractor with more than 30 years' experience in multiple operating and contracting roles can be challenged because many oil and gas operators, both in the UK and Australian landscape, are multi-national independent oil companies (Huijskes et al. 2017; Carpenter 2018). For example, while BP have only decommissioned North-West Hutton and Miller in the United Kingdom, BP have experience of decommissioning other oil and gas facilities in other regions, such as the Eugene Island facilities in the Gulf of Mexico (Velazquez & Byrd 2003; DeFranco et al. 2004). Similarly, in the Australian landscape, Chevron, who are currently planning the decommissioning of the Thevenard Island oil and gas facilities, have experience decommissioning oil and gas facilities in other regions such as the Gulf of Mexico (Kaiser & Liu 2014).

This suggests that the experience, and perhaps the extent and depth of knowledge of the oil and gas operators of the oil and gas decommissioning process may be limited when considering only the UK or Australian landscape alone. However, as oil and gas operators may have experience in managing oil and gas decommissioning projects elsewhere around the world, the extent and depth of knowledge of the oil and gas operators of the oil and gas decommissioning process might actually be greater. Hence, it could perhaps be beneficial for oil and gas operators to facilitate the transfer of knowledge of oil and gas decommissioning across their business globally.

One way to facilitate the transfer of knowledge in oil and gas decommissioning is to have an experienced decommissioning manager transferred to an emerging oil and gas decommissioning landscape. For example, according to a decommissioning consultant with 40 years' experience in the oil and gas industry, ConocoPhillips appointed the decommissioning manager, who managed the decommissioning of the Viking oil and gas facilities in the United Kingdom, as decommissioning manager for the Bayu Undan oil and gas facilities in Australia, hence facilitating the transfer of knowledge from the UK landscape to the Australian landscape.

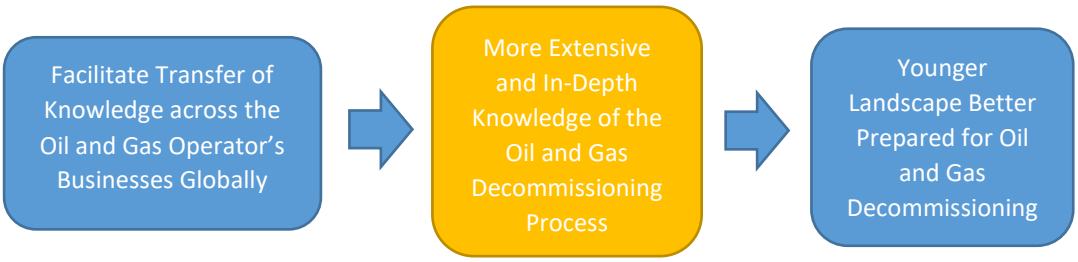


Figure 9-3 – A Better Prepared Oil and Gas Decommissioning Landscape through Transfer of Knowledge across the Oil and Gas Operator's Business Globally

9.2.1.2 – Extent and Depth of Supply Chain's Knowledge of the Oil and Gas Decommissioning Process

Of interviewees representing the UK and Australian oil and gas decommissioning communities, 60% agreed that the expertise in oil and gas decommissioning lies with the supply chain. According to a lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries:

> *The contractors know more about how to remove this stuff than the operators. The contractors are the ones that own the equipment and vessels, and they are the ones that do the actual removal work*
>
> *– A lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries*

However, a decommissioning engineer with 22 years' experience in the oil and gas industry, representing the 40% of interviewees who disagree that the expertise in oil and gas decommissioning lies with the supply chain, stated that:

> *Oil and gas operators know their own assets better…because they are ones that own them…operating them and maintaining them.*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

This suggests that while the supply chain stakeholders may the ones doing the actual decommissioning work, oil and gas operators are perhaps more knowledgeable on the specifications and condition of the oil and gas facility itself. This further suggests that facilitating the transfer of knowledge between oil and gas operators and the supply chain could be beneficial for the development of more effective oil and gas decommissioning solutions.

In the United Kingdom, transfer of knowledge between oil and gas operators and the supply chain are being facilitated by industry representative bodies, such as Oil and Gas UK and Decom North Sea, through various workshops, conferences, and trade delegations dedicated to oil and gas decommissioning (OGUK 2019). The Malaysian branch of the Society of Petroleum Engineers has also been hosting annual decommissioning and abandonment symposiums since 2016, in order to facilitate the transfer of knowledge

between oil and gas operators and the supply chain across South-East Asia. As such, it could perhaps be advantageous for industry representative bodies in Australia to host events dedicated to oil and gas decommissioning, in order to facilitate further transfer of knowledge between oil and gas operators and the supply chain in Australia.

Figure 9-4 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and the Supply Chain by Facilitating Transfer of Knowledge between Oil and Gas Operators and the Supply Chain

9.2.1.3 – Extent and Depth of Regulators' Knowledge of the Oil and Gas Decommissioning Process

Another interesting debate that arose from the analysis of interview data concerns the extent and depth of regulators' knowledge of the oil and gas decommissioning process. Of interviewees representing the UK and Australian communities, 20% state that regulators have a limited extent and depth of knowledge of the oil and gas decommissioning process. According to an interviewee from the UK part of the research, a former decommissioning manager with 40 years' experience in the oil and gas industry:

> *It comes down to regulatory incompetence. This government doesn't have the scientific expertise available to it to properly assess the decommissioning programmes.*
>
> *– A former decommissioning manager with 40 years of experience in the oil and gas industry*

This finding suggests that the effectiveness of engagement between oil and gas operators and regulators depends on the extent and depth of regulators' knowledge of the oil and gas decommissioning process. As the UK regulators have been regulating oil and gas decommissioning for at least 25 years (OPRED 2019), this finding also suggests that the extent and depth of regulators' knowledge of the oil and gas decommissioning process is perhaps

not so much dependent on the extent of their experience of regulating oil and gas decommissioning activities.

In response to the comment by a former decommissioning manager with 40 years' experience in the oil and gas industry, a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom stated that:

> *We have in-house environmental managers and inspectors who work here for environmental impacts…but there are certain statutory consultees which we would want a view on…They would be the HSE for safety, our environmental managers and inspectors who work here for environmental impact, other users of the sea like fishermen: Scottish Fishermen Federation, or the National federation of Fishermen's Federation, technical feasibility, that we kind of assess ourselves, and for cost, we will ask a view on cost from the Oil and Gas Authority. Around environment I guess there is other people like the Joint Nature Conservation Council, they are not statutory consultees, but we consult them.*
>
> *– A regulator with 15 years' experience or regulating oil and gas decommissioning activities in the United Kingdom*

This finding suggests that while there appear to be environmental experts within the BEIS (Department for Business, Energy and Industrial Strategy), consideration for the approval of the decommissioning proposals appears to be highly dependent on the views of stakeholders from organisations outside BEIS. It is possible that BEIS consults statutory consultees for the assessment of oil and gas decommissioning proposals because of the low extent and depth of their knowledge of the oil and gas decommissioning process, so that they can properly assess the decommissioning proposals themselves.

As mentioned in ***Chapter 6: Case Studies of Past Decommissioning Projects*** , the extent and depth of knowledge of government departments can have an influence on their level of competence (Kasim 2015; Kasim 2008). Establishing a competent government department well equipped with technical knowledge of the oil and gas decommissioning process was one of the primary rationales of the Ministry of Energy of the Kingdom of Thailand for sponsoring their regulatory officers to pursue a Master of Science in Decommissioning at the University of Aberdeen (Muanthongthae 2019; Chumphonwong 2020).

Hence, it could perhaps be beneficial for oil and gas decommissioning regulators to ensure that their regulatory officers are equipped with a competent level of knowledge of the oil and gas decommissioning process, to ensure they are competent enough to properly assess oil and gas decommissioning proposals. It is also possible that a more competent regulator would improve the effectiveness of engagement between oil and gas operators and regulators.

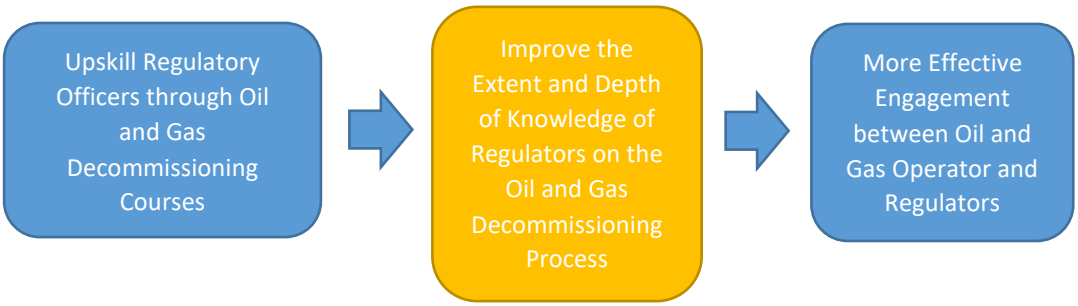


Figure 9-5 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Regulators by Upskilling Regulatory Officers through Oil and Gas Decommissioning Courses

9.2.1.4 – Extent and Depth of Environmental NGOs' Knowledge of the Oil and Gas Decommissioning Process

Another interesting debate that arose from the analysis of interview data concerns the extent and depth of eNGOs' (environmental non-governmental organisations knowledge of the oil and gas decommissioning process. Of the interviewees representing the UK and Australian oil and gas decommissioning communities. 10% of them argued that:

> *Environmental NGOs are becoming increasingly more informed and knowledgeable about decommissioning, and they are also becoming more understanding on how difficult it is to do decommissioning.*
>
> *– A discipline engineer with 17 years' experience in the oil and gas industry*

This suggests that environmental NGOs have some knowledge of the oil and gas decommissioning process. However, 40% of interviewees representing the UK and Australian oil and gas decommissioning communities felt that environmental NGOs still have a limited extent and depth of knowledge of the oil and gas decommissioning process, although 12 years have passed since

Greenpeace's protest regarding the Brent Spar decommissioning. According to a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom, who had extensive interaction with environmental NGOs:

> *There are a couple of environmental groups in Scotland who came along to stakeholder events and didn't really understand the whole technical concept of what decommissioning is going through……they didn't understand the scale of decommissioning and what we are going through to be honest. I have been at one event where I have to explain to some eNGOs beside me what they are talking about, because they don't have that level of knowledge. You are asking them to understand really large concepts like removal and jackets and concrete jackets.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

This suggests that environmental NGOs' level of knowledge of the oil and gas decommissioning process does have an influence on the effectiveness of the engagements between oil and gas operators and environmental NGOs. However, as mentioned in Section 9.0, there are other factors that can influence the effectiveness of engagement between oil and gas operators and environmental NGOs. It is thus possible that other factors could be more influential on the effectiveness of engagement between oil and gas operators and environmental NGOs.

9.2.2 – Extent of Alignment of Goals, Rationale and Interests between Stakeholders

As mentioned in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths*** , the extent of alignment of goals, rationale, and interests between oil and gas operators and stakeholders appear to have an influence on the effectiveness of engagement between oil and gas operators and stakeholders. One example, as discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, is that there is disagreement among joint-venture partners when it comes to the decommissioning plan, which suggests some form of misalignment between different joint-venture partners.

The following sections will discuss how the extent of alignment of goals, rationale, and interests between stakeholders influences the effectiveness of engagement between oil and gas operators and stakeholders.

9.2.2.1 – Extent of Alignment among Joint-Venture Partners

Of interviewees representing the UK and Australian oil and gas decommissioning communities, 15% indicated that there are sometimes interactions among joint-venture partners due to disagreement regarding the decommissioning plan. According to a project manager with 40 years' experience in the UK and Norwegian oil and gas industries:

> *We are an integrated business. We have an upstream business and a downstream business. So, our upstream business is making money because there is a high oil price, our downstream chemical business will be earning less because you will have to pay more for the feedstock. Because we operate refineries in our chemical business, when oil price is low, we tend to do well downstream. That is the benefit of our business, we got a balanced portfolio, and not everybody's got the same business structure as we do. It is one of the strengths that our portfolio has.*
>
> *So we are a well-funded company, we make decisions based on long-term economics. But sometimes we worked with partners who are not as well-funded as we are, and their business is driven more by their short-term cash needs.*
>
> *During the last downturn, when oil was 40 dollars a barrel, and the company had obligations to pay dividends to its shareholders. Some of our competitors are borrowing money to pay their dividends. And that is not unusual, or they might be borrowing money to fund an acquisition. So, you got to look at the whole business. Sometimes companies might choose to defer decommissioning deliberately.*
>
> *– A project manager with 40 years' experience in the UK and Norwegian oil and gas industries*

This suggests that decommissioning plan differs depending on the extent of alignment among joint-venture partners on business goals. For example, as mentioned by the project manager with 40 years' experience in the UK and Norwegian oil and gas industry, some business goals are more driven by short-term cash needs, while others are based on long-term economics.

An organisation whose business goals are more driven by short-term cash needs may defer decommissioning to a later date in order to avoid immediate spending on decommissioning. An organisation whose business goals are more driven by long-term economics may choose to spend and undertake decommissioning as soon as possible in order to minimise the overall cost of decommissioning. Note that as mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, delaying the decommissioning of an oil and gas facility may incur additional operational cost (OPEX) and abandonment cost (ABEX), hence increasing the overall cost of decommissioning the oil and gas facility.

Hence, it could be beneficial for joint-venture partners to set aside a common decommissioning fund at the beginning of the oil and gas lifecycle in order to ensure sufficient funds are available by the time the oil and gas facility is expected to be decommissioned, hence minimising the extent of misalignment among joint-venture partners.

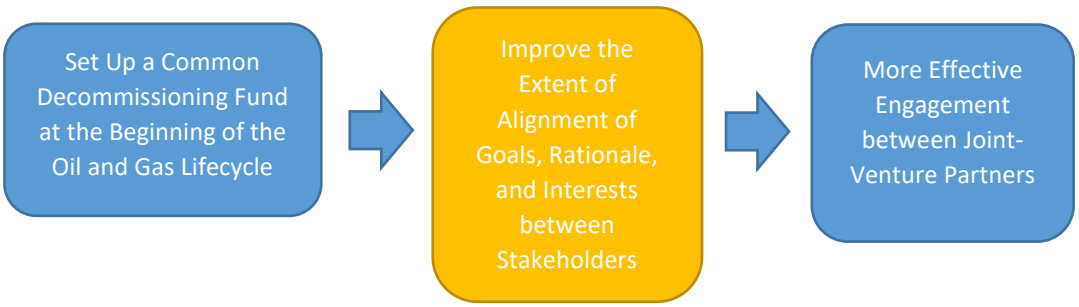


Figure 9-6 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Regulators by Setting up a Common Decommissioning Fund at the Beginning of the Oil and Gas Lifecycle

9.2.2.2 – Extent of Alignment between United Kingdom Oil and Gas Operators and the Oil and Gas Authority (OGA)

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, the OGA appears to take quite a flexible attitude towards the oil and gas operators when it comes to the approval of the CoP (cessation of production) dates for oil and gas facilities. In addition, a total of four interviewees representing oil and gas operators and regulators in the United Kingdom stated that the relationship between oil and gas operators and the OGA is positive. This suggests that there is perhaps a considerable extent of alignment between oil and gas operators and the OGA. According to a representative from the OGA with 34 years' experience in the oil and gas industry:

> *We are purely looking at the cost of decommissioning in total, including well P&A. We get all the cost data from the operators, and then we will then engage with the operators to see whether we think there is opportunity and/ or help them to get it as cheap as possible.*
>
> *Operators are quite happy to engage with use because the operators also don't want to spend that much money and also want to do it as cheap as possible.*
>
> *– A representative from the OGA with 34 years' experience in the oil and gas industry*

This finding suggests that it is possible that there is a high degree of alignment in interests between oil and gas operators and regulators on minimising the overall oil and gas decommissioning cost.

As mentioned in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths*** (see page 416), best practice for managing the OGA is to engage them early. It is possible that early engagement can provide more time for alignment to be achieved between oil and gas operators and the OGA regarding the CoP date.

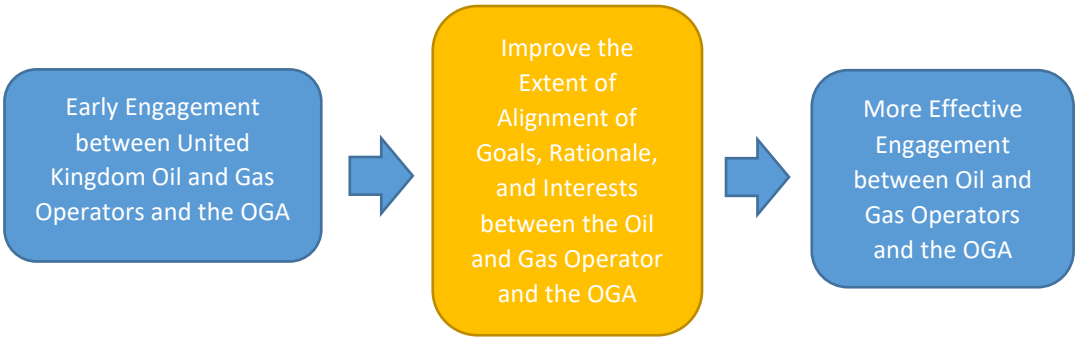


Figure 9-7 – Enhancing the Effectiveness of Engagement between United Kingdom Oil and Gas Operators and the Oil and Gas Authority by Early Engagement

9.2.2.3 – Extent of Alignment between United Kingdom Oil and Gas Operators and the Department of Business, Energy and Industrial Strategy (BEIS)

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, there is misalignment regarding the re-use of similar studies as evidence to support decommissioning proposals. A total of six interviewees representing the UK oil and gas operators and the supply chain claim that the re-use of similar studies in the past as evidence to support the decommissioning proposal is justifiable because of the similarities in environment and design. According to a current decommissioning engineering manager with 37 years' experience in the oil and gas industry:

> *I believe it is valid, because studies are generally similar within the same area. Of course there are exceptions, and we will go do additional studies when there are exceptions.*
>
> *– A representative from the OGA with 37 years' experience in the oil and gas industry*

However, as discussed in ***Chapter 7: Development of Stakeholder Oriented Critical Paths*** (see page 346), the position of BEIS is that they will only accept the re-use of studies in the past as evidence to support the decommissioning proposal if the oil and gas facilities are identical.

While there are many factors that can influence the extent of alignment between the UK oil and gas operators and BEIS, it is possible that the extent

of alignment between them can influence the effectiveness of engagement between them, particularly when discussing the re-use of similar studies as evidence to support the decommissioning proposal.

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, the best practice for managing BEIS is to engage them early. It is possible that early engagement can provide more time for alignment to be achieved between oil and gas operators and BEIS, especially when it comes to the decommissioning proposal contents and the Comparative Assessment.

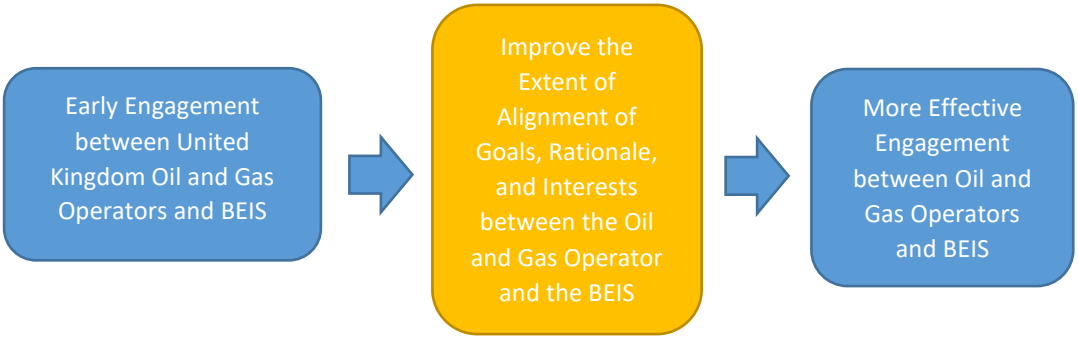


Figure 9-8 – Enhancing the Effectiveness of Engagement between United Kingdom Oil and Gas Operators and the Department of Business, Energy and Industrial Strategy by Early Engagement

9.2.2.4 – Extent of Alignment between United Kingdom Oil and Gas Operators and the Health and Safety Executive (HSE)

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, there were interactions between oil and gas operators and the HSE in the UK landscape due to disagreement regarding the ideal timing of engagement for the safety case change.

One reason, as discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths,*** is the difference in rationale for the ideal timing of engagement for the safety case change, between oil and gas operators and the HSE. For the oil and gas operators, the rationale for their ideal timing for engagement for the safety case change is based on legislation, specifically Section 20(1) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015. For the HSE, their rationale for their ideal timing for

engagement for the safety case change is based on minimising the risk of HSE's impact on project schedule, scope, and cost.

This finding suggests that there are differing and competing pressures when it comes to making decommissioning decisions. This finding also suggests that legislations and regulations can have an influence on the extent of alignment in rationale between stakeholders. Hence, policy makers may want to consider how legislation and regulations may influence the extent of alignment in rationales between stakeholders, and the effectiveness of engagement between stakeholders.

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, the best practice in managing the HSE is to engage them early, at least during the Comparative Assessment Period. It is possible that early engagement can provide more time for alignment to be achieved between oil and gas operators and the HSE.

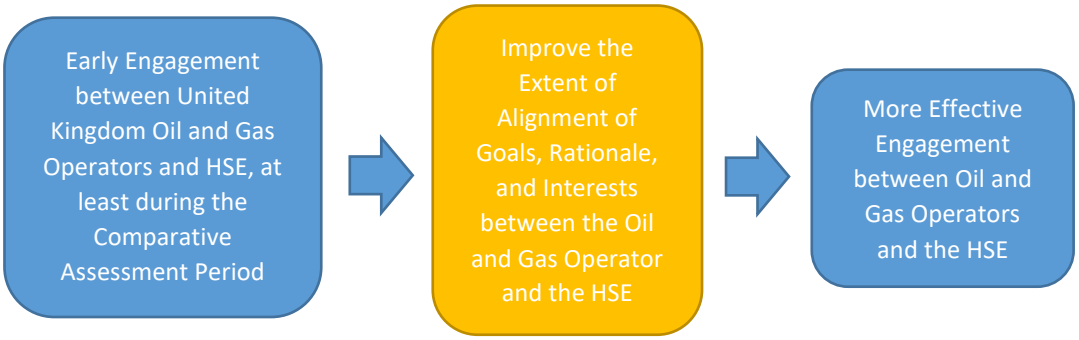


Figure 9-9 – Enhancing the Effectiveness of Engagement between United Kingdom Oil and Gas Operators and the Health and Safety Executive by Early Engagement

9.2.2.5 – Extent of Alignment between Oil and Gas Operators and the Supply Chain

Analysis of the interview data reveals that there is a debate among the oil and gas decommissioning community regarding the extent of alignment between oil and gas operators and the supply chain. This phenomenon was found to be true in both the UK and Australian landscape.

Of interviewees representing the UK and Australian oil and gas decommissioning communities, 45% of them indicated that there is a misalignment between oil and gas operators and the supply chain. According to a project manager with 40 years' experience in the UK and Norwegian oil and gas industries:

> *There will be misalignment of the interest of the owner, whose money is getting spent and the interest of a contractor, who gets paid more for doing more. So, that is just the real world. But more times we tend to align on most things. But we always remember one company likes spending money, our money. There are always differences between an owner and a contractor.*
>
> *– A project manager with 40 years' experience in the UK and Norwegian oil and gas industry*

On the other side of the argument, 40% of interviewees representing the UK and Australian oil and gas decommissioning communities argued that there is a high degree of alignment in interest to reduce the overall cost of decommissioning. Note that the remaining 15% of interviewees are public stakeholders and regulators who did not provide an opinion on this debate. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

I think it is a function of the individuals. BP has developed quite a strong capability in decommissioning, they have learned a lot off North-West Hutton and other projects like Miller that is pushing them towards the direction of collaboration. And I think they have seen some benefits from that……. depending on the portfolio size, the proximity to other locations, to similarity with other facilities, the timing of the various assets, it is going to drive you in different directions.

– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally

This suggests that the extent of alignment in interests between oil and gas operators and the supply chain depends on a variety of factors, meaning that there is considerable uncertainty when it comes to the extent of alignment in interests between an oil and gas operator and the supply chain.

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, best practice for managing supply chain is to engage them early in an oil and gas decommissioning project or programme lifecycle. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

Murchison was a very large Central North Sea platform that has just finished, so the decommissioning is done. They [CNR (Canadian National Resources Limited)] have actually change the sequence based on early engagement with the supply chain. So, they [CNR] are an example of a company that gave flexibility to the main contractors. The main contractor came back and said: "rather than doing the removal over three years, can we do it over two years? And it will cost you less". So, CNR had to go back to Canada, and get approval from Calgary for additional funds, but it all happened very well.

– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally

This suggests that earlier engagement with the supply chain can provide more opportunities for improving the extent of alignment in interests between oil and gas operators and the supply chain, leading to more innovative and cost-effective solutions.

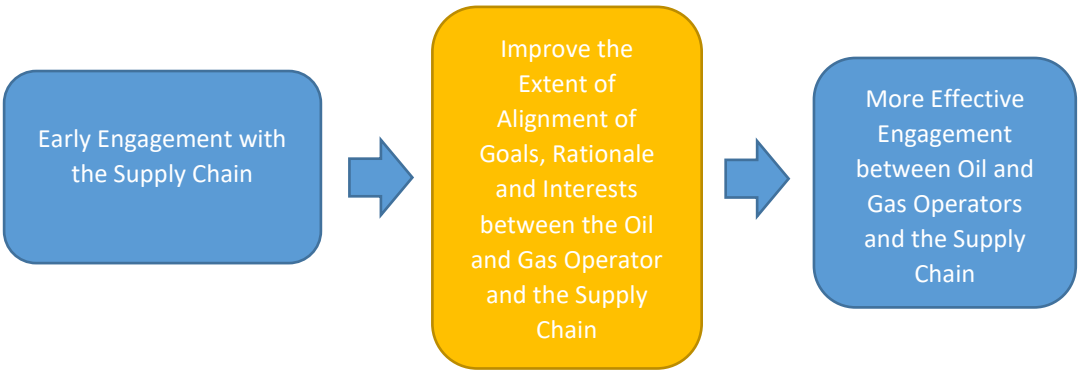


Figure 9-10 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and the Supply Chain by Early Engagement

9.2.2.6 – Extent of Alignment among the Supply Chain

In 2018 and 2019, there were several oil and gas decommissioning consortiums and alliances being formed, such as the Worley-Lloyd Register's-Ardent consortium, the Forth and Tay Decommissioning Alliance, the Paterson-Veolia partnership, and the Fairfield Decom (Whittaker, Oudenot & Vasquez 2019). This suggests that there is a high degree of alignment in interests, rationale and goals among different members of the oil and gas decommissioning supply chain.

However, 10 interviewees representing the supply chain in the UK and Australian landscapes indicated that the phenomenon of forming consortiums is due to a considerable extent of alignment in interests to increase the opportunity of being awarded a job. According to a decommissioning consultant with 40 years' experience in the oil and gas industry:

Just imagine this. If there are 10 contracting companies bidding for the same job, the chances of me getting awarded the contract is 10%.

But if these contracting companies form consortiums or alliance so to speak. Let's say five in consortium A, and five in consortium B. Now I have only two parties bidding for the same job. So, now the chances of me getting awarded the contract is 50%.

– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally

According to a procurement manager with 25 years' experience in the oil and gas industry, a consortium may be a more favourable option than contracting each contractor individually, because it lowers the number of operator-contractor interfaces that the oil and gas operator will have to manage during oil and gas decommissioning. This finding suggests that the extent of alignment among the supply chain can also have an influence on the management of oil and gas decommissioning activities.

9.2.2.7 – Extent of Alignment among Different Regulators in the United Kingdom

An interesting finding is that there appears to be some form of misalignment between SEPA (the Scottish Environmental Protection Agency) and the three other main decommissioning regulators in the United Kingdom (OGA, BEIS, and HSE). According to a representative from SEPA:

SEPA only got involved in decommissioning since 2016. SEPA requested to be involved. At that time, many regulators and operators and contractors, even other regulators like HSE and OGA and even some people within SEPA were questioning on SEPA involvement in decommissioning.

SEPA is looking towards working closer with HSE in the future, maybe coming up with a criterion together. The relationships between SEPA with OGA and HSE is not that close. We felt there is less cooperation between SEPA with OGA and HSE as compare to with operators.

– A representative from SEPA[21]

[21] No job role and work experience were stated as per request by the interviewee.

According to a representative from BEIS, a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *Over the last year [2017], we did a lot of work with the waste regulators, SEPA and the EA [Environment Agency]. I think they [SEPA and EA] are not geared up yet for the level of decommissioning. We updated the guidelines and asked operators to work more closely with the waste regulators.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

According to public policy literature, the extent of alignment between different regulatory bodies can have an influence on the efficiency of the decision-making process (Armstrong 2018; McGowan & Wallace 1996). In addition, as illustrated in **Figure 9-11** (below, page 435), each regulator is responsible for a different part of the oil and gas decommissioning process in the UK landscape.

Hence, it could be beneficial for the UK oil and gas decommissioning regulators, to ensure that there is a high degree of alignment between them in order to ensure a more efficient decision-making process for oil and gas decommissioning activities.

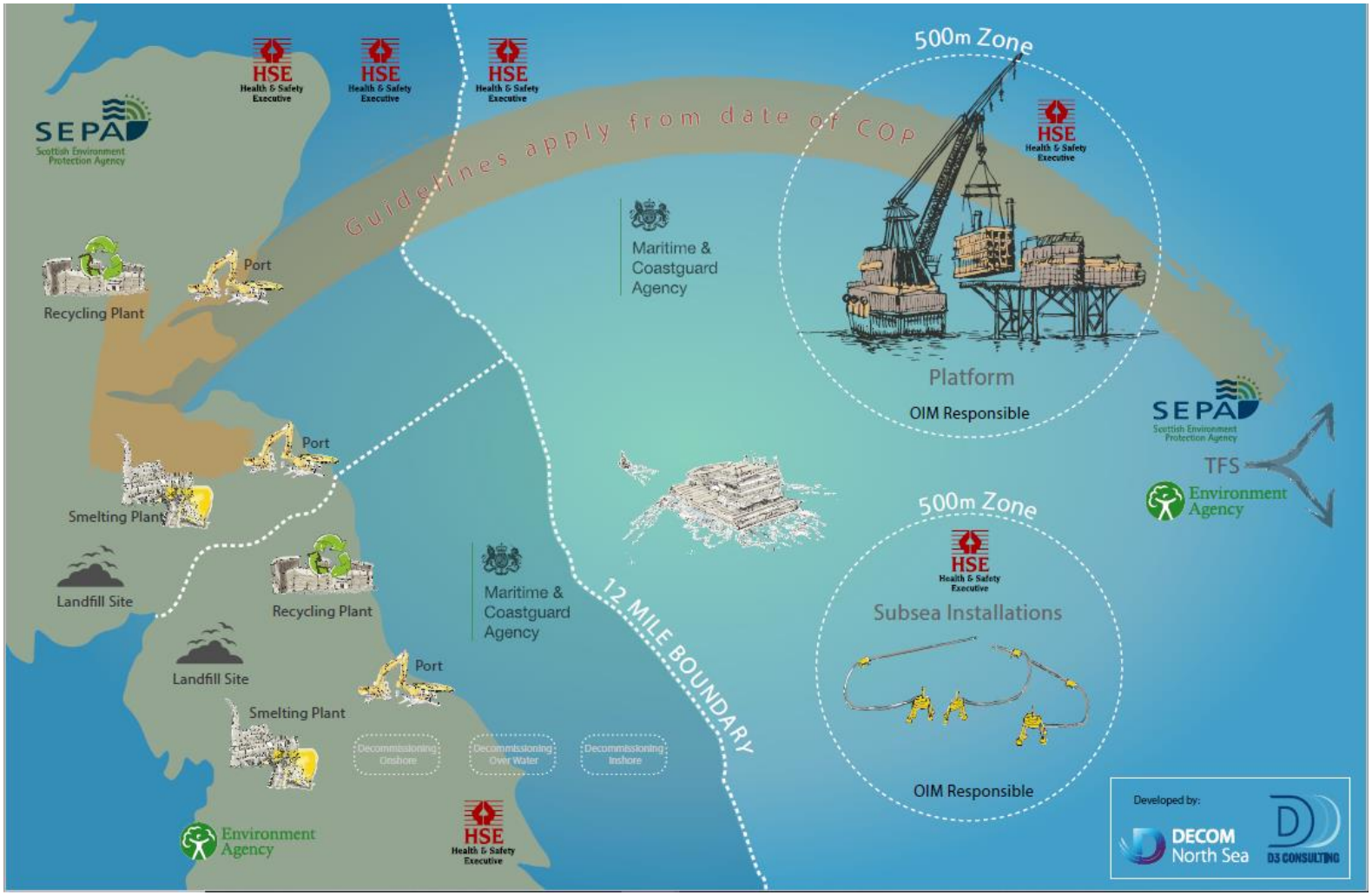


Figure 9-11 – Illustrated Map of Regulatory Responsibilities for Decommissioning in the United Kingdom (Decom North Sea 2018)

9.2.2.8 – Extent of Alignment among Environmental NGOs

According to a former project manager with 35 years' experience in the oil and gas industry:

> *There was a situation where Greenpeace UK had gone along with a programme and was okay with it, and then I think it was the Dutch part of Greenpeace then came in and disagreed. And there we were like hang on, Greenpeace UK had said yes. But they say that was UK Greenpeace, we are Dutch Greenpeace, and we don't agree on what they agreed on. So you got differences even within the same group, and they may not always talk as one voice.*
>
> *– A former project manager with 35 years' experience in the oil and gas industry*

An interesting finding, on revisiting the literature, is that the environmental activists who boarded the legs of Brent Bravo and Brent Alpha platforms in 2019 were from Greenpeace Netherlands and Greenpeace Germany, and not from Greenpeace UK. This suggests that a key method for managing oil and gas decommissioning stakeholders is to disaggregate them, even if they belong to the same organisation. For example, as seen in ***Appendix T*** (see page 650), which is the list of stakeholders identified for a real oil and gas decommissioning project or programme in the United Kingdom, WWF (World Wide Fund for Nature) was disaggregated into different six unique stakeholders (WWF Denmark, WWF Germany, WWF International, WWF Netherlands, WWF Scotland, and WWF UK).

According to (Ackermann & Eden 2011), disaggregating stakeholders creates more precision and distinctiveness, allowing organisations to have a deeper understanding of each stakeholder's interests and their impact potential. This suggests that stakeholder impacts in oil and gas decommissioning could be prevented by a careful disaggregation of stakeholders, such that each stakeholder can prioritised, engaged, and managed more effectively.

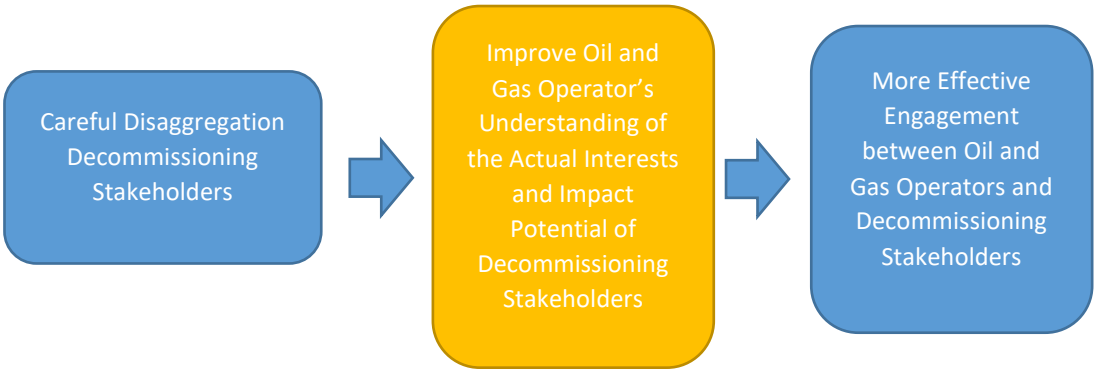


Figure 9-12 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders by Careful Disaggregation of Decommissioning Stakeholders

9.2.3 – Top Management Team's Philosophy and Attitude towards Stakeholder Engagement

As mentioned in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths***, the philosophy and attitude of top management teams and stakeholder managers towards stakeholder engagement appears to have an influence on the stakeholder management plan. As stakeholder management plans for projects and programmes are approved by top management teams before being implemented (Ackermann & Eden 2011; Eskerod & Jepsen 2013; Olander & Landin 2005), this suggests that the effectiveness of stakeholder management is dependent on the philosophy and attitude of the top management teams.

According to a former project manager with 40 years' experience in the oil and gas industry:

Shell have a defined process for engagement with the external world. It didn't fit my philosophical model for decommissioning…When we started off the project with…I was the project stakeholder guy. And we presented to the Head of Technical and the Vice-President of Technical of Aberdeen, and explained to them that the Brent Decommissioning was highly reputational sensitive.

And all he could say was: "What process have you used to get to these conclusions?"

And we said: "Well there wasn't a Shell process that took account the factors of decommissioning."

The gentleman banged the desk very angrily, swore furiously, and said: "This is Shell, we have a process for everything, go and find the one that applies."

And that was the end of that conversation. And from that point on, the management of Shell in my opinion, stopped listening to their own people, and the outside world. And they started on this track that they have been on for 12 years of deciding what they want to do, and finding a way to justify it.

– A former project manager with 40 years' experience in the oil and gas industry

This finding suggests that top management teams have a preference that stakeholder engagement should be done in accordance with corporate processes. According to a former compliance manager with 40 years' experience in the oil and gas industry, one major reason why top management teams prefer the use of corporate processes is that there is a perception by oil and gas operators that not following corporate processes is the reason for stakeholder impacts.

While corporate processes may be useful to ensure that the quality of stakeholder engagements are the same for all projects and programmes in the organisation (Eccles, Ioannou & Serafeim 2014; Schouten & Remme 2006), as noted by a decommissioning consultant with 40 years' experience in the oil and gas industry:

There are always exceptions to corporate processes. For example if you look at the Stage-Gate Project Management System, which the oil and gas industry are implementing it rigorously today. When it was introduced, they only work for 99%

of the projects. So, for most projects it is fine, but you still need to acknowledge that the 1% still exists.

– *A former project manager with 40 years' experience in the oil and gas industry*

This suggests that it is possible that oil and gas decommissioning comprises the 1% of projects which can be managed more effectively without corporate processes. It could, therefore, be beneficial for top management teams of oil and gas operators to be flexible when it comes to the enforcement of corporate processes for oil and gas decommissioning projects or programmes.

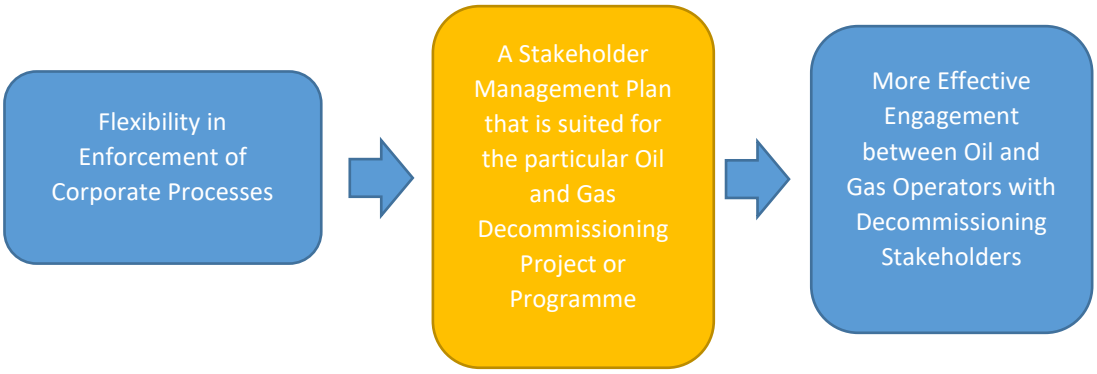


Figure 9-13 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders by Flexible Enforcement of Corporate Processes

9.2.4 – Oil and Gas Operators' and Stakeholders' Extent of Engagement Fatigue

One of the most interesting emergent findings in this research is the phenomenon of engagement fatigue, which has been frequently mentioned by interviewees ever since the first interview. In total, 80% of interviewees representing both the UK and Australian landscapes mentioned the existence of stakeholder engagement fatigue, which suggests that it is a real and commonly occurring phenomenon in the oil and gas industry.

9.2.4.1 – Extent of Engagement Fatigue in the United Kingdom Landscape

While the possibility of stakeholder engagement fatigue occurring was mentioned countless times by oil and gas operators, the supply chain, and regulators in the UK landscape, stakeholder engagement fatigue was not mentioned to be actually occurring by any interviewee from the UK part of the

research. According to an executive manager of a commercial fishing representative body in the United Kingdom:

> *We will comment on every project even if 50 projects comes at the same time. In fact according to regulation, no decommissioning project will be approved without our comment. For Scotland, I believe we will be able to cope with the influx of decommissioning activity. However, there may be a lack of staff in the English side.*
>
> *– An executive manager of a commercial fishing representative body in the United Kingdom*

This suggests that in the UK landscape, there is actually a low extent of engagement fatigue among the stakeholders. However, as the possibility of stakeholder engagement fatigue occurring was mentioned countless times by oil and gas operators, the supply chain, and regulators in the UK landscape, it is possible that they are the ones who are feeling the fatigue of engagement.

According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles, who attempts to explain the stakeholder engagement fatigue phenomenon in the United Kingdom:

> *A lot of operators are coming to decommissioning almost fresh. They are doing stakeholder consultation for decommissioning for the first time. So, operators are not necessarily feeling fatigue with themselves because they are learning.*
>
> *But, the idea at the industry that we have to keep going and do the same studies and go through the same stakeholder engagement process…There is definitely a feeling that we are implementing this is a sub optimal way and there is room for some streamlining here, which would mean less effort for everybody. Less effort sounds like less cost, who would not like less cost? Most people would like that.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

This suggests that the reason for the feeling of stakeholder engagement fatigue among oil and gas operators, the supply chain, and regulators, is the repetitiveness of the stakeholder engagement process for oil and gas decommissioning in the UK landscape.

9.2.4.1.1 – Legislative Obligation in Engaging Statutory Consultees

One reason for the repetitiveness of stakeholder engagement process in the United Kingdom is, according to a former project manager with 40 years' experience of managing oil and gas project globally:

> *As you go through that preparation of the decommissioning programme [proposal], you have your statutory consultees that you must go to and get their feedback, and include that into your programme [proposal].*
>
> *– A former project manager with 40 years' experience of managing oil and gas project globally*

Furthermore, a revisit to the literature finds that in Section 29(3) of the Petroleum Act 1998, amended 2016, it is stated that:

> *A notice under subsection (1) may require the person to whom it is given to carry out other consultations (with statutory consultees) as may be specified in the notice before submitting an abandonment programme.*
>
> *– Section 29(3) of the Petroleum Act 1998, as amended by the Energy Act 2016*

In support of Section 29(3) of the Petroleum Act 1998, as amended by the Energy Act 2016, Paragraph 6.17(3) of the Offshore Oil and Gas Decommissioning Guidance Notes states that:

> *The operator should commence statutory consultations as required under Section 29(3) of the Petroleum Act 1998. This comprises of the representatives of those parties who may be affected by the decommissioning proposals, such as the fishing industry. Details of the statutory consultees will be specified in a letter to all companies in receipt of a notice under Section 29 of the Act, further to that notice.*
>
> *– Paragraph 6.17(3), Offshore Oil and Gas Decommissioning Guidance Notes 2018*

The current legislative arrangement in the United Kingdom suggests that statutory consultees must be engaged as stakeholders regardless of their actual extent of interest and impact potential. However, according to Ackermann and Eden (2011), Eskerod and Huemann (2013), Aaltonen and Kujala (2016), and much other stakeholder management literature, stakeholder interests and impact potential can differ from one organisation to

another, or from one project to another. This means that a statutory consultee who may be interested in one oil and gas decommissioning project or programme may well not be interested in the others.

Thus, enforcing a legislative requirement for oil and gas operators in the United Kingdom to engage statutory consultees may not be the most strategic and efficient way of managing oil and gas decommissioning stakeholders in the UK landscape. It could be beneficial, from a strategic stakeholder management perspective, to amend Section 29(3) of the Petroleum Act 1998 such that it provides more flexibility regarding the management of stakeholders depending on the specificity and uniqueness of stakeholder interests and their impact potential on the particular oil and gas decommissioning project or programme.

However, it must also be noted that Section 29(3) of the Petroleum Act 1998 could also be an effective mechanism for enabling statutory consultees to quickly let an operator know if they had no interest. Equally, an operator's lawyers would likely be happier if they had a record of a response from such consultees. The nightmare scenario would be the operator judging that they did not need to consult a particular body and then that body raising problem at a later stage or problems emerging which could have been avoided by such consultation. It is possible that Section 29(3) of the Petroleum Act 1998 provided reassurance to oil and gas operators.

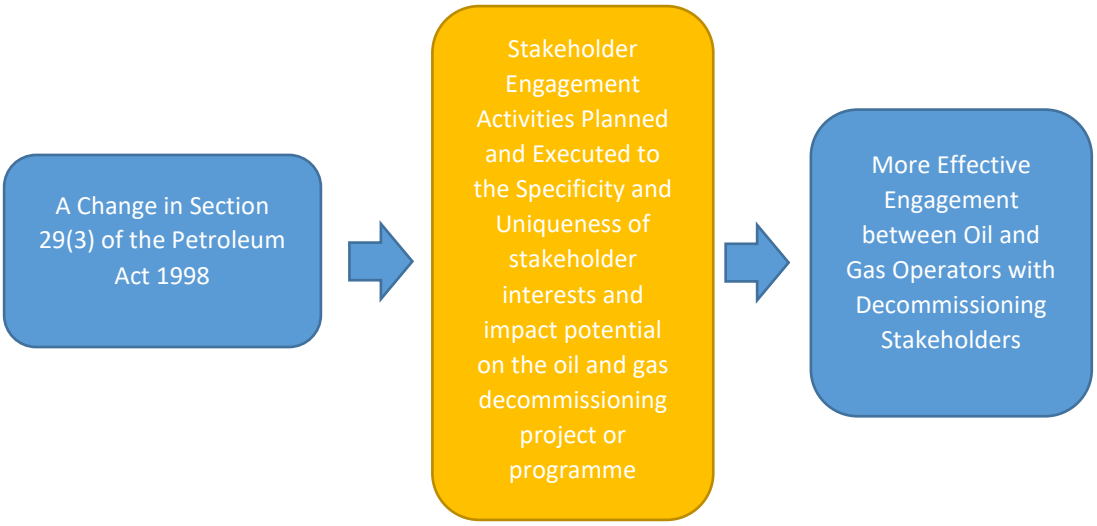


Figure 9-14 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders by a Change in Section 29(3) of the Petroleum Act 1998

9.2.4.1.2 – Over engaging Stakeholders

A total of six interviewees representing oil and gas operators, the supply chain, and regulators in the United Kingdom stated that some oil and gas operators are over engaging stakeholders. According to a decommissioning manager with 25 years' experience in the oil and gas industry:

> *The North-West Hutton is one project where there were too many stakeholder engagements. It is not good to engage too many stakeholders because you will end up with too many comments that you will have to deal with and address. Some of the engagements were not necessary. It is much better just to engage the correct stakeholders, and then invite any additional comments from the online page.*
>
> *– A decommissioning manager with 25 years' experience in the oil and gas industry*

It is possible that due to the legacy of Brent Spar, oil and gas operators in the United Kingdom are taking extra precautions by overestimating the extent of interests and potential impacts of stakeholders when mapping them, leading to over engagement with stakeholders. This finding also implies that there is still a lack of understanding of the extent of interests and potential impacts of oil and gas decommissioning stakeholders in the United Kingdom.

According to a regulator with 15 years' experience in regulating oil and gas decommissioning activities in the United Kingdom, how much oil and gas operators involve stakeholders should be proportionate to the scale of the programme. This suggests that it is possible that the extent of interest and potential impact of stakeholders are higher for larger-scale oil and gas decommissioning projects or programmes. Examples of larger-scale oil and gas projects or programmes include Brent and Brae (Shell 2017d; Marathon Oil 2017; RockRose Energy 2019). This finding also implies that the stakeholder management strategy should differ depending on the scale of the oil and gas decommissioning project or programme.

9.2.4.2 – Extent of Engagement Fatigue in the Australian Landscape

As discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, it is surprising that stakeholder engagement fatigue was mentioned by oil and gas operators in the Australian oil and gas decommissioning landscape considering that the Australian landscape is still in its infancy when it comes to stakeholder engagement (Barrymore & Ballard 2019).

9.2.4.2.1 – Overfeeding Information

As discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, the reason for stakeholder engagement fatigue is a perception by oil and gas operators that stakeholders require the environment plan and all the requisite factsheets to make an informed assessment of possible consequences to the proposed oil and gas activity.

This suggests that it could perhaps be beneficial for oil and gas operators in the Australian landscape to have an initial consultation with potential stakeholders to confirm their interests, and the information they require to make an informed assessment, before following up by sending them the relevant information they require. Such an approach may minimise unnecessary stakeholder interactions and prevent stakeholders from becoming fatigued from engaging oil and gas operators.

9.2.4.2.2 – Variation in Stakeholder Interests

According to a decommissioning engineer with 22 years' experience in the oil and gas industry:

> *We have done Comparative Assessment workshops with local stakeholders, particularly the fishery folks, actual fishermen, government agencies, and also with the local community to talk about decommissioning*
>
> *Some of the stakeholders want to be engaged more, they are very information hungry. Other ones are like "we told you last time, this is what our opinion is". So, people like the port authorities seem to be very "you know what our opinion is, we made it very clear, you don't need to engage with us anymore.*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

It is possible that stakeholder engagement fatigue is occurring in Australia because oil and gas operators are engaging different public stakeholders groups in the same manner. For example, as mentioned by the decommissioning engineer with 22 year of experience, CA workshops were conducted with the fishermen, government agencies, and the local community. This suggests that it could be more beneficial for oil and gas operators to vary their stakeholder engagement activities depending on the extent of interest and potential impacts of the respective stakeholders.

As mentioned in **Section 9.2.4.1.2** (see page 443), it was suggested that the extent of interest and potential impacts of stakeholders are higher for larger-scale oil and gas decommissioning projects or programmes. However, the Echo Yodel oil and gas facility, which is a much smaller scale oil and gas facility consisting of only pipelines, umbilicals, and subsea structures (Woodside 2019), was subjected to stakeholder impacts when the oil and gas operator, Woodside, was pressured by stakeholders to abandon the plans to leave the Echo Yodel facility in place (Milne 2020).

The Echo Yodel oil and gas facilities had considerable public attention in 2001, as it was part of the North-West Shelf Venture, one of the largest resource development in Australian history (Woodside 2017). This suggests that it is possible that the extent of interests and potential impacts of stakeholders on the oil and gas decommissioning project or programme depends on the extent of public attention the oil and gas facility had throughout its lifecycle.

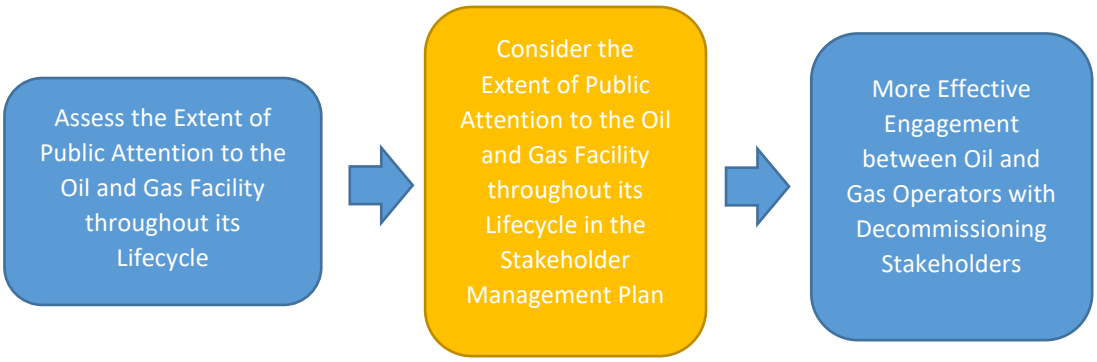


Figure 9-15 – Enhancing the Effectiveness of Engagement between Oil and Gas Operators and Stakeholders by Assessing the Extent of Public Attention to the Oil and Gas Facility throughout its Lifecycle

9.2.5.1 – Extent of Trust between Regulators on United Kingdom Oil and Gas Operators

A total of six interviewees representing the OGA (Oil and Gas Authority), BEIS (the Department for Business, Energy and Industrial Strategy), the HSE (Health and Safety Executive), and SEPA (the Scottish Environmental Protection Agency), mentioned that there is a good relationship between oil and gas operators and regulators in the United Kingdom. According to a representative from BEIS:

> *Our relationship with the operator is also very important, we have a collaborative relationship. Although we say we are the approval, we don't act it dictatorially. We try and reach a solution together and make sure that we take their views into account when making policies and things. We have a very good relationship with the operators. We don't have much concerns with them.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

In addition, as mentioned in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths***, the OGA is flexible when it comes to the approval of CoP dates. It is possible that the flexibility of regulators when it comes to the enforcement of regulations and guidelines is due to the high degree of trust regulators have with the oil and gas operators in the UK landscape.

9.2.5.2 – Extent of Trust between United Kingdom Oil and Gas Operators and the Department for Business, Energy and Industrial Strategy (BEIS)

According to two interviewees, the competency of BEIS is questionable because of the inconsistency in standards and procedures when it comes to the approval of decommissioning proposals. According to a former project manager with 40 years' experience in the oil and gas industry:

If you look at the Maureen, or Murchison, or the Miller decommissioning programme, the oil and gas operators responded to every single comment by the stakeholders.

The government let Fairfield off on the Merlin and Osprey Decommissioning. They close out the stakeholder dialogue, before they even answer all the points of the stakeholders. The government should never let Fairfield do that…it comes down to regulatory incompetence.

– A former project manager with 40 years' experience in the oil and gas industry

A revisit to the literature finds that inconsistency in regulatory standards and procedures can impair stakeholders' perception of procedural justice (Makkai & Braithwaite 1996; Tyler & Bies 1990; Kerman & Hanges 2002). Additionally, according to Hough et al. (2010) and (Saunders and Thornhill (2003), it is suggested that stakeholders' perception of procedural justice can have an influence on their extent of trust.

It is possible that there is some form of distrust by oil and gas operators regarding BEIS because of inconsistency in standards and procedures when it comes to the approval of decommissioning proposals. Hence, it could be beneficial for BEIS to be more consistent with standards for procedures when it comes to the approval criteria of oil and gas decommissioning programmes.

9.2.5.3 – Extent of Trust between Oil and Gas Operators and the Supply Chain in the United Kingdom

The importance of trust between oil and gas operators and the supply chain was mentioned by 40% of interviewees from the UK part of the research, and it is the most frequently mentioned topic when discussing trust and the effectiveness of engagement between oil and gas operators and stakeholders. This suggests that the extent of trust between oil and gas operators and the supply chain may have a high level of influence on the effectiveness of engagement between them. According to a project manager with 27 years' experience in the oil and gas industry:

Working together, collaboration, and relationship and trust between the contractor and operator is extremely important in a decommissioning project.

– A project manager with 27 years' experience in the oil and gas industry

It is possible that the emphasis by interviewees on the importance of trust between oil and gas operators and the supply chain is because a higher extent of trust between oil and gas operators and the supply chain can improve the effectiveness of engagement between them.

9.2.5.4 – Extent of Trust between Oil and Gas Operators and the Supply Chain in other Landscapes

According to an interviewee from the Australian part of the research, a project manager with 17 years' experience in the oil and gas industry:

When contractor XYZ comes up with a good idea, that is all and good. But it is still our liability. We are conscious on that fact. I know there are other organisations who do that, but we don't feel comfortable giving more responsibilities to the contractor. If a well leaks, it is not the contractors name in the papers, it is our names that gets in the papers.

– A project manager with 17 years' experience in the oil and gas industry

It is possible that oil and gas operators in Australia tend to be much more conservative when it comes to trusting contractors. As the Australian oil and gas decommissioning landscape is much younger than that of the United Kingdom (Barrymore & Ballard 2019; Shaw, Seares & Newman 2018), it is possible that the extent of trust between operators and contractors may improve as the oil and gas industry matures in the landscape.

However, from a review of industry literature such as Othman, Omar and Zain (2019) and Sirirattanachatchawan et al. (2019), it appears that in other emerging oil and gas decommissioning landscapes, such as Thailand and Malaysia, the extent of trust between oil and gas operators and contractors appears to be quite high. According to Othman, Omar and Zain (2019), for example, Vestigo Petroleum did not perform any additional integrity tests on the platform prior to the removal and relocation, opting to trust the information provided by the oil and gas operator, PETRONAS.

This suggests that it is possible that the extent of trust between oil and gas operators and the supply chain is more influenced by the local culture than by the maturity of the oil and gas decommissioning landscape.

9.2.5.5 – Extent of Trust between Oil and Gas Operators and Public Stakeholders in the United Kingdom

Of interviewees representing UK oil and gas decommissioning community, 23% of them stated that honesty is important when it comes to stakeholder engagement. According to a project manager with 40 years' experience in the UK and Norwegian oil and gas industry:

> *First and foremost, our job is to be honest with people, honest with science, honest with stakeholders, and honest with the regulators on what the options are…we must always be honest, and…we will not be able to persuade anybody if we are found to be dishonest. Nobody will believe us ever.*
>
> *– A project manager with 40 years' experience in the UK and Norwegian oil and gas industries*

According to the literature, being honest can improve the extent of trust between organisations and stakeholders, hence improving communication between them (Genter 2019; Kendall 1964; Wilburn & Wilburn 2011; Moffat & Zhang 2014; Nelsen 2006). This suggests that the extent of trust between oil and gas operators and stakeholders can have an influence on the effectiveness of engagement between them.

According to a regulator with a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *The industry wants to be open and honest, we want to consult. But to be honest this is something that the industry is already doing constantly.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

As stakeholder impacts are still occurring, as evident by the 2019 Brent Field decommissioning protest (Thomas 2019), this finding suggests that perhaps the extent of trust itself is not the only factor influencing the effectiveness of engagement between oil and gas operators and public stakeholders.

9.2.6 – Extensiveness of Early Engagement between Oil and Gas Operators and Stakeholders

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, early engagement appears to be one of the best practices to minimise stakeholder impacts. This suggests that it is possible that the extent of early engagement may have an influence on the effectiveness of engagement between oil and gas operators and stakeholders.

The following sections will discuss how the extensiveness of early engagement between oil and gas operators and stakeholders influences the effectiveness of engagement between them.

9.2.6.1 – Extensiveness of Early Engagement between Oil and Gas Operators and Regulators

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, early engagement appears to be best practice to manage UK regulators, such as the OGA (Oil and Gas Authority), BEIS (the Department for Business, Energy and Industrial Strategy), and the HSE (Health and Safety Executive).

For the OGA, early engagement provides more time for oil and gas operators and the OGA to reach an agreement on the CoP date. For BEIS, early engagement provides more time for oil and gas operators and BEIS to reach an agreement regarding the contents of the decommissioning proposal. For the HSE, early engagement provides more time for oil and gas operators and the HSE to reach an agreement regarding the precise decommissioning methodology in terms of safety.

Interestingly, industry literature suggests that many emerging oil and gas decommissioning landscapes, such as Malaysia and Thailand, are also actively promoting early engagement between oil and gas operators and regulators in their guidelines (Laister & Jagerroos 2018; Akbar Ali, Abdul Karim & Rusli 2019; Jagerroos & Kayleigh 2019). Overall, the findings suggest that the more extensive the early engagement between oil and gas operators and the regulators, the higher the likelihood of achieving alignment between them, hence improving the likelihood of effective engagement.

9.2.6.2 – Extensiveness of Early Engagement between Oil and Gas Operators and the Supply Chain

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, early engagement appears to be best practices to manage supply chain stakeholders in the United Kingdom. Early engagement between oil and gas operators and the supply chain, as mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths*** (see page 424), can create more opportunities for co-creation of solutions between oil and gas operators and the supply chain, improving the management of cost, schedule, and scope of the oil and gas decommissioning project or programme.

Overall, the findings suggest that the more extensive the early engagement between oil and gas operators and the supply chain, the higher the likelihood of achieving alignment between them, hence improving the likelihood of effective engagement between them.

9.2.6.3 – Extensiveness of Early Engagement between Oil and Gas Operators and Public Stakeholders

When it comes to engaging public stakeholders such as commercial fishing organisations, there appears to be a debate that arose from the interview data regarding the relationship of the extent of early engagement between oil and gas operators and public stakeholders, and the effectiveness of engagement between them. Six interviewees representing oil and gas operators from both the UK and Australian landscape commented that early engagement with public stakeholders provides more time for oil and gas operators to address any concerns raised by them. For example, according to a stakeholder manager with 10 years' experience in the oil and gas industry:

> *Operators tend to engage with key stakeholders very early in the process. They [operators] kind of do their own independent engagement, so by the time it BEIS gets the programme for the consultation, and sends it to the stakeholders for comments, most of the time, they [stakeholders] would have been familiar with what the proposals are because they [stakeholders] would have spoken to the operator.*
>
> *– A stakeholder manager with 10 years' experience in the oil and gas industry*

However, two interviewees felt that an extensive early engagement process with public stakeholders has no benefits. According to a decommissioning consultant with 40 years' experience in the oil and gas industry:

> *If you engage stakeholders too early, and you have nothing on the table to show them, they will be asking "what are you engaging us for?"*
>
> *– A stakeholder manager with 10 years' experience in the oil and gas industry*

This suggests that engaging public stakeholders as early as possible may not be the best strategy and most effective method for managing public stakeholders. The finding also suggests that the timing of engagements is just as important as the engagement platform when it comes to influencing the effectiveness of engagement between oil and gas operators and public stakeholder.

9.2.7 – Stakeholders' Capacity for Effective Engagement

During the UK part of the research, whenever stakeholder engagement fatigue was mentioned, interviewees also linked this to stakeholders' capacity for effective engagement. This suggests that there is perhaps a relationship between the extent of stakeholders' engagement fatigue and their capacity for engagement. The finding also suggests that stakeholders' capacity for effective engagement can also influence the effectiveness of engagement between oil and gas operators and stakeholders.

The following sections will discuss how the stakeholders' capacity for effective engagement can influence the effectiveness of engagement between oil and gas operators and stakeholders.

9.2.7.1 – Regulators' Capacity for Effective Engagement

According to a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *Often people don't really see the amount of decommissioning that is going on we used to have only three to four programmes a year. Today we have 27 programmes at execution.*
>
> *We have increased our staff by 66% over the last few years, and we are probably about to do it again.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

According to Section 29(2A) of the Petroleum Act 1998, as amended by the Energy Act 2016, there is a legislative obligation for oil and gas operators to engage with the Oil and Gas Authority. Paragraph 6.27 of the Offshore Oil and Gas Decommissioning Guidance Notes also stated that oil and gas operators must keep OPRED (Offshore Petroleum Regulator for Environment and Decommissioning) informed of the progress of the decommissioning operation.

Overall, this suggests that it is important for UK regulators to ensure that they have sufficient staff to handle these mandatory engagements with oil and gas operators. Additionally, governments and regulatory bodies in emerging oil and gas decommissioning regions may want to consider whether they have the capacity and capability to ensure effective engagement with oil and gas operators when implementing policies, regulations, and guidelines.

9.2.7.2 – Public Stakeholders' Capacity for Effective Engagement

According to a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *Stakeholders have known about this level of decommissioning for a number of years, and they have up staffed as well……We have also tried to tell all the relevant stakeholders like JNCC [Joint Nature Conservation Committee] on the level of programmes, and they know now, and they have been trying to upstaff as well.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

This finding suggests that public stakeholders also need sufficient staff in order to engage effectively with the oil and gas operators. However, as discussed in **Section 9.2.4.1**, some public stakeholder groups clearly have limited capacity in that regard.

When questioned on how the regulators would respond when public stakeholders have limited capacity for effective engagement for oil and gas decommissioning, a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom stated that:

> *Decommissioning Programmes will keep going forward, if stakeholders want to come back to us, they must come back to us within a certain time. We would allow a little bit of flexibility, but not to a point that will hold back a huge amount of Programmes, we just couldn't do that. It will actually impact on cost, it will impact on the integrity on some of the platforms.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

This suggests that there is a conflict between ensuring that public stakeholders are able to provide their view, and the performance of the oil and gas decommissioning project or programme. According to Sachs and Maurer (2009), not involving stakeholders may raise concerns over procedural justice. However, as summarised in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 33), public stakeholders are not the only stakeholders of an oil and gas decommissioning project or programme.

To return to the debate on whether oil and gas decommissioning is a project or a programme, the comment from the regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom suggests that oil and gas decommissioning is being viewed and managed more as a project rather than a programme, as the project performance is being prioritised over the satisfaction of stakeholders.

According to PMI (2017) and Serrador (2013), the success of a project is defined by the project performance (i.e. schedule, cost, and budget), whereas the success of a programme is defined by how well the programme satisfies the requirements of the stakeholders. As discussed in **Section 9.2.4.2.2** (see page 445), stakeholder interests and impact potential appears to differ depending on how much public attention the oil and gas facility has throughout its lifecycle. This suggests that, for higher profile oil and gas facilities, it could be more beneficial to manage their decommissioning as programmes rather than as projects, in order to minimise the risks of stakeholder impacts on the reputation of the organisation.

9.3 – Conclusion

Overall, this chapter has detailed the emergent findings regarding factors influencing the effectiveness of stakeholder engagement. The findings and recommendations are presented in **Tables 9-1** and **9-2,** respectively (below, pages 456 to 458).

Table 9-1 – Summary of Findings in Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement

Type of Findings	**Description**	**Section in this Chapter where this Finding is Discussed**
Project Management Findings	Oil and gas operators perceive oil and gas decommissioning as part of a field development project rather than a waste management process.	Section 9.2.1.1
	There is a conflict between ensuring that public stakeholders are able to provide their view, and the performance of the oil and gas decommissioning project or programme.	Section 9.2.7.2
	Oil and gas decommissioning is being viewed and managed more as a project than a programme, as the project performance is being prioritised over the satisfaction of stakeholders.	Section 9.2.7.2
	For higher profile oil and gas facilities, it could be more beneficial to manage their decommissioning as programmes rather than a projects, in order to mitigate the risks of stakeholder impacts on the reputation of the organisation.	Section 9.2.7.2
	It is possible that oil and gas decommissioning can be managed more effectively without corporate processes.	Section 9.2.3
Stakeholder Management Findings	Stakeholder impacts in oil and gas decommissioning could be prevented by a careful disaggregation of stakeholders, such that each stakeholders can prioritised, engaged, and managed more effectively.	Section 9.2.2.8
	Stakeholder management strategy should differ depending on the scale of the oil and gas decommissioning project or programme.	Section 9.2.4.1.2
	Oil and gas operators in the United Kingdom are taking extra precautions by overestimating the extent of interests and potential impacts of stakeholders when mapping them, leading to over engagement with stakeholders.	Section 9.2.4.1.2
	There is still a lack of understanding by oil and gas operators of the actual extent of interests and potential impacts of oil and gas decommissioning stakeholders in the United Kingdom.	Section 9.2.4.1.2
	The extent of interests and potential impact of stakeholders on the oil and gas decommissioning project or programme is dependent on the extent of public attention the oil and gas facility had throughout its lifecycle.	Section 9.2.4.2.2
	Engaging public stakeholders as early as possible may not be the most strategic and effective method to manage public stakeholders.	Section 9.2.6.3
	The timing of engagements is just as important as the engagement platform as an influence on the effectiveness of engagement between oil and gas operators and public stakeholder.	Section 9.2.6.3
Stakeholder's Level of Knowledge on the Decommissioning Process	The extent and depth of oil and gas operators' knowledge of the oil and gas decommissioning process is limited.	Section 9.2.1.1
	Oil and gas operators have a lack of experience of managing oil and gas decommissioning projects or programmes in the United Kingdom.	Section 9.2.1.1
	Oil and gas operators are perhaps more knowledgeable on the specification and condition of the oil and gas facility itself.	Section 9.2.1.2
	Environmental NGOs have some knowledge of the oil and gas decommissioning process.	Section 9.2.1.4
	Environmental NGO's level of knowledge of the oil and gas decommissioning process does have an influence on the effectiveness of engagement between oil and gas operators and environmental NGOs.	Section 9.2.1.4
	Top management teams have a preference that stakeholder engagement should be done in accordance with corporate processes	Section 9.2.3
	While there appear to be environmental experts within the Department for Business, Energy and Industrial Strategy (BEIS), considerations for the approval of the decommissioning proposals appear to be highly dependent on the views of stakeholders from organisations outside BEIS. It is possible that BEIS consults statutory consultees for the assessment of the oil and gas decommissioning proposals because of the limited extent and depth of knowledge on their knowledge of the oil and gas decommissioning process, in order to properly assess the decommissioning proposals themselves.	Section 9.2.1.3

Level of Alignment of Goals, Rationale, and Interests between Stakeholders	Decommissioning plans differ depending on the extent of alignment between joint-venture partners regarding business goals.	Section 9.2.2.1
	There is a considerable extent of alignment in interests between oil and gas operators and regulators regarding minimising the overall oil and gas decommissioning cost.	Section 9.2.2.2
	There are different and competing pressures when it comes to making decommissioning decisions.	Section 9.2.2.4
	There are considerable uncertainties when it comes to the extent of alignment in interests between an oil and gas operator and the supply chain.	Section 9.2.2.5
	The extent of alignment among the supply chain can also have an influence on the management of oil and gas decommissioning activities	Section 9.2.2.6
Extensiveness of Early Engagement between Oil and Gas Operators and Stakeholders	The more extensive the early engagement between oil and gas operators and the regulators, the higher the likelihood of achieving alignment between them, thus improving the likelihood of effectiveness of engagement between them.	Section 9.2.2.2, Section 9.2.2.3, Section 9.2.2.4, Section 9.2.2.5, Section 9.2.6.1
	Earlier engagement with the supply chain can provide more opportunities for improving the extent of alignment in interests between oil and gas operators and the supply chain, leading to the development of more innovative and cost-effective solutions.	Section 9.2.2.5, Section 9.2.6.2
Oil and Gas Operator's and Stakeholder's Extent of Engagement Fatigue	Stakeholder engagement fatigue it is real and commonly occurring phenomenon in the oil and gas industry.	Section 9.2.4
	In the United Kingdom landscape, there is actually a low extent of engagement fatigue among the stakeholders.	Section 9.2.4.1
	In the United Kingdom landscape, oil and gas operators, the supply chain, and regulators are the ones who are feeling the fatigue of engagement.	Section 9.2.4.1
	The reason for the feeling of stakeholder engagement fatigue among oil and gas operators, the supply chain, and regulators, is the repetitiveness of the stakeholder engagement process for oil and gas decommissioning in the United Kingdom landscape.	Section 9.2.4.1
	Stakeholder engagement fatigue is occurring in Australia because oil and gas operators are engaging different public stakeholders groups in the same manner.	Section 9.2.4.2.2
Extent of Trust between Oil and Gas Operators and Stakeholders	There is a high level of trust by regulators have for the oil and gas operators in the United Kingdom landscape.	Section 9.2.5.1
	Stakeholders' perception of procedural justice can have an influence on the extent of their trust.	Section 9.2.5.2
	More trust between oil and gas operators and the supply chain can improve the effectiveness of engagement between them.	Section 9.2.5.3
	Oil and gas operators in the Australian landscape tend to be much more conservative when it comes to trusting contractors.	Section 9.2.5.4
	The extent of trust between oil and gas operators and the supply chain is more influenced by the local culture than the maturity of the oil and gas decommissioning landscape	Section 9.2.5.4
	The extent of trust between oil and gas operators and stakeholders can have an influence on the effectiveness of engagement between them.	Section 9.2.5.5
	The extent of trust itself is not the only factor influencing the effectiveness of t engagement between oil and gas operators and public stakeholders.	Section 9.2.5.5
Stakeholder's Capacity for Effective Engagement	Public stakeholders need sufficient staff in order to engage effectively with the oil and gas operators.	Section 9.2.7.2

Regulatory Findings	Legislation and regulations can have an influence on the extent of alignment in rationale between stakeholders.	Section 9.2.2.4
	The competency and effectiveness of engagement between oil and gas operators and regulators are dependent on the extent and depth of regulators' knowledge of the oil and gas decommissioning process.	Section 9.2.1.3

Table 9-2 – Summary of Recommendations in Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement

Type of Recommendations	**Description**	**Section in this Chapter where this Finding is Discussed**
Recommendations to Operators	Facilitate transfer of knowledge across the landscapes globally in order to better prepare younger landscapes for oil and gas decommissioning.	Section 9.2.1.1
	It could be more beneficial for oil and gas operators to vary their stakeholder engagement activities depending on the extent of interest and potential impact of the respective stakeholders.	Section 9.2.4.2.2
Recommendations to Regulators	Facilitate transfer of knowledge between oil and gas operators and the supply chain in order to create more innovative and cost effective decommissioning solutions.	Section 9.2.1.2
	It is more beneficial for oil and gas decommissioning regulatory organisations to ensure that their regulatory officers are thoroughly equipped with knowledge of the oil and gas decommissioning process, in order to ensure they are competent to properly assess oil and gas decommissioning proposals.	Section 9.2.1.3
	It could be more beneficial for joint-venture partners to set aside a common decommissioning fund at the beginning of the oil and gas lifecycle in order to ensure sufficient funds are available by the time the oil and gas facility is expected to be decommissioned, hence minimising the extent of misalignment among joint-venture partners.	Section 9.2.2.1
	It could be beneficial for the United Kingdom oil and gas decommissioning regulators, to ensure that there is a considerable extent of alignment between them in order to ensure a more efficient decision-making process for oil and gas decommissioning activities.	Section 9.2.2.7
	It could be beneficial, from a strategic stakeholder management point of view, to amend Section 29(3) of the Petroleum Act 1998, such that it provides more flexibility regarding the management of stakeholders depending on the specificity and uniqueness of stakeholder interests and impact potential on the particular oil and gas decommissioning project or programme.	Section 9.2.4.1.1
	There could be some form of distrust by oil and gas operators regarding BEIS because of inconsistency in standards and procedures when it comes to the approval of decommissioning proposals. As such, it could be beneficial for BEIS to be more consistent with standards for procedures when it comes to the approval criteria of oil and gas decommissioning programmes.	Section 9.2.5.2
	It is important for regulators to ensure that they have sufficient staff to handle mandatory engagements with oil and gas operators. Additionally, governments and regulatory bodies in emerging oil and gas decommissioning regions may want to consider whether they have the capacity and capability to ensure effective engagement with oil and gas operators when implementing policies, regulations, and guidelines.	Section 9.2.7.1

In terms of project management, it was found that there is a conflict between ensuring that stakeholders are able to provide their view, and the performance of the oil and gas decommissioning project or programme. It was also found that oil and gas decommissioning is being viewed and managed as a project rather than as a programme, as the project performance is being prioritised over the satisfaction of stakeholders.

In terms of stakeholder management, the findings support the work of Ackermann and Eden (2011), which suggests that stakeholder impacts can be prevented by a careful disaggregation of stakeholders, such that each stakeholder can prioritised, engaged, and managed more effectively. It was also found that the timing of engagements is just as important as the engagement platform when it comes to influencing the effectiveness of engagement between oil and gas operators and public stakeholders. Additionally, it was found that interactions between stakeholders can also have an influence on the interactions between organisations and stakeholders.

In terms of the factors affecting the effectiveness of engagement between organisations and stakeholders, it was found that the extent of trust and extent of alignment between organisations and stakeholders are the two most important factors affecting the effectiveness of engagement between organisations and stakeholders. It was also found that the extent of early engagement between organisations and stakeholders can have an influence on the extent of alignment between organisations and stakeholders. Stakeholder engagement fatigue was also found to be a real and commonly occurring phenomenon in the oil and gas decommissioning landscape, largely due to the repetitiveness of stakeholder engagement activities, and overestimation of stakeholder interests and impact potential.

The next chapter, ***Chapter 10: Regulatory Impact on Project Performance***, will highlight and discuss the regulatory findings from the interview data, thus providing an insight into the impact of legislations, regulations, and guidelines on the management of oil and gas decommissioning activities and stakeholders.

Chapter 10: Regulatory Impact on Project Performance

10.0 – Chapter Abstract

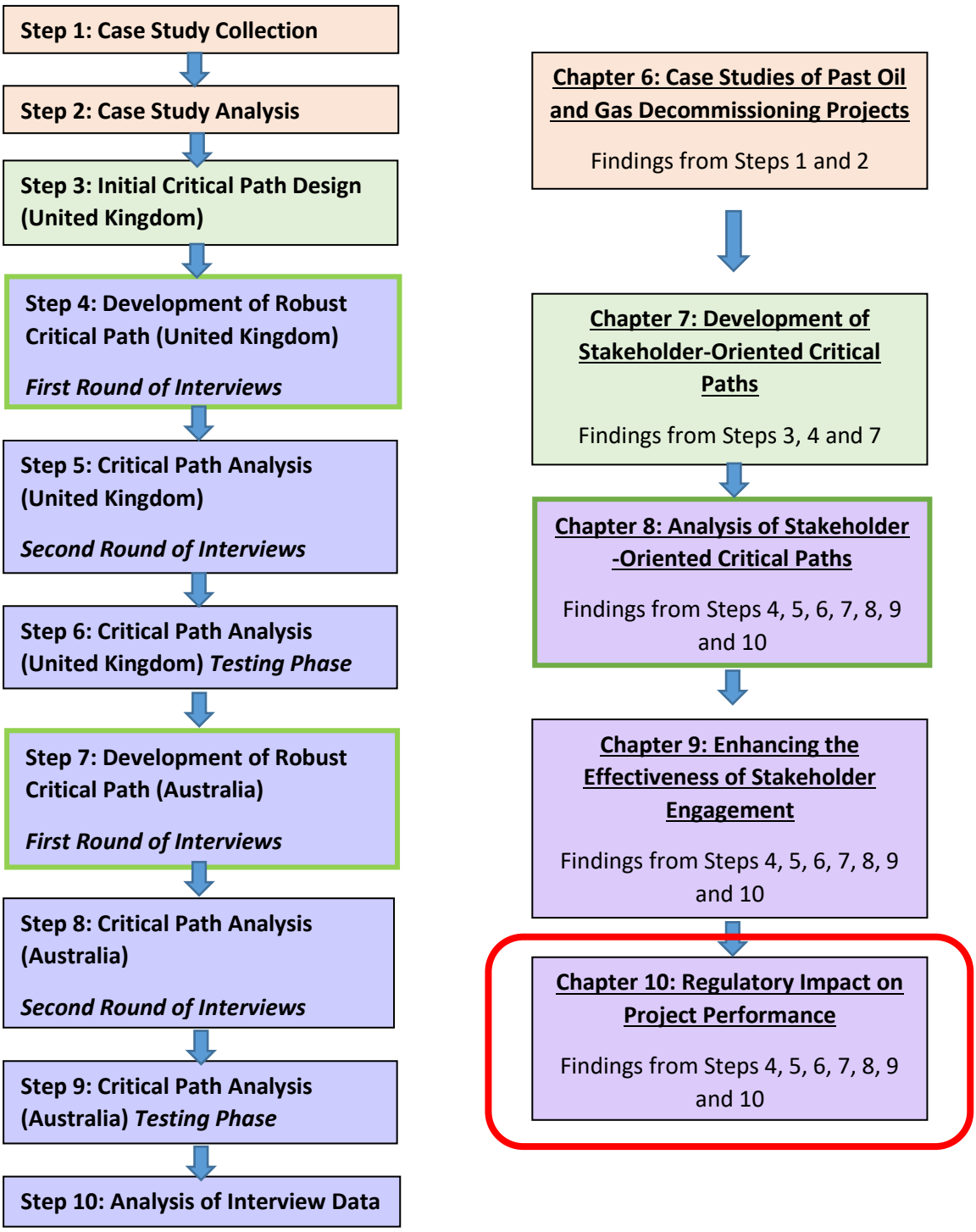


Figure 10-1 – The Fifth Results Chapter – Regulatory Impact on Project Performance

One of the emergent insights that have surfaced numerous times throughout the results chapters is that legislation, regulations and guidelines have an impact on the scope, cost, and schedule of a project.

As discussed in **Chapter 8**, the stakeholder-oriented critical paths vary depending on the legal landscape that the project is subjected to. Additionally, there are areas within current legal instruments, mostly domestic ones, which can be improved in order to enhance the effectiveness of stakeholder engagements for oil and gas decommissioning. Overall, the findings in **Chapter 8** suggest that a form of feedback system exists, whereby existing legal instruments can be improved by analysing stakeholder interactions on the stakeholder-oriented critical paths. The improved legal instruments can then influence future stakeholder interactions in order to enhance project performance and ensure successful delivery of the projects.

As such, this chapter will explore the regulatory findings from the interview data, highlighting the limitations in the current regulatory arrangements, and proposing possible ways to address them. Overall, the regulatory findings can be divided into five main categories:

- Prescriptive or Goal Setting? (Section 10.1)
- Conflicting Goals (Section 10.2)
- The Influence of liability In-Perpetuity (Section 10.3)
- Regulatory Uncertainties (Section 10.4)
- Global Connections (Section 10.5)

10.1 – Prescriptive or Goal Setting?

According to the literature, the legal frameworks for oil and gas decommissioning can be broadly divided into two categories – prescriptive and goal setting (Fam et al. 2018; Paterson 2015; Techera & Chandler 2015; Chandler et al. 2017). A prescriptive regulatory framework means that there is a prescriptive set of requirements set out by the regulator, which must be fulfilled by the oil and gas operator. A goal-setting regulatory framework means that there is only the overarching goal set by the regulator, while the specific actions to achieve the overarching goal are to be determined by the oil and gas operators themselves.

10.1.1 – The OSPAR Decision 98/3 Derogation Criteria

As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 111), OSPAR Decision 98/3 introduced a prescriptive set of three criteria for which derogation may be considered by the OSPAR committee:

> *(i) All or part of the footings of a steel installation weighing more than 10,000 tonnes in air emplaced before 9 February 1999.*
>
> *(ii) A concrete installation (including a gravity based concrete installation, a floating installation and any concrete anchor-base which results, or is likely to result, in interference with other legitimate uses of the sea).*
>
> *(iii) Any other disused offshore installation when exceptional or unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties can be demonstrated.*
>
> *– Paragraph 3, OSPAR Decision 98/3*

However, according to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

What if it is 9,999 tonnes? Why is the answer to that structure different to a structure that is 10,001 tonnes? What is the magic with the 10,000?.

For something that is above 10,000 tonnes but easy to remove, then it should be remove.

For something that is 8,000 tonnes, but in an area that is extremely sensitive and has a large ecosystem that has developed over 25 years, the answer might be to leave it in place.

So actually, the prescriptive answer will be wrong for both cases.

– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally

This suggests that there may be cases that will be an exception to the derogation criteria set by OSPAR Decision 98/3, and that it is not practical to enforce the OSPAR derogation criteria in practice. Hence, it may be beneficial for an amendment to be made with regard to the OSPAR Decision 98/3 criteria, making it a case-by-case approach to derogation assessment in order to prevent negative impacts on the marine ecosystem (Techera & Chandler 2015; Fam et al. 2018).

However, it is of note that OSPAR currently shows no sign of moving to a case-by-case approach (Gordon, Paterson & Usenmez 2018a). Hence, it might be worth questioning to what extent is OSPAR Decision 98/3 a product of a particular political situation which now makes change very difficult.

10.1.2 – Technical Requirements for Well Plugging and Abandonment

According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

> *The new version of the well abandonment guidelines in the UK is a risk-based approach. What it means is that design the well abandonment programme based on the risk of the well.*
>
> *For example, a HPHT [High-Pressure-High-Temperature] well with 5% H_2S[22] has got a high-risk profile. A sub-hydrostatic gas well with no pressure recovery from the reservoir is a low risk.*
>
> *So, the abandonment design won't be the same for both cases, need more confidence in the high risk one.*
>
> *How much more? That depends on the risk assessment.*
>
> *But how does the regulator check that it is a good risk assessment? That is difficult. That is really difficult. It is really difficult to regulate a risk-based guideline.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

A revisit to the literature finds that geological location, design of the well, the integrity of well, and many other factors can influence the well barrier design during well plugging and abandonment (Vrålstad et al. 2019; Towler, Hywel-Evans & Firouzi 2020). This finding supports studies from regulatory literature such as Boyd Pollett (2017), which suggests that a risk-based, or goal-setting approach is more beneficial to regulating well plugging and abandonment.

However, as suggested by a current well contractor with more than 30 years' experience in multiple operating and contracting roles, a risk-based, or goal-setting approach to regulating well plugging and abandonment can be difficult, especially if the regulators do not have sufficient technical expertise in well plugging and abandonment. This means that if regulators are operating under a goal-setting regime, it is necessary for regulators to adequately equip their regulatory officers with technical expertise in order for them to be competent to regulate oil and gas decommissioning activities.

[22] H_2S (Hydrogen Sulphide) is a flammable gas commonly found during drilling and production of hydrocarbons.

10.1.3 – Timing of Stakeholder Engagements

As discussed in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths***, Section 20(1) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015, which prescribe ideal timing for engagements between UK oil and gas operators and the HSE (Health and Safety Executive), have an influence on the engagement behaviours of oil and gas operators with the HSE, impacting the effectiveness of their engagements.

This finding suggests that it is not practical for legislation, regulations, and guidelines to be prescriptive regarding the timing of stakeholder engagement. As explained in ***Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement***, the interests and impact potential of stakeholders vary depending on the project. This suggests that a goal-setting approach could be beneficial for the timing of stakeholder engagements, such that stakeholder engagements can be planned and executed depending on the specificity and uniqueness of stakeholder interests and impact potential on the project.

10.1.4 – The Use of Multi-Criteria Decision-Making Tools

As discussed in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 145), there are some regulatory frameworks that are prescriptive regarding the use of specific multi-criteria decision-making tools. For example, as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 145), in the United Kingdom, the CA (Comparative Assessment) is an approval requirement for oil and gas decommissioning proposals. Other jurisdictions, such as Thailand, opted for the use of BPEO (Best Practicable Environmental Option), a different multi-criteria decision-making tool.

A total of eight interviewees representing oil and gas operators and the supply chain in the UK landscape explicitly criticised the robustness of the UK approval process because of the prescriptive regulations regarding the use of the CA as a multi-criteria decision-making tool. According to a decommissioning engineering manager with 22 years' experience in the oil and gas industry:

> *Most of the time we know the answer even before we begin to do the Comparative Assessment. Because if you go by the rules and the guidelines that is established to do the Comparative Assessment, you will most of the time are going to get the same answer.*
>
> *– A decommissioning engineering manager with 22 years' experience in the oil and gas industry*

Interestingly, when it comes to recommending solutions to improve the robustness of the current UK CA process, all eight interviews pointed to NEBA (Nett Environmental Benefit Analysis). According to a decommissioning manager with 30 years' experience in the oil and gas industry:

My personal opinion is that you will need this robustness of process so that people cannot gain the Comparative Assessment to come out with the answer that they prefer.

I don't know if you have looked at NEBA? Nett Environmental Benefit Analysis/ Assessment. It looks at more than just the environment. It started off as an environmental benefits assessment, but that's now something that many countries are using for the basis of Comparative Assessment because I composes on robustness on how you do it, so you can't with NEBA say "well that is the answer it need, so therefore I am going to change all the Comparative Assessment inputs to come out with that answer.

– A decommissionig manager with 30 years' experience in the oil and gas industry

This suggests that it may be beneficial for NEBA to be adopted as the ideal multi-criteria decision-making tool by oil and gas operators, the supply chain and regulators, in order to determine the precise decommissioning options.

10.1.5 – The Selection of Independent Reviewers in the United Kingdom

According to Annex A of the Offshore Oil and Gas Decommissioning Guidance Notes:

In addition to stakeholder engagement, it is important that the studies and the assessment process that supports the chosen decommissioning option are subject to independent expert verification.

– Annex A, Offshore Oil and Gas Decommissioning Guidance Notes, 2018

However, the Offshore Oil and Gas Decommissioning Guidance Notes are not prescriptive regarding the process of selecting the independent reviewers. From their interview data, two interviewees raised the issue of conflict of interest between oil and gas operators and the independent third-party companies that reviews the oil and gas operators' decommissioning proposals.

According to a former project manager with 40 years' experience in the oil and gas industry:

> *Dunlin is owned by Mitsubishi, Fairfield is just the operator……interesting when you look at the independent audit company for Fairfield – Xodus…*
>
> *Who ultimately owns Xodus? Mitsubishi*
>
> *Xodus is okay for your in-house assessment, but from the point of view of a public document, to satisfy the people of Britain, Fairfield should have used something like Ramboll.*
>
> *Ramboll are in the same game, but they are not owned by Mitsubishi. So, their ultimate earning is not reliant on the client.*
>
> *– A former project manager with 40 years' experience in the oil and gas industry*

While there may or may not be conflicts of interest between the Xodus Group, Fairfield Energy, and the Mitsubishi Corporation, this phenomenon raises the question of whether regulators should be more prescriptive regarding the UK independent review process. According to literature such as Cohen (1985), Konovsky (2000), and Tyler and Lind (2002), it is suggested that conflicts of interest can have an impact on stakeholders' perception of procedural justice. Hence, it may be beneficial for BEIS (the Department for Business, Energy and Industrial Strategy) to be more prescriptive towards oil and gas operator's selection of independent reviewers to verify the decommissioning proposals.

Another approach, consistent with the United Kingdom's approach to corporate governance, could be to set out what the regulator regards as best practice. However, such an approach does require an operator or other duty holder to justify their actions if they depart from that.

10.2 – Conflicting Goals

According to five interviewees representing oil and gas operators and contractors from the UK landscape, there are conflicting regulatory goals in the United Kingdom, resulting in challenges when managing oil and gas decommissioning activities.

10.2.1 – Minimising Cost vs. Maximising Environmental Benefit

According to a former compliance manager with 40 years' experience in the oil and gas industry:

> *The current government policy is pulling in too many different directions. We have the HM Treasury and the OGA wanting to pull cost down, and we have BEIS trying to fulfil OSPAR obligations and doing what is best for the environment, which will increase the cost of decommissioning.*
>
> *If you want a 'clear seabed', then you will need a prescriptive legislation to achieve that goal, so that you can protect the environment. But that will drive up cost because you will be spending more money.*
>
> *If you want to save more money as a government, then you need an open legislation, where you have more flexibility for interpretation, and more options available for people to use to minimise cost.*
>
> *– A former compliance manager with 40 years' experience in the oil and gas industry*

This suggests that the optimum approach in regulating oil and gas decommissioning (i.e. prescriptive or goal-setting) depends on the overall goal of the domestic jurisdiction. This finding also suggests that there may be conflicting goals between different regulatory bodies. Thus, as mentioned in ***Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement***, it is important to have extensive alignment between different regulatory bodies.

10.2.2 – Minimising Cost vs. Maximising Local Content

As discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths,*** one of the reasons for interactions between oil and gas operators and the supply chain in the UK landscape, is the conflict between minimising cost and maximising local content. Also discussed in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, maximising local content is an issue governments and regulators should take into consideration, especially when it comes to economic growth.

In 2017, the OGA (Oil and Gas Authority) introduced the Supply Chain Action Plan, which places an additional obligation on oil and gas operators in the United Kingdom to submit their supply chain contracting strategy to be approved for use by the OGA (OGA 2017).

According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

> *The Supply Chain Action Plan would suggest that the operator has at least a moral obligation to develop that capability internal to the UK. But the operator equally has a legislative obligation to minimise cost. So, you have got competing things.*
>
> *Operators are going to try and get the best price from the best provider that they can. They [the operator] are not really going to focus on development of the supply chain, for a gap that is there. They [the operator] are not really going to focus to maximising UK content. If it in cheaper to go to Norway, they will go to Norway.*
>
> *– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

Hence, governments and regulators in emerging oil and gas decommissioning landscapes may want to bear in mind that policies for maximising local content may not be effective when there are policies in place for minimising overall cost.

10.2.3 – Minimising Cost vs. Minimising Project Risks

As mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths*** (see page 352), there is a legislative obligation in the United Kingdom to minimise the overall cost of oil and gas decommissioning. As also discussed in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths***, the legislation regarding minimising overall cost appears to influence oil and gas operators in the United Kingdom so that they have tighter schedules, and execute more oil and gas decommissioning activities in parallel (i.e. more SimOps (simultenous operations)).

According to Gordon, Paterson and Usenmez (2018b), having tighter schedules increases the risks of a breach in contract. Additionally, according to the literature, there are more risks involved in executing SimOps than executing the activities sequentially (Baybutt 2017; Shi, Martinez & Phillips 2005). Overall, this suggests that governments and regulators should bear in mind how their policies influence all aspects of the projects, not just the cost.

10.3 – The Influence of Liability In-Perpetuity

Another interesting debate that arose from the interview data regards the liability in-perpetuity arrangement in the United Kingdom. According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

> *Long term liability drives certain behaviours. The planning the work and what operators do are because they have this long-term liability.*
>
> *It creates the idea that "If we take it all away, there is no long-term liability. So, let's just take it all away."*
>
> *Now is that actually really the best answer, in the sense of balancing cost against impact? And given that the tax payer is essentially paying 50 to 60% of the bill, and yet they have very little say, if any, in that decision.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

This suggests that governments and regulators should consider how their policies influence the behaviours of oil and gas operators when implementing them.

A total of four interviewees stated that allowing oil and gas operators to be relieved of their liability by paying a fee to the regulator is a more effective solution than the liability in-perpetuity arrangement, as it provides more financial security to the regulator. In a scenario where oil and gas operators are allowed to be relieved of their liability by paying a fee to the regulator, if the oil and gas operator ceases to exist, the fee paid previously by the oil and gas operator would be available for the regulators to use to continue maintaining infrastructures that are left in place. Whereas under a liability in-perpetuity arrangement, if the oil and gas operator ceases to exist, there will be no funds available for the regulators to use to continue maintaining infrastructures that are left in place.

Consequently, the UK regulators may want to consider adopting policies to allow oil and gas operators to be relieved of their liability by paying a fee, creating a fund that can be used either for continuous maintenance of infrastructures left in place, or to invest in other areas of the economy. For

example, Norway has a fund for the decommissioning of pipelines, set up under the Removal Grants Act (Fam et al. 2018)

10.4 – Regulatory Uncertainties

A total of five interviewees from both the UK and Australian landscape indicated that there are jurisdiction uncertainties when it comes to regulating oil and gas decommissioning activities.

10.4.1 – Regulatory Uncertainties in the United Kingdom Continental Shelf

As discussed in ***Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement***, in the United Kingdom regulatory responsibities are divided among several different regulatory bodies. A total of three interviewees from the UK landscape mentioned the existence of a grey area in the jurisdiction, related to the regulation of waste material when it is being transported from a location outside the 12 nm (nautical mile) boundary up until it reaches the 12 nm boundary. **Figure 10-2** (below) illustrates the grey area identified by the three interviewees:

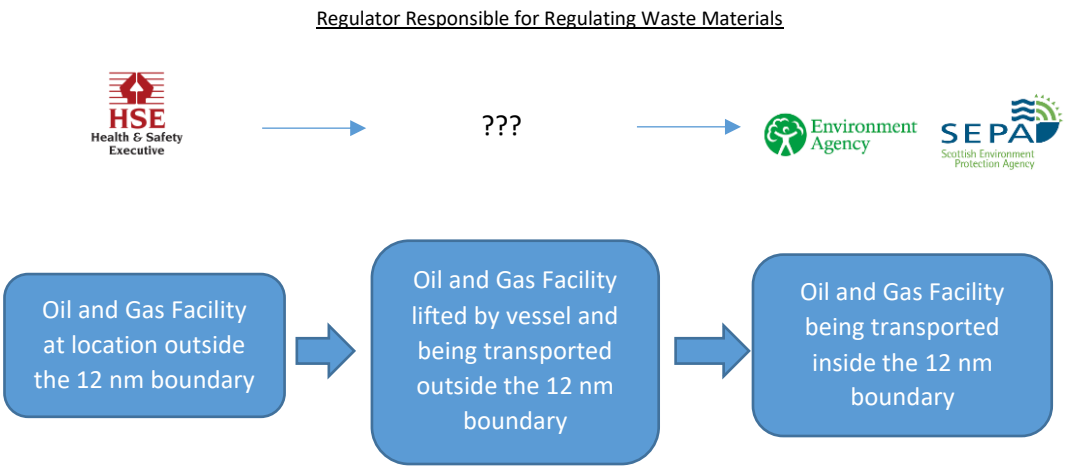


Figure 10-2 – Regulatory Uncertainties in the United Kingdom Continental Shelf

According to a regulator with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *"As soon as you lift the infrastructure up, and that goes on to the back of a barge. That part there is not an installation. So, therefore the oil and gas legislation doesn't apply*
>
> *In terms of outside the 12 nautical miles, no one regulates it from an oil and gas perspective, it will be regulated as a normal marine transport activity."*
>
> *- (A regulator with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom)*

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths***, hydrocarbons and NORMs (naturally occurring radioactive materials) may remain on an oil and gas facility even after cleaning. This means that some of these hydrocarbons and NORMs may still linger on the oil and gas facility during transport outside the 12 nm boundary, posing risks to health, safety, and the environment. Hence, it may be beneficial for the regulators to be clearer as to who is responsible for regulating waste materials when it is being transported outside the 12 nm boundary.

As many oil and gas regulations are designed to regulate oil and gas exploration and production activities rather than oil and gas decommissioning activities (Hunter 2010), it would also be beneficial for regulators in emerging oil and gas decommissioning regions to investigate their jurisdiction limits and regulatory responsibilities in order to identify possible gaps and limitations in the current arrangements. Identifying these gaps and limitations early can allow policy makers to address these gaps and prevent any legal conflicts during oil and gas decommissioning.

10.4.2 – Jurisdiction Uncertainties in the Timor Sea

As discussed in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 135), the former Australia-Timor-Leste Joint-Development Area, was a temporary maritime arrangement between Australia and Timor-Leste made in order to exploit the hydrocarbon resources located within the disputed maritime area of the Timor Sea (Lundahl & Sjöholm 2008). **Figure 10-3** (below) illustrates the Australia-Timor-Leste Joint-Development Area, also known as the Timor Gap.

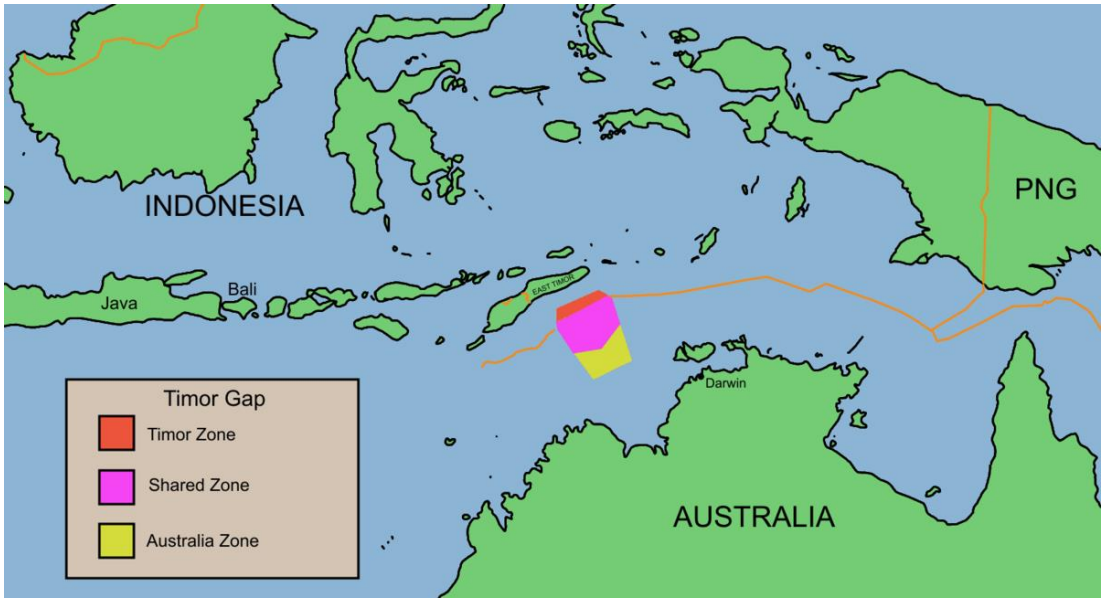


Figure 10-3 – The Timor Gap (Lundahl & Sjöholm 2008)

According to Lundahl and Sjöholm (2008), Timor-Leste had exclusive jurisdiction rights in the Timor Zone, while Australia had exclusive jurisdiction rights in the Australia Zone. However, both Australia and Timor-Leste can apply customs, quarantine, and migration laws within the Shared Zone, subject to the regulations of a joint commission established by Timor-Leste and Australia.

Of interviewees from the Australian landscape, 30% of them mentioned jurisdiction uncertainties in the Timor Sea because of the existence of the former Australia-Timor-Leste Joint-Petroleum Development Area. According to a decommissioning consultant with 40 years' experience in the oil and gas industry:

Do you know about the Bayu-Undan facility, in the Timor Sea?

What do you think? Would it be legal for Australia to bring the Bayu-Undan facility and dispose it in Timor Leste?

Well because the entire oil and gas facility is in a joint-development area, and not under one single jurisdiction, the answer is: no one knows yet.

– A decommissioning consultant with 40 years' experience in the oil and gas industry

This finding suggests that the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, may not be applied within joint-development areas. Article 4(2) of the Basel Convention, it is states that:

Each Party shall take the appropriate measures to……

(e) Not allow the export of hazardous wastes or other wastes to a State or group of States belonging to an economic and/or political integration organisation that are Parties, particularly developing countries, which have prohibited by their legislation all imports, or if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner, according to criteria to be decided on by the Parties at their first meeting.

– Article 4(2), Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, 2018

According to the Basel Convention, Timor-Leste is deemed as a developing country, which means it is actually illegal under the Basel Convention, for Australia to transport any oil and gas facility from within their jurisdiction boundaries and dispose of it in Timor Leste. However, as indicated by Lundahl and Sjöholm (2008), both Australia and Timor-Leste can apply customs, quarantine and migration laws within the Shared Zone of the Timor Gap. So, it is unclear whether it would be considered as an import if an oil and gas facility was brought from the Shared Zone of the Timor Gap into an area that is solely under the jurisdiction of Timor-Leste.

This finding has implications for several other joint-development area arrangements across the world, such as the Malaysia-Thailand Joint-Development Area and Malaysia-Vietnam Joint-Development Area (Keyuan 2006). Hence, it may be beneficial for sovereign states involved in a joint-development area arrangement, to put in place legislative and regulatory arrangements regarding the transport and disposal of hazardous waste materials produced in joint-development areas.

10.5 – Global Connections

Another interesting finding from the interview data is that there are interactions between different stakeholder groups globally, in order to share information and ideas regarding oil and gas decommissioning. This suggests that an oil and gas decommissioning landscape is not isolated. Events that occur in one particular oil and gas decommissioning landscape can have an influence on another landscape.

10.5.1 – Interactions between Regulators Internationally

Four regulators from both the UK and Australian landscapes stated that there are considerable interactions between different regulators globally. According to a regulator with 15 years' experience in regulating oil and gas decommissioning activities in the United Kingdom

> *We ourselves talked to quite a number of international regulators. New Zealand, Australia, Mexico, Brazil, Malaysia, Indonesia, Brunei. A lot of them are mirroring our regulations. A lot of them are starting to look at decommissioning. We are talking to a lot of regulators who are changing some of their regulations. I know Australia is going through quite a bit of a change at the moment. And New Zealand is just starting to look at decommissioning. New Zealand have quite a few different things at Taranaki.*
>
> *Most of that is giving them information other than us. We would like to learn from them if we could, but generally all of them are at a very early stage of decommissioning.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

This finding suggests that many countries are adopting regulatory arrangements similar to those of the United Kingdom. However, considering that there are other similarly advanced regulatory arrangements out there, for example in Norway (Hunter 2010), one might question why the UK regulations should be the centre of attention rather than Norway. It could perhaps be argued that the events of Brent Spar are a blessing in disguise for the United Kingdom, putting them at the forefront of knowledge expansion in the field of oil and gas decommissioning regulations.

10.5.2 – Interactions between Commercial Fishing Organisations Internationally

Another interesting finding that surfaced from the interview data is that there appear to be considerable interactions between different commercial fishing organisations globally. According to a representative from a commercial fishing organisation in the United Kingdom:

> *We went to Perth two years ago to share our approach to decommissioning with the industry fishing body in Western Australia. They are actually quite keen to follow in our footsteps in how to engage with the industry.*
>
> *We also went to New Jersey to share our experiences with the fishermen to discuss about potential for developing a similar model in the USA.*
>
> *- An executive manager of a commercial fishing organisation in the United Kingdom*

This finding suggests that public stakeholders can also influence one another on a global scale, leading to changes in stakeholder interests and impact potential over time. It is possible that through interactions between the different public stakeholders globally, stakeholder interests and impact potential may stabilise over time across the different oil and gas decommissioning landscapes.

10.6 – Conclusion

Overall, this chapter has discussed the findings from the perspective of regulatory law. The findings and recommendations are presented in **Tables 10-1** and **10-2,** respectively (below, pages 480 to 481). In conclusion, findings from this chapter indicate that there are still limitations to and gaps in the current regulatory arrangements, both domestically and internationally. This presents ample opportunities for further research in the field of regulatory law.

Table 10-1 – Summary of Findings in Chapter 10: Regulatory Impact on Project Performance

Type of Findings	**Description**	**Section in this Chapter where this Finding is Discussed**
Regulatory Findings	There may be cases which will be an exception to the derogation criteria set by OSPAR Decision 98/3, and it is not practical to enforce the OSPAR derogation criteria in practice.	Section 10.1.1
	It is not practical for legislation, regulations, and guidelines to be prescriptive regarding the timing of stakeholder engagements.	Section 10.1.3
	The optimum approach to regulate oil and gas decommissioning (i.e. prescriptive or goal-setting) depends on the overall goal of the domestic jurisdiction.	Section 10.2.1
	It is important to have a high degree of alignment between different regulatory bodies.	Section 10.2.1
	The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, may not be applied within joint-development areas.	Section 10.4.2
	An oil and gas decommissioning landscape is not isolated. Events that occur in one particular oil and gas decommissioning landscape can have an influence on another landscape.	Section 10.5.1
	Many countries are adopting regulatory arrangements similar to those of the United Kingdom.	Section 10.5.1
	Public stakeholders can also influence one another on a global scale, leading to changes in stakeholder interests and impact potential over time. It is possible that through interactions between the different public stakeholders globally, stakeholder interests and impact potential may stabilise over time across the different oil and gas decommissioning landscapes.	Section 10.5.2

Table 10-2 – Summary of Recommendations in Chapter 10: Regulatory Impact on Project Performance

Type of Recommendations	Description	Section in this Chapter where this Finding is Discussed
Recommendations to Regulators	It may be beneficial for an amendment to be made to the OSPAR Decision 98/3 criteria, making it a case-by-case approach to derogation assessment in order to prevent negative impact on the marine ecosystem	Section 10.1.1
	If regulators are operating under a goal-setting regime, it is necessary for regulators to equip their regulatory officers with technical expertise in order for them to be competent to regulate oil and gas decommissioning activities.	Section 10.1.2
	It may be beneficial for NEBA to be adopted as the ideal multi-criteria decision-making tool by oil and gas operators, the supply chain, and regulators, in order to determine the precise decommissioning options.	Section 10.1.3
	It may be beneficial for the Department for Business, Energy and Industrial Strategy to be more prescriptive on oil and gas operator's selection of independent reviewers to verify the decommissioning proposals.	Section 10.1.5
	Governments and regulators in emerging oil and gas decommissioning landscapes may want to bear in mind that policies on maximising local content may not be effective when there are policies in place on minimising overall cost.	Section 10.2.2
	Governments and regulators should bear in mind how their policies influence all aspects of the projects, not just the cost.	Section 10.2.3
	Governments and regulators should consider how their policies influence the behaviours of oil and gas operators when implementing them.	Section 10.3
	United Kingdom regulators may want to consider adopted similar policies to their Norwegian counterparts and allow oil and gas operators to be relieved of their liability by paying a fee, creating a fund that can either be used for continuous maintenance of infrastructures left in place, or to invest in other areas of the economy.	Section 10.3
	It would also be beneficial for regulators in emerging oil and gas decommissioning regions to investigate their jurisdiction limits and regulatory responsibilities in order to identify possible gaps and limitations in the current arrangements. Identifying these gaps and limitations early can allow policy makers to address these gaps and prevent any legal conflicts during oil and gas decommissioning.	Section 10.4.1
	It may be beneficial for sovereign states involved in a joint-development area arrangement, to put legislative and regulatory arrangements in place regarding the transport and disposal of hazardous waste materials produced in joint-development areas.	Section 10.4.2

Chapter 11: Discussion

11.0 – Chapter Abstract

This chapter will demonstrate how the research findings address the research objectives and contribute to knowledge and practice. **Figure 11-1** (below, page 483), presents a conceptual framework that summarises the key findings from this research. The chapter will then close out by summarising recommendations for future research.

11.1 – The Research Objectives

The overarching aim of this research, as stated in ***Chapter 5: Research Methodology*** (see page 151), is to enhance project managers' understanding of the oil and gas decommissioning landscape by:

- Developing stakeholder-oriented critical paths[23] that are representative of oil and gas decommissioning projects in the United Kingdom and Australia.
- Identifying critical points[24] on the stakeholder-oriented critical paths and determining where on the critical paths considerable stakeholder interactions exists.
- Identifying which stakeholders are most impactful and determining appropriate mechanisms to ensure effective decommissioning.
- Identifying how project managers currently engage stakeholders.
- Identifying what project managers deem as best practice to manage the stakeholder interactions.
- Identifying the differences between the oil and gas decommissioning landscapes in the United Kingdom and Australia.

[23] Definition of critical path and stakeholder-oriented critical path can be found in Section 3.3.2.2 of Chapter 3 – Managing Oil and Gas Decommissioning.
[24] Critical points are activities in the stakeholder-oriented critical path that are potentially subjected to considerable stakeholder impacts.

11.2 – The Overall Contribution

First and foremost, the author argues that this thesis provides a significant contribution to knowledge by building on and integrating the bodies of knowledge relating to a) project management, b) stakeholder management, c) oil and gas decommissioning, and d) regulatory law, cumulating in the form of a conceptual framework as illustrated in **Figure 11-1** (below). Each of the different sections of the overall conceptual framework will be unpacked and discussed in subsequent sections of this chapter along with their systemic nature.

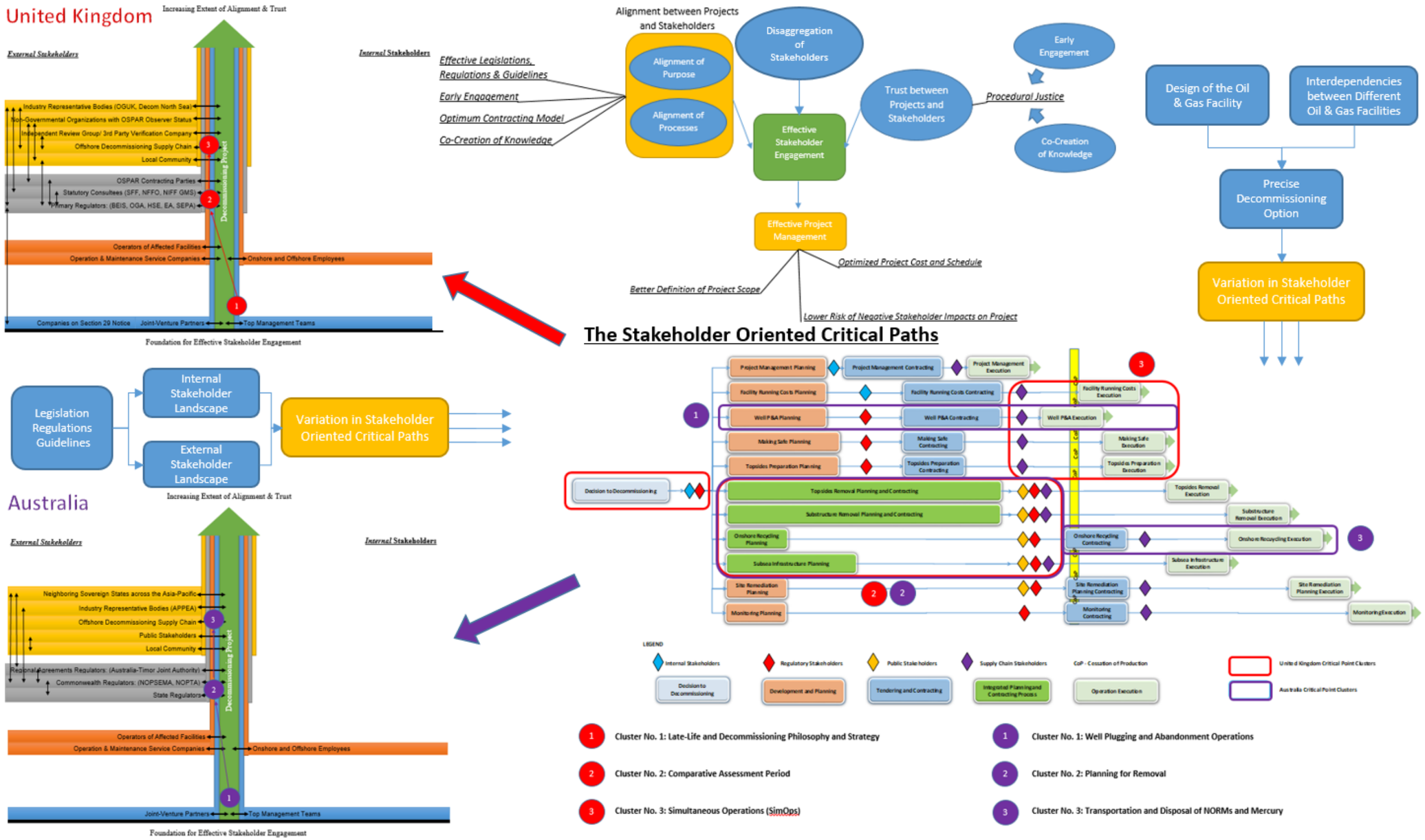
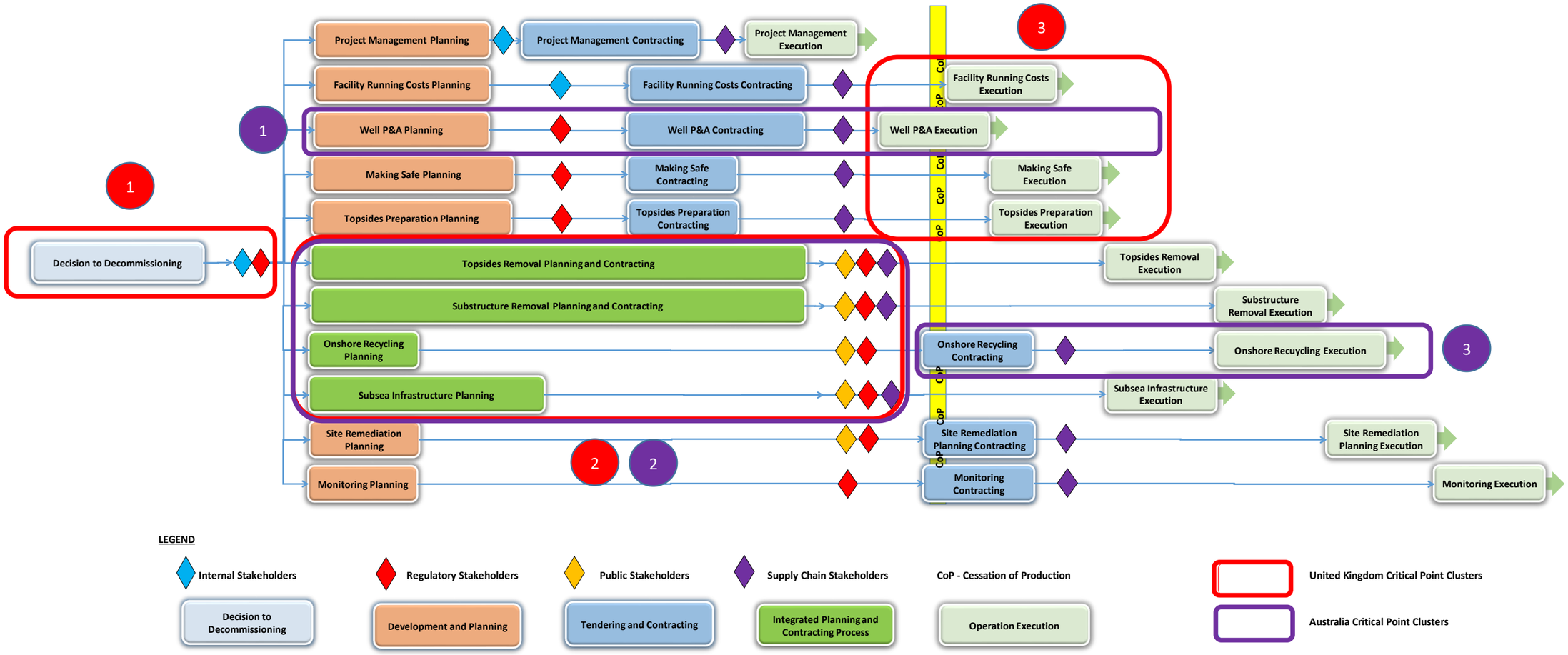


Figure 11-1 – The Overall Conceptual Framework (Tung and Otto 2019a, 2019b; Tung 2020a, 2020b)



1 **Cluster No. 1: Late-Life and Decommissioning Philosophy and Strategy**

2 **Cluster No. 2: Comparative Assessment Period**

3 **Cluster No. 3: Simultaneous Operations (SimOps)**

1 **Cluster No. 1: Well Plugging and Abandonment Operations**

2 **Cluster No. 2: Planning for Removal**

3 **Cluster No. 3: Transportation and Disposal of NORMs and Mercury**

Figure 11-2 – The Conceptual Framework for the Stakeholder Oriented Critical Paths (Tung 2020b)
(Credit goes to Marathon Oil for Providing the Based Template for the Conceptual Framework)

11.3 – The Stakeholder-Oriented Critical Paths

The author argues that Research Objective 1 has been addressed through the successful modelling of the UK stakeholder-oriented critical path and the Australian stakeholder-oriented critical path, both of which can be found in ***Appendix P*** (see pages 634 to 639). The stakeholder-oriented critical paths themselves are a contribution to knowledge as they provide a national level representation of oil and gas decommissioning projects. The stakeholder-oriented critical paths expand upon existing literature such as BP (2011), CNR (2014), Marathon Oil (2017), and Shell (2017d), which are all only single company representations. The stakeholder-oriented critical paths expand the existing literature by deepening the understanding regarding the homogeneity and heterogeneity between different decommissioning projects across different companies.

The key findings from the stakeholder-oriented critical paths are illustrated in **Figure 11-2** (above, page 484). Credit goes to Marathon Oil for providing the initial structure for the conceptual framework to illustrate the stakeholder-oriented critical paths. Note that Marathon Oil only contributed the idea of representing each work scope (Well P&A, Making Safe, etc.) using planning, contracting, and execution. The remainder of the stakeholder-oriented critical paths conceptual framework, including the timing of the project activities, the cluster of critical points, the integration between planning and contracting for certain work scopes, and the stakeholder groups involved, were all contributed by the author.

The author also argues that Research Objective 2 has been addressed through the successful identification of the critical points on the stakeholder-oriented critical paths. The critical points can be found labelled on the stakeholder-oriented critical paths found in ***Appendix P*** (see pages 634 to 639). The critical points are also the most noticeable feature in **Figure 11-2** (above, page 484), which are presented in the form of clusters.

For the UK stakeholder-oriented critical path, there is a total of 39 critical points, which can be grouped into three clusters. The three critical point clusters, in chronological order, are:

- Cluster No. 1: Late-Life and Decommissioning Philosophy and Strategy
- Cluster No. 2: Comparative Assessment Period
- Cluster No. 3: Simultaneous Operations (SimOps)

For the Australian stakeholder-oriented critical path, there is a total of 390 critical points, which can be grouped into three clusters. The three critical point clusters, in chronological order, are:

- Cluster No. 1: Well Plugging and Abandonment Operations
- Cluster No. 2: Planning for Removal
- Cluster No. 3: Transportation and Disposal of NORMs and Mercury

The critical points clusters show that stakeholder interactions take place at specific points throughout an oil and gas decommissioning project lifecycle. Not all project activities are identified as critical points, which means that only certain project activities are potentially subjected to considerable stakeholder impacts. This extends existing work on project stakeholder management by suggesting that it is more efficient for project managers to prioritise stakeholder engagement efforts on project activities potentially subjected to considerable stakeholder impacts, rather than having a consistent stakeholder engagement effort through the entire project lifecycle.

There are also variability and homogeneity in terms of critical points between the United Kingdom and the Australian landscape. For example, as illustrated in **Figure 11-2** (above, page 484), only approximately 33.3% of critical points on the UK stakeholder-oriented critical path and the Australian stakeholder-oriented critical path are the same, suggesting that stakeholder interactions are context-dependent. This extends existing work on project stakeholder management in the oil and gas decommissioning field, such as (Genter 2019), by proposing that the ideal timing for stakeholder engagement throughout a project lifecycle is context and location dependent.

The following sub-sections will elaborate upon each of the key findings from the stakeholder-oriented critical paths and discuss their respective contributions to knowledge and practice.

11.3.1 – Engaging the *Right* Stakeholders in the *Right* Way at the *Right* Time

Firstly, the stakeholder-oriented critical paths contribute to knowledge by revealing that as the oil and gas decommissioning project progresses through time, stakeholder interactions tend to shift progressively from internal stakeholder dominated to external stakeholder dominated. As illustrated in **Figure 11-3** (below, page 488), Cluster No. 1 primarily involves internal stakeholder interactions, specifically interactions between project management teams and top management teams. As the project progresses to Cluster No. 2 and Cluster No. 3, interactions between oil and gas operators and external stakeholders such as regulators and contractors, become more prominent. The author argues that it is important to engage the right stakeholders in the right way at the right time throughout a project lifecycle in order to ensure effective engagement and a more successful project.

The author also argues that this thesis contributes to knowledge by identifying a new method of mapping stakeholders, enabling organisations to prioritise stakeholders based on the chronological order of the interaction between organisations and the respective stakeholders throughout a project lifecycle. **Figures 11-3** and **11-4** (below, pages 488 and 489) illustrate the use of the newly identified method to map stakeholders for an oil and gas decommissioning project in the UK and Australian landscapes respectively. It is of note that the red and purple numbered circles in **Figures 11-3** and **11-4** denote the critical point clusters, which are numbered chronologically according to the timing of the interactions relative to the oil and gas decommissioning project lifecycle.

As shown in **Figure 11-3**, stakeholders that will be engaged earlier on in the project lifecycle are placed lower down in the diagram, while stakeholders who will be engaged later on in the project are placed higher up in the diagram. The position of the stakeholders along the green arrow signifies the start of the

interaction between the organisation and the stakeholder relative to the project lifecycle. For example, as illustrated in **Figure 11-3** (below), top management teams are engaged by project managers at the start of the project and the interactions continue until the completion of the project.

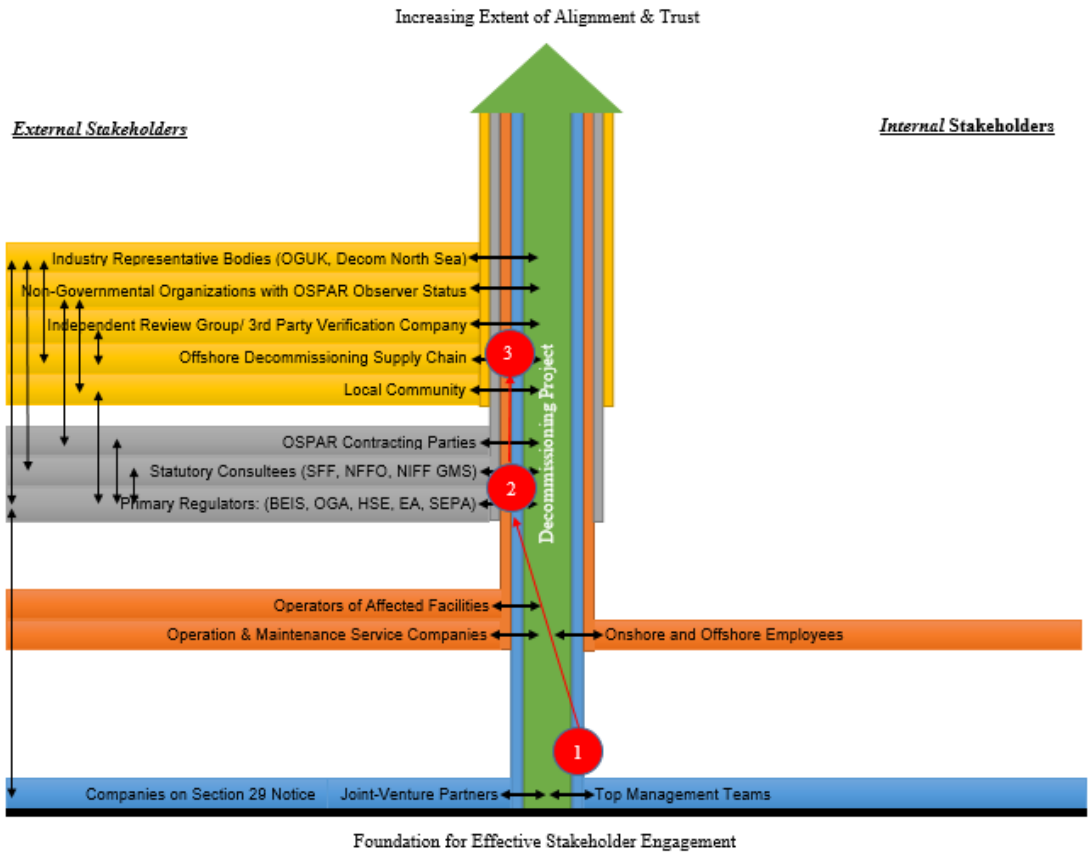


Figure 11-3 – An Example of Stakeholder Mapping for an Oil and Gas Decommissioning Project in the United Kingdom (Tung 2020a)

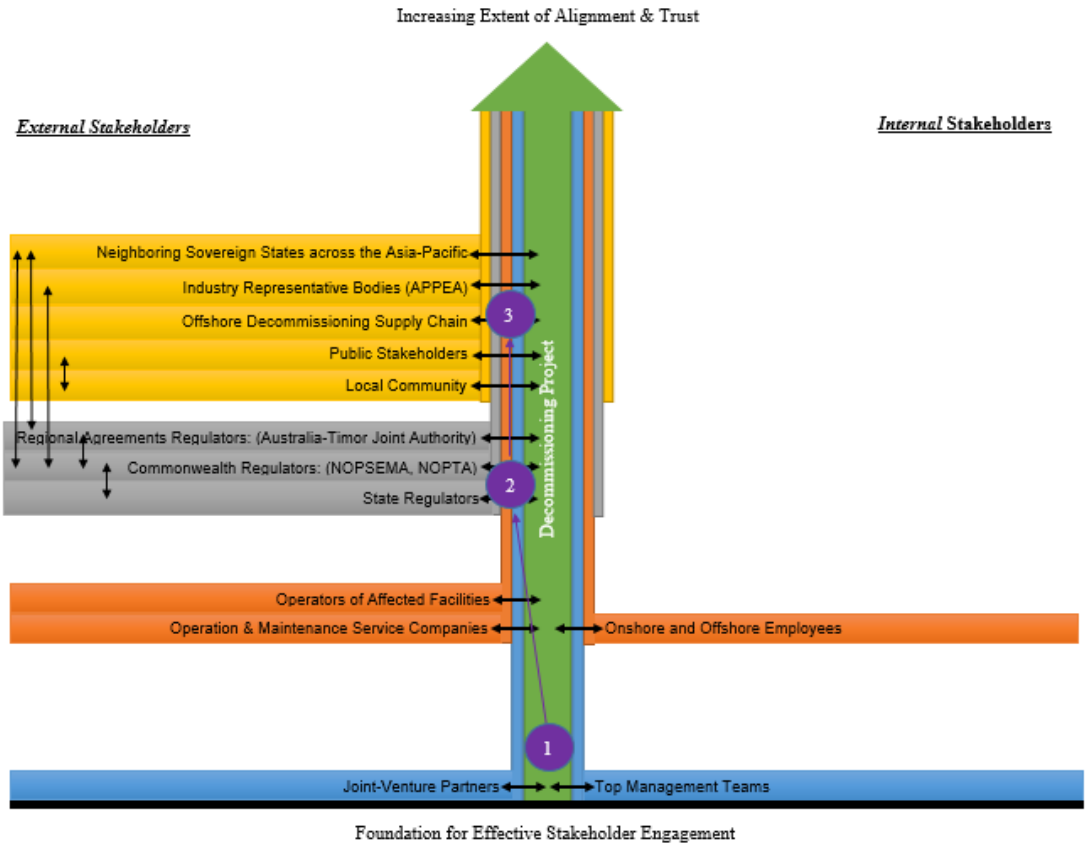


Figure 11-4 – An Example of Stakeholder Mapping for an Oil and Gas Decommissioning Project in the Australia (Tung 2020a)

This new method builds on the idea that stakeholders' extent of interests evolve throughout the lifecycle of an oil and gas decommissioning project (Tung 2020a). Project managers can utilise this new method as a tool to prioritise stakeholders depending on the chronological order of the interaction between organisations and the respective stakeholders throughout a project lifecycle. Stakeholder management efforts can then be prioritised such that the right stakeholders are engaged at the right time. Using **Figure 11-4** (above) as an example, more resources can be allocated to engage "joint-venture partners" earlier on in the project lifecycle, while more resources can be allocated to engage the "local community" later on in the project lifecycle. However, as illustrated by the vertical arrows, it is also critical to maintaining ongoing stakeholder engagement throughout the project lifecycle.

Overall, the tool can enable a more efficient allocation of materials and resources, such that the *right* stakeholders are engaged at the *right* time throughout the project lifecycle, leading to more effective management of projects and stakeholders (Tung 2020a).

While the extent of interest of stakeholders appears to change throughout a project lifecycle, project managers using the method will also need to be aware that potential stakeholder impacts are cumulative as the project progresses. The idea that potential stakeholders are cumulative is illustrated in **Figures 11-3** and **11-4** (above, pages 488 and 489), where the green arrow becomes increasingly thicker as the project progresses. Top management teams and joint-venture partners, for example, have the potential to stop funding the oil and gas decommissioning project at any given time throughout the project lifecycle.

Interestingly, the new stakeholder mapping method bears similarities to an oil and gas well, as illustrated in **Figure 11-5** (below):

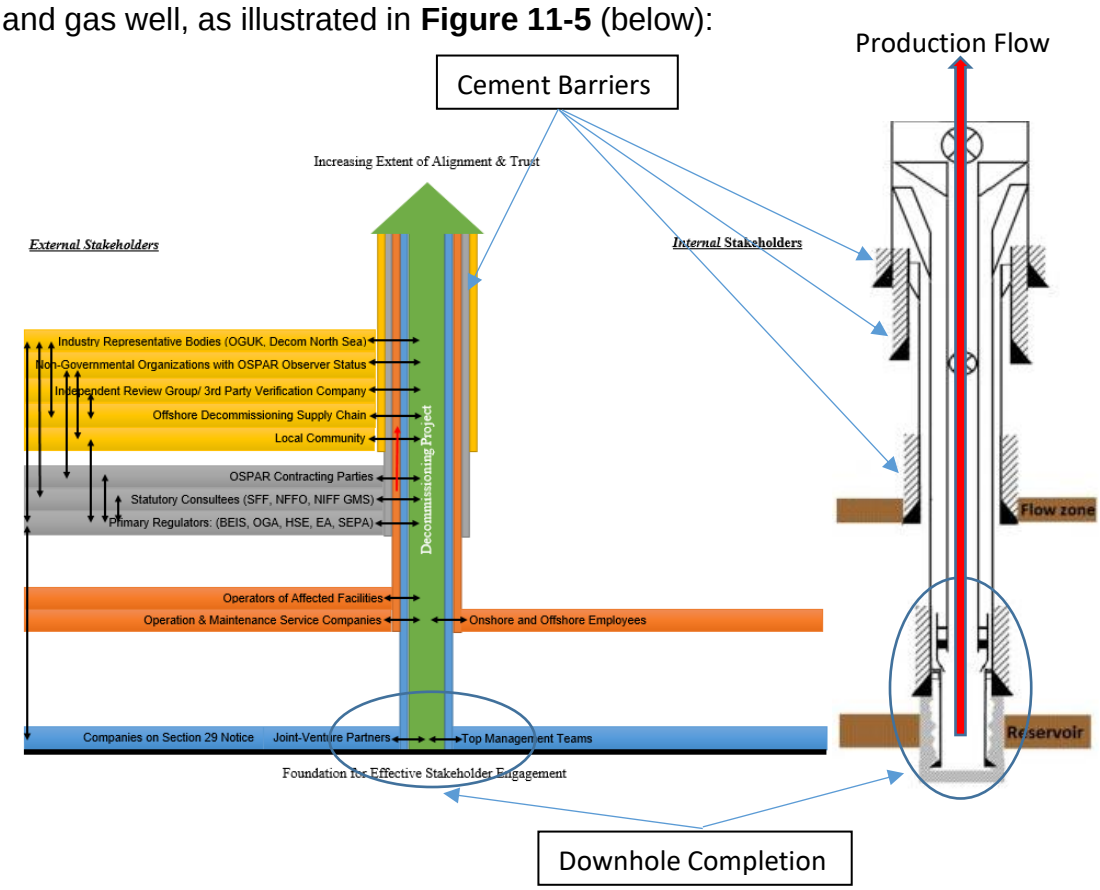


Figure 11-5 – A Comparison between the New Stakeholder Mapping Method and an Oil and Gas Well Diagram (Vrålstad et al. 2019)

The downhole completion of the well (i.e. the bottom most part of the well) is perhaps the most important part of well engineering (Bellarby 2009). Without a well-planned and well-designed downhole completion, the production flow from the reservoir will not be optimal (Bourgoyne Jr et al. 1986; Bellarby 2009). Drawing on this analogy, the author argues that the bottom-most part of the

new stakeholder map (i.e. the interaction between the project management team, top management team, and joint-venture partners) during the inception of the oil and gas decommissioning projects, is critical in order to ensure effective decommissioning. As revealed through the analysis of the stakeholder-oriented critical paths, the stakeholder management plan is the result of the interaction between project management teams and top management teams, laying the foundation for effective engagement between projects with stakeholders throughout the rest of the oil and gas decommissioning project lifecycle.

During well completion, cement barriers are usually placed in order to prevent the collapse of the well (i.e. the pathway for hydrocarbon fluids to be produced) (Bellarby 2009). The direction of the hydrocarbon production pathway is illustrated by the red arrow in **Figure 11-5** (above, page 490). Drawing on this analogy, the author argues that stakeholders represent the cement barriers that are securing the pathway for the successful delivery of the project. Engaging the right stakeholders in the right way at the right time forms a stronger bond of trust and alignment between organisations and stakeholders (i.e. a stronger cement bond), hence preventing negative stakeholder impacts (i.e. collapse of the cement barriers) on the project and securing the pathway for the successful delivery of the oil and gas decommissioning project.

When compared with traditional stakeholder mapping tools such as the power-interest grid (Ackermann &Eden 2011; Mitchell, Agle & Wood 1997) and the salience model (Mitchell, Agle & Wood 1997), this new method in mapping stakeholders could be an additional approach for projects. While the power-interest grid and the salience model are able to prioritise stakeholders based on their potential impact on projects (Ackermann & Eden 2011; Mitchell, Agle & Wood 1997), they do not explicitly inform project managers of the timing of engagements with the respective stakeholders relative to a project lifecycle. **Figure 11-6** (below, page 492) illustrates the power-interest grid.

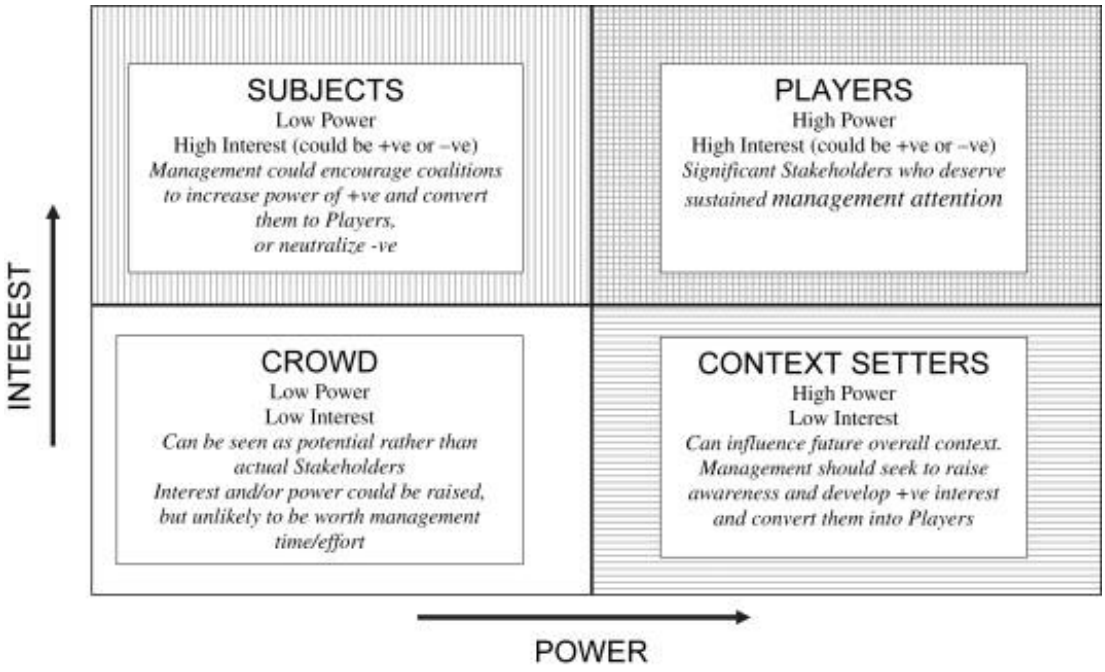


Figure 11-6 – Stakeholder Power-Interest Grid (Ackermann & Eden 2011)

The author argues that the extent of interests of stakeholders evolves throughout the lifecycle of a project. For example, a joint-venture partner will most likely have a high influential power on and high level of interest in the oil and gas decommissioning project during the early planning phase because they are concerned with the decisions made in relation to the precise decommissioning option. However, once the precise decommissioning option has been determined and set in stone following the approval of the oil and gas decommissioning project by the regulators, the extent of interest by joint-venture partners may decrease. In other words, this means that joint-venture partners may shift from being “players” to bring “context setters” over the course of the project lifecycle.

Thus, it would not be wise to have a fixed prioritisation of stakeholders throughout the course of a project, nor would it be efficient for stakeholder engagement efforts to be the same throughout a project lifecycle. For example, while joint-venture partners may need to be actively engaged during the early planning phase when deciding on the precise decommissioning option, they may only need to be kept informed through monthly reports throughout the remainder of the project lifecycle.

11.3.2 – Limitations of the Technical Critical Path

Secondly, the author argues that the stakeholder-oriented critical paths contribute to knowledge as they build on the existing body of knowledge of critical paths established by Kelley Jr and Walker (1959). The stakeholder-oriented critical paths contribute to knowledge because they explicitly put front and centre stakeholders who can substantially impact the success or otherwise of a project, rather than the schedule.

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 64), the technical critical path is determined using a traditional project management approach developed by Kelley Jr and Walker (1959). The author argues that the technical critical path only offers a myopic and idealistic view of projects as the traditional approach to develop the technical critical path only takes into account the duration or project activities, and not the context and impact of stakeholders. This is a serious omission, as stakeholders can have considerable impact on project costs, schedules, and scopes. The review of the stakeholder-oriented critical paths in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths*** revealed the impact of this lens.

The author also argues that the duration of a project activity does not necessarily reflect the extent and depth of stakeholder impact on that project activity. While a project can be completed ahead of schedule, it can still be subject to cost overruns and scope changes. In some cases, stakeholder impacts may also be positive, bringing benefits to the project (Eskerod & Ang 2017; Eskerod, Ang & Andersen Erling 2018). Contractors, for example, may be able to offer a more cost-effective solution than the one proposed by the oil and gas operators.

The stakeholder-oriented critical path adds an additional layer on top of the technical critical path, offering project managers with an additional lens on the context of stakeholders. The dual-layer of technical and stakeholder-oriented critical paths offers project managers a more realistic view of projects, enabling project managers to be better informed and thus make appropriate decisions.

11.3.3 – Variability and Homogeneity

Thirdly, the author argues that stakeholder-oriented critical paths address Research Objective 6 and contribute to knowledge by revealing the levels of variability and homogeneity of stakeholder interactions in oil and gas decommissioning projects between the UK landscape and the Australian landscape. As illustrated in **Figure 11-2** (above, page 484), when comparing clusters of critical points on the UK and Australian stakeholder-oriented critical paths, they are only approximately 33.3% similar.

Overall, this means that stakeholder-oriented critical paths are context-sensitive. As such, project managers should bear in mind that the variability and homogeneity in stakeholder interactions vary across different landscapes, when managing projects and stakeholders.

As illustrated in **Figure 11-1** (above, page 483), the stakeholder-oriented critical paths for oil and gas decommissioning differ depending on:

- Legislation, Regulations, and Guidelines
- The Internal and External Stakeholder Landscape
- The Design of the Oil and Gas Facility
- Interdependencies between Different Oil and Gas Facilities
- The Precise Decommissioning Option

Based on this research, it was found that the stakeholder-oriented critical paths appear to be dependent on legislation, regulations and guidelines. For example, as discussed in ***Chapter 8: Analysis of Stakeholder Oriented Critical Paths***, the MER (Maximising Economic Recovery) Strategy obligations resulted in additional stakeholder interactions in the United Kingdom in comparison to the Australian landscape. The contextual contributions to the stakeholder-oriented critical paths will be elaborated later in this chapter in **Section 11.4** (see page 502).

11.3.4 – Complementing Existing Industry Frameworks

At the point when this thesis was submitted, to the best of the author's knowledge, there are three key industry frameworks with similar functions to that of the stakeholder-oriented critical paths developed in this research:

1) Decom North Sea's Late-Life Planning Portal (L2P2) (Esson 2017),
2) Oil and Gas Authority's Decommissioning Roadmap (OGA 2016a), and
3) Oil and Gas UK's Decommissioning WBS (Work Breakdown Structure) (Aabel et al. 1997; OGA 2016a; OGUK 2019)

As mentioned in ***Chapter 8: Analysis of Stakeholder-Oriented Critical Paths*** (see page 388)**,** none of the three industry frameworks provide explicit information regarding the duration of each project activity, nor do any of the three industry frameworks present information regarding the dependencies between project activities. The author therefore argues that the stakeholder-oriented critical paths developed in this research, contribute to practice by complementing existing industry frameworks, and providing project managers with information regarding the duration of project activities and dependencies between project activities in an oil and gas decommissioning project.

In addition, the stakeholder-oriented critical paths also provide project managers with information regarding stakeholder impacts throughout an oil and gas decommissioning project. **Figure 11-2** (above, page 484) and **Table 11-1** (below, page 483) are frameworks that complement the stakeholder-oriented critical paths, provide project managers with information on:

- Where is/are the Critical Point(s)? i.e. Where on the Stakeholder-Oriented Critical Path does Stakeholder Interaction Exist?
- Which Stakeholder(s) are Involved at the Critical Point(s)?
- How Impactful was/were the Stakeholder(s) at the Critical Points?
- Which Critical Point is the Most Important? And Why?
- Why was/were the Stakeholder(s) Impactful at the Critical Points?
- What was/were the Decision(s) made by Project Managers to Manage the Stakeholder(s)?
- What was/were the Reason(s) for Project Managers Decision(s) made to manage the Stakeholder(s)?

- How did the Stakeholder(s) respond to the Decision(s) made by Project Managers?
- How differently would the Project Managers manage the stakeholders if given Hindsight?
- How do Decision(s) made on earlier Critical Points affect Stakeholder Impact(s) and Response(s) at later Critical Points and vice-versa?
- What is best practice to manage the stakeholder(s) at the Critical Points?

Such information can be useful for project managers to use as a guide, in order to allocate resources and engage the respective stakeholders at appropriate times throughout the oil and gas decommissioning project lifecycle, thus improving the overall management of oil and gas decommissioning stakeholders.

Table 11-1 – Managing Stakeholder Interactions for Oil and Gas Decommissioning Projects

Critical Points	**Stakeholder**	**Impact of Stakeholders**		**Most Impactful?**	**Reasons for Interactions**	**Project Manager's Decision**	**Rationale for Project Manager's Decision**	**Stakeholder's Response**	**Action In Response to Stakeholder's Response**	**Impact on Other Project Activities**	**Current Best Practice**
		Level of Impact	Probability of Impact								
1 **UK Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy**	Project Management Team (PMT)	High	High	Most Important, because it influences future project activities and stakeholder interactions further down the project lifecycle.	Misinterpretation of Decommissioning Strategy	-	-	-	-	Influences future project activities and stakeholder interactions when seeking regulatory approval	Smaller Decommissioning Team Decommissioning Strategy Workshops
	Top Management Team (TMT)	High	High	-	Philosophical Differences regarding Stakeholder Engagement	Improve Extent of Alignment between PMT and TMT on the Stakeholder Engagement Plan	-	Accepted Stakeholder Management Plan of the Stakeholder Manager Under the Condition that TMT are kept informed	-	Influences future stakeholder engagement activities during comparative assessment	Improve Extent of Alignment between PMT and TMT on the Stakeholder Engagement Philosophy
	Joint Venture Partners (JVP)	High	Medium	-	Disagreement on decommissioning plan	Improve Level of Alignment among JVP on the Decommissioning Plan	-	-	-	-	Improve Level of Alignment among JVP on the Decommissioning Plan
	The Oil and Gas Authority (OGA)	High	Low	-	To Agree on Cessation of Production (CoP) Date	Early Engagement with OGA	Reduce Risk of CoP Date Not getting Approved	Approve CoP Date Early	-	-	Early Engagement with OGA

	The Wider Oil and Gas Decommissioning Industry	High	Low	-	Fulfil MER Strategy Obligations	Early Engagement with the Wider Oil and Gas Decommissioning Industry	Fulfil MER Strategy Obligations	Co-Creation of Decommissioning Solutions with the Oil and Gas Operator	-	Influence Project Cost, Schedule, and Scope. Influence future Interaction with the Wider Oil and Gas Decommissioning Industry during Comparative Assessment and Simultaneous Operations (SimOps)	Early Engagement with the Wider Oil and Gas Decommissioning Industry
2 **UK Cluster No. 2 – Comparative Assessment Period**	The Department of Business, Energy and Industrial Strategy (BEIS)	High	Low	-	Uncertainties with the Expectation of BEIS	Early Engagement with BEIS	Understand Expectation of BEIS Early	-	-	Influences Comparative Assessment and Public Consultation Activities	Early Engagement with BEIS
	The Supply Chain	High	Medium	-	Positive Supply Chain Influence and Impacts not Maximise	-	-	-	-	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps	Early Engagement with the Wider Oil and Gas Decommissioning Industry during when seeking collaboration to fulfil MER Strategy Obligations.
	The Supply Chain	Low	Low	-	Not Maximising Local Content	Treat Supply Chain Views as Noise	Optimise Project Cost	-	-	-	-
	Commercial Fishing Stakeholders	Medium	Low	-	Discuss about Impact on Safety of Fishermen. Fulfil Regulatory Obligations	Honest and Transparent Conversation with Commercial Fishing Stakeholders	Improve Extent of Trust between the Oil and Gas Operators and Commercial Fishing Stakeholders	Co-operative with Oil and Gas Operators	-	-	Honest and Transparent Conversation with Commercial Fishing Stakeholders

	Environmental Stakeholders	Medium	Low	-	Disagreement with regard to the Evidenced used in the Comparative Assessment	Co-Creation of Knowledge with Environmental Stakeholders	Improve eNGOs Level of Acceptance of Evidenced used in the Comparative Assessment	Co-operative with Oil and Gas Operators	-	-	Co-Creation of Knowledge with Environmental Stakeholders
	Academia and Other Research Institutions	Low	Low	-	Consult to develop decommissioning solutions	-	-	-	-	-	-
3 **UK Cluster No. 3 – Simultaneous Operations (SimOps)**	Health and Safety Executive (HSE)	High	High	-	Regulatory engagement for the approval of safety case change	Engage the HSE approximately three months prior to the physical removal of the oil and gas facility	Section 9(2), Offshore Installations (Safety Case) Regulations 2005	Dissatisfaction by the HSE due to HSE being placed under significant time constraint	Engage the HSE approximately earlier in the oil and gas lifecyle – during the comparative assessment period	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps and Removal	Engage the HSE approximately three months prior to the physical removal of the oil and gas facility
	Contractors and Sub-Contractors	High	High	-	Scope creep and schedule delays	Earlier Interactions with Contractors and Sub Contractors prior to execution Alternative Contracting Models	Ensure Good Working Relationship between Oil and Gas Operator, Contractors, and Subcontractors	Improved Working Relationship between Oil and Gas Operator, Contractors, and Subcontractors	-	Influence Project Cost, Schedule, and Scope Influence future Interaction with the Supply Chain during SimOps and Removal	Earlier Interactions with Contractors and Sub Contractors prior to execution Alternative Contracting Models
1 **Australia Cluster No. 1 – Well Plugging and Abandonment Operations**	Public Stakeholders	Low	Low	-	Requirements of the Environment Plan	Send them all Environment Plans and Factsheets	Provide information required for stakeholders to make an informed assessment on the impact of the	Stakeholder Engagement Fatigue	Initial Consultation with Potential Stakeholders to verify actual stakeholder interests,	Influence Project Scope	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity

							decommissioning activity		needs, and concerns		
	Joint-Venture Partners (JVP)	High	Medium	-	Unexpected issues encountered, and changes in the decommissioning plan	Schedule Project Activities Further Apart	Improving Flexibility of Project Schedule in Consideration of Potential Stakeholder Impacts	Minimum Interactions among JVP	-	-	Schedule Project Activities Further Apart
2 **Australia Cluster No. 2 – Planning for Removal**	National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) / State Regulators	High	Medium	-	Difference in opinion between oil and gas operators and regulators in the Australian oil and gas decommissioning landscape regarding the comparative assessment	Early Engagement with Commonwealth/State Regulators	Improve Extent of Alignment on the Environmental Plan Contents	-	-	-	Early Engagement with Commonwealth/State Regulators
	The Supply Chain	Medium	Medium	-	To obtain Input from the supply chain	Early Engagement Depending on the Scale of the Project	Provide sufficient time to evaluate the input to develop the decommissioning plan	-	-	Influence Project Cost, Schedule, and Scope	Early Engagement Depending on the Scale of the Project
	Public Stakeholders	Low	Low	-	Requirements of the Environment Plan	Sent them all Environment Plans and Factsheets	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity	Stakeholders Engagement Fatigue	Initial Consultation with Potential Stakeholders to verify actual stakeholder interests, needs, and concerns	Influence Project Scope	Provide information required for stakeholders to make an informed assessment on the impact of the decommissioning activity

3 **Australia Cluster No. 3 – Transportation and Disposal of NORMs and Mercury**	Disposal Contractor	High	High	Most Important. Due to the Limited Options to Transport and Disposal NORMs and Mercury in Australia	Unexpected Changes to Project Scope, Schedule, and Cost	Work with disposal contractors to seek alternative solutions	Develop a new solution for the disposal of NORMs and Mercury	Increased Project Scope, Cost and Schedule	Have contingency plans	Influence Project Cost, Schedule, and Scope	Have contingency plans
	Port Authorities	High	High	Most Important. Due to the Limited Options to Transport and Disposal NORMs and Mercury in Australia	Unexpected Changes to Project Scope, Schedule, and Cost	Work with disposal contractors to seek alternative solutions	Develop a new solution for the disposal of NORMs and Mercury	Increased Project Scope, Cost and Schedule	Have contingency plans	Influence Project Cost, Schedule, and Scope	Have contingency plans

11.4 – Semi-Structured Interview Findings – Stakeholder Management

The author argues that Research Objectives 3, 4 and 5 have been addressed through the successful identification of appropriate mechanisms to ensure effective decommissioning. The appropriate mechanisms to ensure effective decommissioning, as illustrated in **Figure 11-7** (below, page 503) are:

- Disaggregation of Stakeholders
- Early Engagement
- Co-Creation of Knowledge
- Effective Legislation, Regulations and Guidelines
- Optimum Contracting Models

The first three mechanisms, which are more closely related to stakeholder management literature, will be discussed in the sub-sections of **Section 11.4**. The latter two mechanisms, which are more related to the legal aspect of oil and gas decommissioning, will be discussed separately in the sub-sections of **Section 11.5** (see page 508).

The author also argues that this thesis contributes to knowledge in the field of stakeholder management by building on and combining existing conceptual frameworks regarding the extent of trust between organisations and stakeholders (de Oliveira and Rabechini Jr 2019; Eskerod and Vaagaasar 2014; Karlsen, Græe and Massaoud 2008; Moffat and Zhang 2014), the extent of alignment in purpose between organisations and stakeholders (Huxham and Vangen 2013; Savage et al. 2010), the extent of alignment of processes between organisations and stakeholders (Almajali and Dahalin 2011; Box and Platts 2005), co-creation of knowledge between organisations and stakeholders (Aarikka-Stenroos and Jaakkola 2012; Kazadi, Lievens and Mahr 2016; Keeys and Huemann 2017; Jull, Giles and Graham 2017), and stakeholder's perception of procedural justice (Kim and Mauborgne 1998), cumulating in a new conceptual framework for effective stakeholder engagement, as illustrated in **Figure 11-7** (below, page 503).

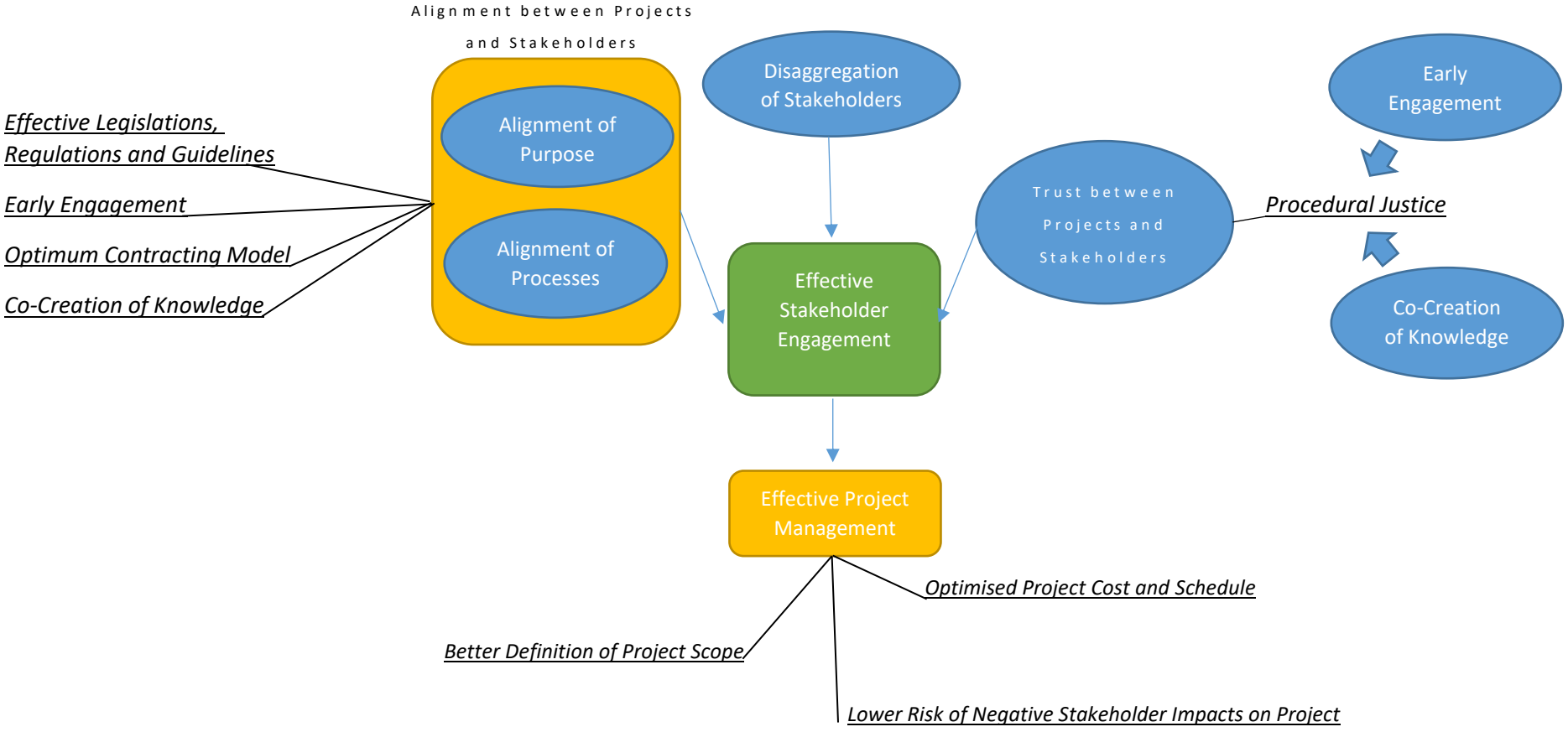


Figure 11-7 – Conceptual Framework for Effective Stakeholder Engagement

11.4.1 – Disaggregation of Stakeholders

Disaggregation of stakeholders was identified as one of the mechanisms to ensure effective decommissioning. The author argues that this thesis contributes to knowledge by building upon the proposal made by Ackermann and Eden (2011) that disaggregation of stakeholders can improve the management of stakeholders. In this research, it was found that in many instances, stakeholders within the same organisation have different interests and concerns. For example, on the North-West Hutton decommissioning project, while the UK branch of Greenpeace was satisfied with the proposed decommissioning plan for North-West Hutton, the Dutch contingent of Greenpeace was not, leading to interactions between Amoco/BP and Greenpeace Netherlands.

As noted by Ackermann and Eden (2011), disaggregating stakeholders creates more precision and distinctiveness, allowing organisations to have a deeper understanding of each stakeholder's interests and impact potential. As such, this suggests that stakeholder impacts in oil and gas decommissioning can be prevented by a careful disaggregation of stakeholders, such that each stakeholder can be prioritised, engaged, and managed more effectively.

11.4.2 – Extent of Trust and Extent of Alignment between Projects and Stakeholders

In this research, the extent of trust between organisations and stakeholders was found to be capable of influencing the effectiveness of engagement between them. This finding supports the work of Eskerod and Vaagaasar (2014), Moffat and Zhang (2014), de Oliveira and Rabechini Jr (2019), Karlsen, Græe and Massaoud (2008), and many others in the field of stakeholder management, who all suggest that the extent of trust between organisations and stakeholders is the most important factor of the effectiveness of stakeholder engagement.

However, it was also found that the extent of alignment in purpose between organisations and stakeholders also plays a significant role in the effectiveness of engagement between them. For example, according to a representative from the OGA (Oil and Gas Authority), the effectiveness of engagement between oil and gas operators and the OGA in the UK landscape is due to an alignment in purpose to lower the overall cost of oil and gas decommissioning. This finding supports those of various studies in the field of collaboration such as Huxham and Vangen (2013) and Savage et al. (2010), which suggest that alignment of purpose can improve the effectiveness of engagement between organisations and stakeholders

In addition, it was found that the extent of alignment in processes between organisations and stakeholders is also capable of having considerable influence on the effectiveness of engagement between them. For example, according to a project manager with 27 years' experience in the oil and gas industry, extensive alignment of operating and safety procedures between BP and its contractors – Petrofac and Siapem, dramatically improved the effectiveness of engagement between them, resulting in a higher level of work efficiency, leading to the project being completed ahead of schedule and under budget. This finding supports much of the literature in the field of stakeholder management, such as Almajali and Dahalin (2011) and Box and Platts (2005), which suggests that alignment of procedures and systems can improve the effectiveness of engagement between organisations and stakeholders.

Overall, the author argues that all three factors – the extent of trust, extent of alignment of purpose, and extent of alignment of processes between organisations and stakeholders – are important factors in influencing the effectiveness of stakeholder engagement. As such, the author further argues that it is insufficient to focus only on improving the extent of trust between organisations and stakeholders. In certain situations, it may be beneficial for project managers to focus more effort on improving the extent of alignment in purpose and procedures rather than the extent of trust between organisations and stakeholders.

11.4.3 – Co-Creation of Knowledge is Key

The author also argues that this thesis contributes to knowledge by revealing that co-creation of knowledge is an effective mechanism to ensure effective decommissioning. As illustrated in **Figure 11-7** (above, page 503), co-creation of knowledge can not only improve the extent of trust between organisations and stakeholders, but also the extent of alignment in purpose, and the extent of alignment in procedures between organisations and stakeholders.

According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally, co-creation of decommissioning solutions between oil and gas operators and the supply chain can enable them to align in purpose and processes, leading to a more efficiently executed project. According to a decommissioning consultant with 40 years' experience in the oil and gas industry, the co-creation of knowledge between Phillips UK and Greenpeace UK regarding the management of drill cuttings, resulted in improved trust between Phillips UK and Greenpeace UK.

As co-creation of knowledge is a mechanism that can improve multiple influencing factors (extent of trust, extent of alignment of purpose, and extent of alignment of procedures), it is argued that co-creation of knowledge is a key mechanism in improving the effectiveness of stakeholder engagement. The author proposes that co-creation of knowledge be adopted as a best practice to manage stakeholders by project managers.

11.4.4 – Early Engagement Provides Opportunities

It was also found in this research that early engagement can be an effective mechanism to ensure effective decommissioning. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally, early engagement with the supply chain can provide more opportunities for improving the extent of alignment in interests between oil and gas operators and the supply chain, leading to the development of more innovative and cost-effective solution.

This finding supports the findings of industry literature such as Cahuzac (2014) and Genter (2019) which suggest that early engagement directly results in effective decommissioning. However, the author argues that early

engagement merely provide better opportunities for organisations to employ other more effective mechanisms such as disaggregation of stakeholders and co-creation of knowledge, rather than having a directly leading to effective decommissioning. Early engagement may not be useful if the organisations do not utilise the additional time to engage stakeholders effectively. This means that while the timing of stakeholder engagement is important, stakeholders must also be engaged in the right way. As such, the author proposes that disaggregation of stakeholders and co-creation of knowledge, should be prioritised over early engagement.

11.4.5 – The Existence of Stakeholder Fatigue

In addition, the author argues that the thesis contributes to knowledge by revealing that stakeholder engagement fatigue is a real and commonly occurring phenomenon in both the mature landscape of the United Kingdom and the younger profile of Australia. This suggests that the phenomenon of stakeholder fatigue is independent of the maturity of the landscape.

It was also found in this research that stakeholder engagement fatigue occurs due to over-engagement and the repetitiveness of stakeholder engagement activities, often due to ineffective legislation, regulations, and guidelines. Section 29(3) of the Petroleum Act 1998, for example, enforces a legislative requirement for oil and gas operators in the United Kingdom to engage statutory consultees regardless of the actual extent of their interest and impact potential.

The author argues that stakeholder engagement activities should be planned and executed according to the specificity and uniqueness of stakeholder interests and impact potential on the oil and gas decommissioning project or programme. A flexible approach to regulating stakeholder engagement could be more favourable.

Overall, the phenomenon of stakeholder engagement fatigue is perhaps one of the most interesting emergent findings in this research because it has been raised by 90% of the interviewees without a prompt from the author. Further work can be done in order to develop innovative strategies and ideas to alleviate stakeholder engagement fatigue.

11.5 – Semi-Structured Interview Findings – Regulatory Law

The author argues that this thesis also contributes to the existing body of knowledge in the field of regulatory law. As presented in **Chapter 10**, domestic legal instruments appear to be more impactful on the oil and gas decommissioning stakeholder-oriented critical paths as compared to international and regional instruments. For example, on the UK stakeholder-oriented critical paths, domestic legal instruments such as the Petroleum Act 1998 and OPRED Guidelines, appear to be the cause for stakeholder interactions in Cluster No. 1 and Cluster No. 3.

However, as discussed in **Chapter 4**, many domestic legal instruments worldwide are developed based on existing international and regional instruments. As such, while domestic legal instruments can directly impact the intensity of stakeholder interaction throughout the course of an oil and gas decommissioning project, it can also be argued that international and regional instruments do also have a role in influencing the stakeholder-oriented critical path insofar as domestic legal arrangements must at least comply with relevant international and regional commitments.

11.5.1 – Section 20(1) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015

Firstly, the author argues that this thesis contributes to knowledge by revealing that in the United Kingdom, Section 20(1) of the (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 limits the amount of time to ensure effective engagement between the duty holder (which is usually the oil and gas operator) and the HSE (Health and Safety Executive_, increasing the likelihood of impact of the HSE on oil and gas decommissioning projects.

The author proposes an amendment of Section 20(1) of the (Offshore Safety Directive) (Safety Case etc.) Regulations 2015, removing the word “shorter”, and introducing an obligation for continuous engagement between the duty holder (usually the oil and gas operator) and the HSE.

11.5.2 – Section 29(3) of the Petroleum Act 1998

Secondly, the author argues that this thesis contributes to knowledge by revealing that prescriptive regulations such as Section 29(3) of the Petroleum

Act 1998 limits the effectiveness of engagement between organisations and stakeholders. It was revealed that Section 29(3) of the Petroleum Act 1998 places an obligation on oil and gas operators in the United Kingdom to engage particular stakeholders regardless of the extent of their interests and impact potential on the oil and gas decommissioning project.

As discussed in ***Chapter 9: Enhancing the Effectiveness of Stakeholder Engagement*** (see page 513), enforcing a legislative requirement for oil and gas operators in the United Kingdom to engage stakeholders regardless of the extent of their interests and impact potential, may not be the most strategic and efficient way of managing oil and gas decommissioning stakeholders. Engaging stakeholders regardless of the extent of their interests and impact potential may lead to issues such as stakeholder engagement fatigue.

As such, the author proposes that an amendment be made to Section 29(3) of the Petroleum Act 1998, such that it provides organisations with the option management of stakeholders depending on the specificity and uniqueness of stakeholder interests and impact potential on a particular oil and gas decommissioning project or programme.

However, it is also possible that Section 29(3) of the Petroleum Act 1998 provided reassurance to oil and gas operators. It must also be noted that Section 29(3) of the Petroleum Act 1998 could also enable statutory consultees to quickly let an operator know if they had no interest. Equally, an operator's lawyers would probably be happier if they had a record of a response from such consultees. The nightmare scenario would be the operator judging that they did not need to consult a particular stakeholder and then that stakeholder raising problems at a later stage or problems emerging which could have been avoided by such consultation.

11.5.3 – Regulating the Selection Independent Reviewers

Thirdly, the author argues that this thesis contributes to knowledge by revealing that there is a limitation in the current Offshore Oil and Gas Decommissioning Guidance Notes published by OPRED (the Offshore Petroleum Regulator for Environment and Decommissioning).

It was revealed in ***Chapter 10: Regulatory Impact on Project Performance*** (see page 539) that current guidance regarding the selection of the third-party independent organisation for the verification of studies and surveys conducted by the oil and gas operator, was not prescriptive enough on how conflict of interest between the oil and gas operator and the third party independent organisation is determined. Conflict of interest may have an influence on stakeholders' perceptions of procedural justice (Tyler 1988; Tyler & Bies 1990; Konovsky 2000), which in turn can have an impact on the extent of trust and effectiveness of engagement between organisations and stakeholders (Moffat & Zhang 2014; Eskerod & Vaagaasar 2014).

As such, the author proposes that OPRED update their guidance notes and be more prescriptive regarding how conflict of interest between the oil and gas operator and the third party independent organisation is determined.

Another approach, consistent with the United Kingdom's approach to corporate governance, could be to set out what the regulator regards as best practice. However, such an approach does require an operator or other duty holder to justify their action if they depart from that.

11.5.4 – Regulatory Uncertainties in the United Kingdom

Fourthly, the author argues that this thesis contributes to knowledge by revealing that there is currently a grey area in the UK regulatory arrangement, specifically regarding the regulation of waste material when it is being transported from a location outside the 12 nm (nautical mile) boundary up until it reaches the 12 nm boundary (Tung and Otto 2019b). The grey area is illustrated in **Figure 11-8** (below).

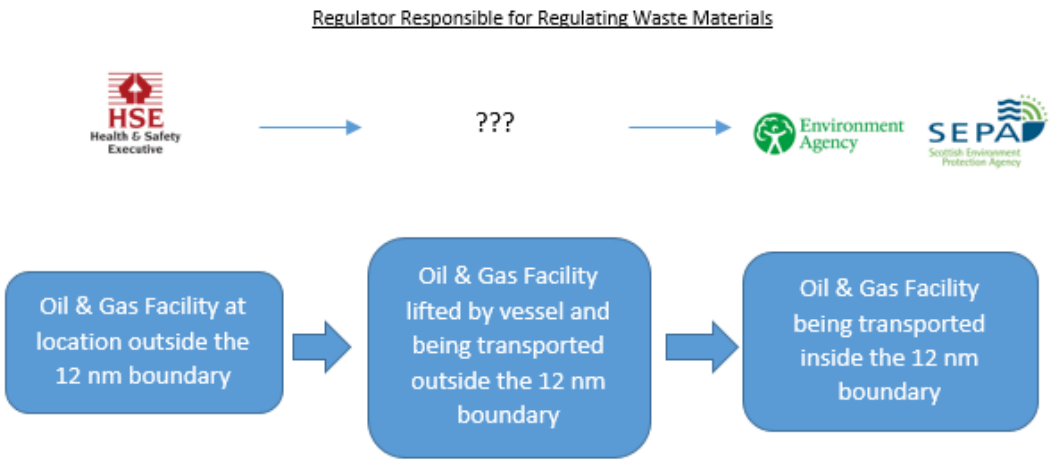


Figure 11-8 – Regulatory Uncertainties in the United Kingdom Continental Shelf (Tung and Otto 2019b)

As such, the author proposes that regulators investigate their jurisdiction limits and regulatory responsibilities in order to identify possible gaps in current regulatory arrangements. Identifying these gaps early can enable policy makers to address any issues early and mitigate any future legal conflict.

11.5.5 – Jurisdiction Uncertainties in Joint-Development Areas

Finally, the author argues that this thesis contributes to knowledge by revealing that there are jurisdictional uncertainties in joint-development areas. As discussed in ***Chapter 10: Regulatory Impact on Project Performance***, there is uncertainty regarding the applicability of the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, in joint-development areas (Tung and Otto 2019b).

As such, the author proposes that sovereign states involved in a joint-development area arrangement put in place regulatory arrangements regarding the transport and disposal of hazardous waste materials produced in joint-development areas.

11.6 – Semi-Structured Interview Findings – Technical Aspect

It is revealed through the development of the stakeholder-oriented critical paths that the stakeholder-oriented critical paths can vary depending on the technical aspect of oil and gas decommissioning. As such, the engineering and technical findings from this research can be argued to be contextual contributions in this thesis.

11.6.1 – The Risks of Well Plugging and Abandonment

During the development of the stakeholder-oriented critical paths, risk profiles for starting well plugging and abandonment before and after CoP (cessation of production) were developed, both of which can be found in ***Appendix N*** (see pages 626 to 627).

One key finding from the risk profiles is that for well plugging and abandonment, the risk of stakeholder impacts are equally as important as technical risks. As observed in **Table N-1** and **Table N-2** in ***Appendix N***, 50% of the risks are stakeholder impacts. Existing literature in the field of well plugging and abandonment, such as Khalifeh and Saasen (2020) and Vrålstad et al. (2019), only elaborate on the technical risks, such as barrier failures and leakage of hydrocarbons into the marine environment. As such, the author argues that this thesis contributes to knowledge by enhancing project manager's understanding of the risks of stakeholder impacts during well plugging and abandonment operations

Another key finding is that when comparing the two risk profiles in ***Appendix N*** (see pages 694 to 695), it can be seen that the risk profile is more favourable if well plugging and abandonment commences prior to CoP. Managing down wells and starting well plugging and abandonment prior to CoP lowers the risk of stakeholder impacts on the schedule and cost of the oil and gas decommissioning project (Tung and Otto 2019a). As such, the author proposes that in terms of risks, it is much better for oil and gas operators to manage down the wells during the production period and start well plugging and abandonment before CoP.

The idea that it is much more favourable in terms of risks to manage down the wells during the production period and start well plugging and abandonment before CoP can also be argued to be a contribution to practice in the South-East Asian landscape because according to industry literature, idle wells are common in Malaysia (Yusof, Ros & Omar 2018; Jean Christophe, Jimmy & Mohamed Izzat Mohamed 2018; Rusman et al. 2019; Haryanto et al. 2019) and Thailand (Silakorn et al. 2019; Sirirattanachatchawan et al. 2019). Proper well management and starting well plugging and abandonment prior to CoP could be adopted by the industry as best practice in the South-East Asian landscape.

11.6.2 – Interdependencies between Different Oil and Gas Facilities

Another finding in this research is that the stakeholder-oriented critical paths differ due to the interdependencies between different oil and gas facilities. As discussed in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** (see page 230), the Dunlin Alpha decommissioning project involved additional project scopes to install new oil and gas structures because of the interdependency between Dunlin Alpha and its surrounding facilities (EnQuest 2020; Fairfield Energy 2018), as shown in **Figure 11-9** (below, page 513).

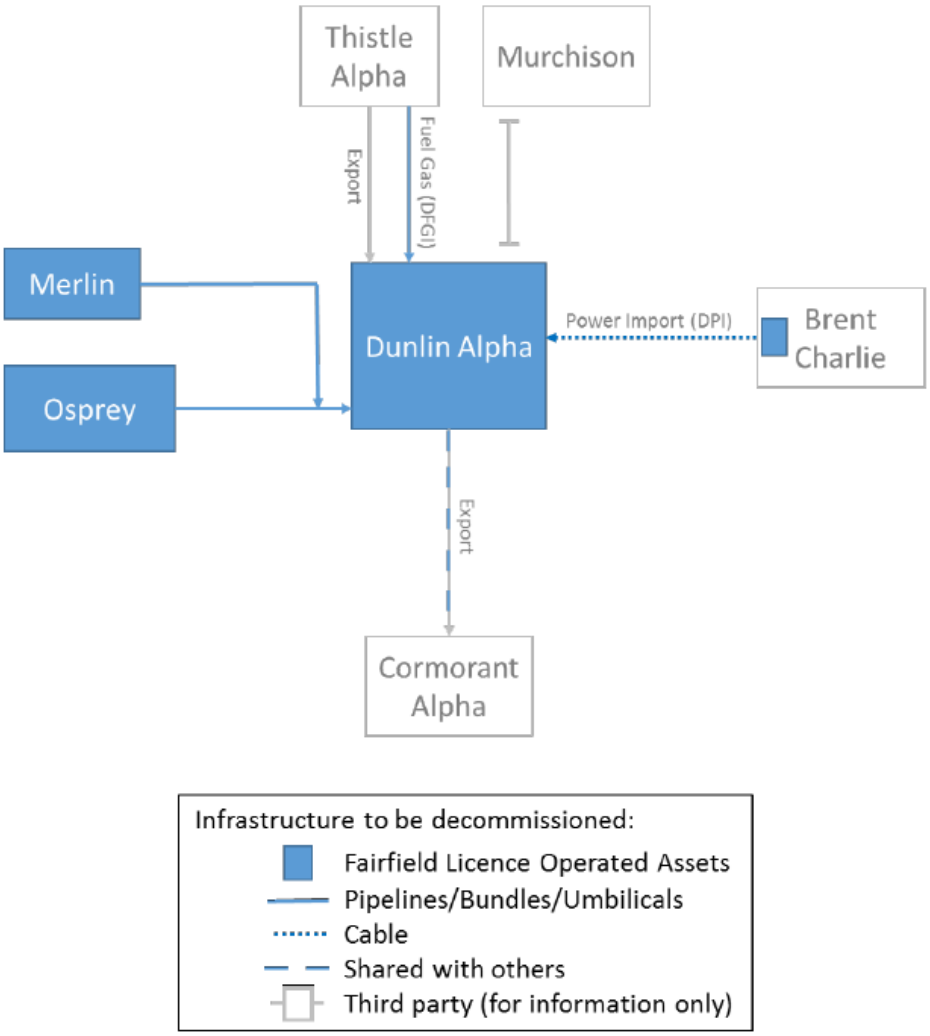


Figure 11-9 – The Relationship between Dunlin Alpha and its Adjacent Facilities (Fairfield Energy 2018)

At the time this thesis was written, planning for decommissioning in the United Kingdom only considered adjacent facilities (OPRED 2013). However, the author argues that considering adjacent facilities alone is insufficient because the interdependencies of different oil and gas facilities is basin-wide, and not just limited to adjacent facilities. **Figure 11-10** (below, page 515) presents the extensive network of more than 70 oil and gas facilities in the UK landscape, all linked by the Forties Pipeline System.

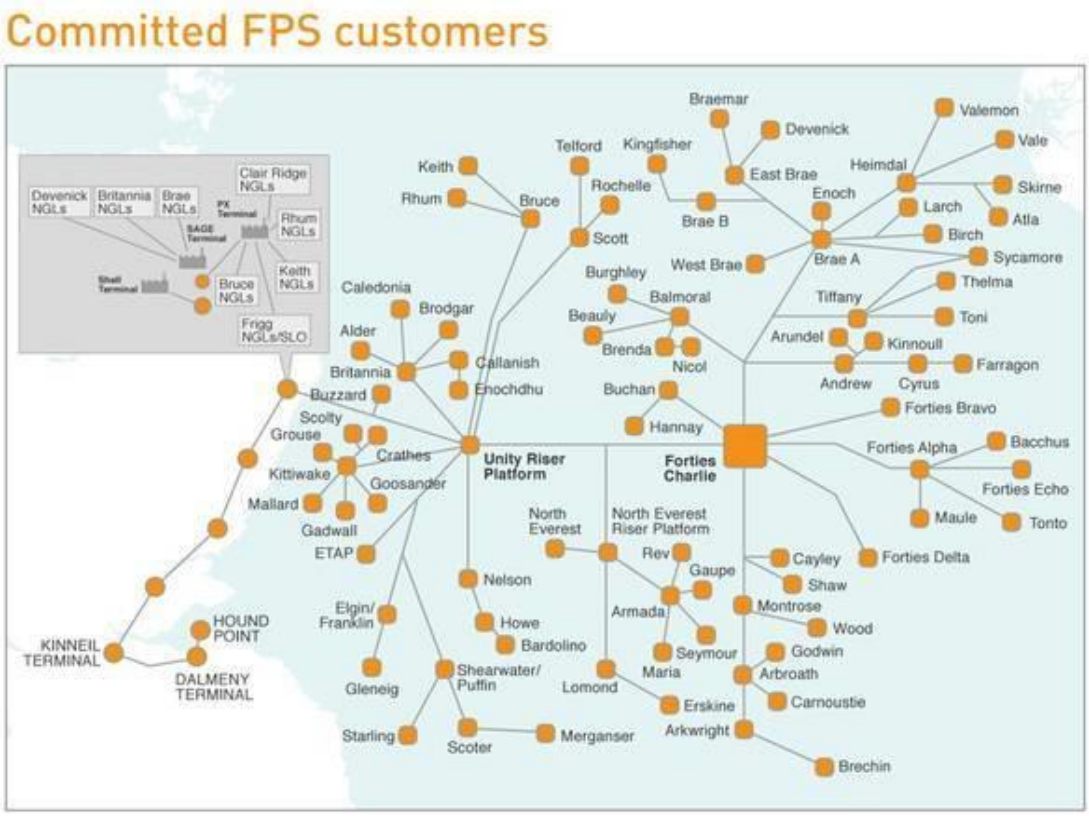


Figure 11-10 – Oil and Gas Facilities in the Forties Pipeline System (FPS) (INEOS 2020)

The attempted shutdown of the Forties Pipeline System for maintenance amidst the COVID-19 pandemic required an extensive stakeholder consultation with every single oil and gas operator linked to the Forties Pipeline System (INEOS 2020). This finding suggests that the decommissioning of oil and gas facilities cannot be viewed in isolation, or in clusters, but that an entire basin should be considered as a portfolio.

Due to the interdependencies between different oil and gas facilities across a hydrocarbon basin, the author argues that oil and gas decommissioning should be coordinated by a third party as an overall basin-wide portfolio. According to a decommissioning manager with 27 years' experience in the industry, managing oil and gas decommissioning as an overall basin portfolio can be beneficial as it can create synergies between different oil and gas decommissioning activities, possibly leading to a reduction in cost.

11.6.3 – Projects or Programmes?

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 56), there is a difference between projects and programmes. In short, programmes consist of multiple projects. The methods and techniques used to manage projects and programmes are also different, with projects focusing more on scope and schedule, while programmes focus more on stakeholder interests and concerns (PMI 2017).

During the case studies, it was observed that there is a mixed-use of the word "project" and "programme" when oil and gas operators are referring to their own case. For example, CNR International used the word "programme" when referring to their Ninian Northern case (CNR 2019) while BP used the word "project" when referring to their Miller case (BP 2011). It must be noted that both the Ninian Northern and Miller cases are Partially Leave-In-Place cases and their project scopes only involved the removal of the Ninian Northern and Miller platforms respectively (BP 2011; CNR 2019). Similarly, during the semi-structured interviews, interviewees offered no consensus regarding the management approach to oil and gas decommissioning. While some interviewees argued that it is better to prioritise stakeholders (i.e. adopt a programme management approach), others argued that it is better to prioritise schedule (i.e. adopt a project management approach) when managing oil and gas decommissioning.

It is possible that the mixture of project and programme management approaches is because oil and gas operators themselves are unsure as to whether oil and gas decommissioning is better managed as a project or a programme. Considering the potential impact of stakeholders, as revealed through the analysis of the stakeholder-oriented critical paths, the author proposes that oil and gas decommissioning activities should be managed by oil and gas operators as programmes.

The author argues that managing oil and gas decommissioning activities as programmes is a better approach as it prioritises stakeholders more than schedule. A programme management approach can minimises the risk of negative stakeholder impacts, while maximising positive stakeholder

influences and impacts on oil and gas decommissioning activities, bringing mutual benefits to both oil and gas operators and stakeholders. For example, according to a former project manager with 36 years' experience in the oil and gas industry, CNR International provided flexibility of schedule to the contractors, leading to a reduction in the cost for the removal of the Murchison platform.

In particular for the UK landscape, the proposal document for oil and gas decommissioning is also referred to as a "decommissioning programme" (OPRED 2019). The use of the word "programme" interchangeably when referring to the proposal document and the project/programme, can result in a lot of confusion, particularly for an audience with a project management background. Using the word "programme" when referring to a particular oil and gas decommissioning case, can result in an impression that the oil and gas decommissioning case is being managed using a programme management approach rather than a project management approach.

As such, the author proposes that the UK oil and gas decommissioning community makes a clearer distinction between the proposal document and the temporary organisation set up to manage the oil and gas decommissioning activity. For example, OPRED could re-name the decommissioning proposal document as "decommissioning plan" or "decommissioning proposal". Each oil and gas decommissioning case on the OPRED website could also be labelled "project" or "programme" in order to reflect the appropriate type of temporary organisation set up to manage it, thus serving as valuable information to guide future planning for oil and gas decommissioning activities.

11.7 – Future Research Areas

As mentioned in ***Chapter 7: Development of Stakeholder Oriented Critical Paths*** (see page 374), the body of knowledge in the field of oil and gas decommissioning is still in its infancy, and while there are a number of contributions to knowledge argued in this thesis, there are still many avenues for future research:

- Only past oil and gas decommissioning projects from the UK landscape were used in the case study process. Examining past oil and gas decommissioning projects from other landscapes can be useful to identify common patterns that occur across different landscapes.
- Only two landscapes (UK and Australia) were studied in this research. It would be valuable to repeat this research in other oil and gas decommissioning landscapes to investigate whether the phenomena revealed in this research are present in other landscapes.
- Adopting an action research paradigm to observe and examine how project managers engage stakeholders in a real-life setting.
- It was revealed that over engagement and repetition in stakeholder engagement activities are the two causes for the phenomenon of stakeholder engagement fatigue. Further work can be done to develop strategies to alleviate stakeholder engagement fatigue.
- It was revealed in this research that legislation, regulations, and guidelines can influence an organisation's project and stakeholder management behaviours. Further work can be done to develop measures to improve organisation's management of projects and stakeholders.
- It was revealed in this research that there are still gaps within current oil and gas decommissioning legislation, regulations, and guidelines (e.g. jurisdiction and regulatory uncertainties in joint-development areas). Further work can be done to develop measures to address these gaps.

Chapter 12: Conclusion

Possibly due to the events of Brent Spar, stakeholder impacts are often perceived by the oil and gas industry as being negative on oil and gas decommissioning projects. However, as demonstrated in this research, stakeholders can give rise to benefits in terms of cost, schedule, and scope. As such, the research highlights the importance of project managements and organisations having a comprehensive understanding of stakeholder landscapes, so that they can engage the right stakeholders in the right way at the right time, maximising positive stakeholder impacts while mitigating negative stakeholder impacts.

In terms of academic contribution, the author argues that this thesis contributes to the extant knowledge of project management, stakeholder management, and regulatory law. The most significant contribution of the thesis is the introduction of stakeholder-oriented critical paths, an augmentation of the critical path method that considers the intensity of stakeholder interactions throughout a project. Building on the idea that stakeholder interactions can be more intense on project activities outside the standard critical path, a stakeholder-oriented critical path enables the visualisation of stakeholder impacts throughout the course of a project. Additionally, the standard and stakeholder-oriented critical paths when placed alongside one another, allows project managers to compare and contrast information and considerations between the two critical paths, hence providing project managers with a more holistic view of projects and stakeholders. Having a more holistic view of projects and stakeholders can thus lead to better decision-making and more effective prioritisation of their stakeholder management efforts.

In addition to the stakeholder-oriented critical path, a new stakeholder mapping method was identified, enabling the prioritisation of stakeholders based on the chronological order and impact of stakeholder interactions throughout a project lifecycle. The new stakeholder mapping method can enable better visualisation on the timing of engagement with the respective stakeholders during the course of a project.

This thesis also reveals that the disaggregation of stakeholders, co-creation of knowledge, and early engagement are key mechanisms to ensure effective engagement in oil and gas decommissioning projects. As such, it could be worthwhile to investigate the effectiveness of these three mechanism in related industries such as mining rehabilitation and nuclear decommissioning.

Finally, this thesis also contributes to the regulatory field by confirming some parts of current legislation, regulation and guidance, while suggesting reform of others, thus offering guidance for future policy making in the field of oil and gas decommissioning.

In terms of more practical contributions, the author argues that this thesis enhancing project manager's understanding of oil and gas decommissioning by the creation of two stakeholder-oriented critical paths, one for the UK landscape and the other for the Australian landscape. These reveal key stakeholder interaction opportunities/imperatives throughout an oil and gas decommissioning project lifecycle. These stakeholder-oriented critical paths also shed light on the differences between the UK and Australian stakeholder landscapes. It is envisioned that enhanced understanding of the oil and gas decommissioning landscape can lead to better management and regulation of oil and gas decommissioning activities globally.

Overall, while there are limitations in this research, the author believes that the work presented in this thesis has contributed to knowledge and practice within the fields of oil and gas decommissioning, project management, stakeholder management, and regulatory law.

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Appendix A – Oil and Gas Decommissioning Literature

Table A-1 – Oil and Gas Decommissioning Literature

Disciplines	List of Literature
Engineering	Kerr, Side and Gamblin 1999; Kaiser, Pulsipher and Byrd 2003; O'Connor et al. 2004; Hao and Yang 2004; Kaiser 2006; Aven, Vinnem and Wiencke 2007; Zhao and Gao 2009; Wiegand 2011; Diller 2011; Yang and Kim 2011; Peroni et al. 2012; Lun, Zawawi and Liew 2012; Moo 2014; Small et al. 2015; Cheng et al. 2016; Li and Samuel 2016; Cheng et al. 2017; Ahiaga-Dagbui et al. 2017; McCann et al. 2017; Chandler et al. 2017; Na et al. 2017; Kim et al. 2017; Davidson et al. 2017; Sanwoolu et al. 2017; Yimtae et al. 2018; Zhao 2019; Haryanto et al. 2019; Urdaneta, Neto and Fontoura 2019; Bahrami et al. 2019; Murray 2019; Vrålstad et al. 2019; Akinyemi, Sun and Gray 2020)
Environmental Science	Luckhurst and Luckhurst 1978; Jessee, Carpenter and Carter 1985; Aprieto 1988; Polovina and Sakai 1989; Campos and Gamboa 1989; Bohnsack 1989; Szedlmayer and Shipp 1994; Scarborough Bull and Kendall Jr 1994; Aabel et al. 1997; Frederick 1997; Pickering and Whitmarsh 1997; Grossman, Jones and Seaman Jr 1997; Santos and Monteiro 1998; Shipp 1999; Hakam and Thornton 2000; Dauterive 2000; Jørgensen, Løkkeborg and Soldal 2002; Harriott 2002; Pears and Williams 2005; Love et al. 2007; Page et al. 2007; Gallaway, Szedlmayer and Gazey 2009; Turgeon et al. 2010; Sheehy and Vik 2010; Macreadie, Fowler and Booth 2011; Fowler and Booth 2012; Fadli et al. 2012; Kheawwongjan and Kim 2012; Nichols 2013; Jakšić, Stamenković and Đorđević 2013; Fowler, Macreadie and Booth 2015; Ajemian et al. 2015; Smyth et al. 2015; Molen et al. 2018; Klunder et al. 2018; Coolen et al. 2018; Bull and Love 2019; Schutter et al. 2019; Zawawi, Liew, Shawn, et al. 2019; Kaiser, Shively and Shipley 2020; Coolen et al. 2020)
Cost Management	Kaiser, Pulsipher and Byrd 2003; Kaiser 2006; Kaiser, Yu and Snyder 2010; Kaiser and Yu 2010; Kaiser and Snyder 2012; Kaiser and Liu 2014; Kaiser 2015; Kaiser and Liu 2015a, 2015b; Kaiser and Chambers 2017; Kaiser and Liu 2018; Kaiser, Shively and Shipley 2020)
Stakeholder Management	Askew and Lea-Cox 2017; Shaw, Seares and Newman 2018; Genter 2019; Jagerroos and Kayleigh 2019)
Law	Brown 1982; Igiehon and Park 2001; Martin 2003; Altit and Igiehon 2007; Gallaway, Szedlmayer and Gazey 2009; Heffron 2018; Saraceni and Liddle 2018; Beckstead 2018; Barrymore and Ballard 2019; Trevisanut 2020; Roberts 1994; Forte 1998; Tularak, Khan and Thungsuntonkhun 2007; Paterson 2015; Techera and Chandler 2015; Chandler et al. 2017; Boyd Pollett 2017)

Appendix B – List of Cases

Table B-1 – List of Cases and Documents Used for the Design of the Initial Stakeholder-Oriented Critical Paths (OPRED 2019)

Field name	Operator at Approval	Operator Following Licence / Company Change	Main Installations Decommissioned	Approved Option	Year of Approval
Ann and Alison (PDF, 2.98MB, 60 pages)	Spirit Energy North Sea Limited	-	Subsea installations	Removal to shore for either re-use or recycling	April 2018
			Pipelines	Buried and stable pipelines left in situ. Surface laid pipelines removed to shore for re-use or recycling	April 2018
Saturn (Annabel) (PDF, 2.49MB, 47 pages)	Spirit Energy North Sea Limited	-	Subsea installations	Removal to shore for either re-use or recycling	April 2018
			Pipelines	Buried and stable pipelines left in situ. Surface laid pipelines removed to shore for re-use or recycling	April 2018
Audrey (PDF, 2.87MB, 58 pages)	Spirit Energy North Sea Limited	-	2 fixed platforms	Removal of topsides and jackets to shore for recycling or disposal	April 2018
			Pipelines	Buried and stable pipelines decommissioned in situ. Surface laid pipelines removed to shore for re-use or recycling	April 2018
Rev Decommissioning Programme (PDF, 12MB, 42 pages)	Repsol Norge AS	-	Pipelines	Fully buried and stable pipeline to be left in situ. All other pipelines to be removed. All mattresses on pipelines to be removed	April 2018
Markham ST-1 (PDF, 2.39MB, 49 pages)	Centrica Production Nederland B.V.	-	Fixed Platform	Removal to shore for either re-use or recycling	February 2018
			Pipelines	Two pipelines to be decommissioned in situ	February 2018
Osprey (PDF, 3.92MB, 68 pages)	Fairfield Fagus Limited	-	Subsea Installation	Removed and recovered to shore for recycling/disposal	December 2017
			Pipelines	Full removal with the exception of the Bundles, Umbilical Risers within the Dunlin Alpha Concrete Gravity Based Structure or those	December 2017

				trenched and rock dumped	
Merlin **(PDF, 2.97MB, 56 pages)**	Fairfield Fagus Limited	-	Subsea Installation	Removed and recovered to shore for recycling/disposal	December 2017
			Pipelines	Full removal with the exception of trenched and rock dumped Pipelines and Umbilicals and Umbilical Riser within the Dunlin Alpha Concrete Gravity Based Structure	December 2017
Dunlin Fuel Gas Import (DFGI) and Dunlin Power Import (DPI) **(PDF, 3.48MB, 54 pages)**	Fairfield Fagus Limited	-	Subsea Installation	Removed and recovered to shore for recycling/disposal	December 2017
			Pipelines	Full removal with the exception of trenched and buried Pipelines and Rigid Riser and Riser Cable within the Dunlin Alpha Concrete Gravity Based Structure	December 2017
Viking Satellites CD, DD, ED, GD, HD Pipelines **(PDF, 6.77MB, 32 pages)**	ConocoPhillips (U.K.) Limited	-	Pipelines	All pipelines and associated mattresses to remain in situ	November 2017
LOGGS Satellites Vulcan UR, Viscount VO, Vampire OD - LDP1 **(PDF, 17.5MB, 61 pages)**	ConocoPhillips (U.K.) Limited	-	3 x fixed platforms - Vulcan UR, Viscount VO and Vampire OD	Removal to shore of topsides and jackets for recycling/disposal	November 2017
			Pipelines	All pipelines and associated mattresses to remain in situ	November 2017
Leman BH Decommissioning Programme **(PDF, 4.66MB, 46 pages)** Leman BH Close Out Report **(PDF, 1.71MB, 25 pages)**	Shell U.K. Limited	-	1 x platform	Removal to shore for either re-use or recycling	April 2017 Close Out Report Approved March 2019
Ettrick and Blackbird **(PDF, 2.1MB, 62 pages)**	Nexen Petroleum UK Limited	-	FPSO	Removal for re-use at different location	March 2017
			Subsea Equipment	Removal to shore for either re-use or recycling	March 2017
			Pipelines	Removal to shore for either re-use or recycling; buried pipelines to be left in-situ	March 2017
Ann A4 Decommissioning Programme **(PDF, 1.37MB, 29 pages)**	Centrica North Sea Limited	-	A4 Wellhead Protection Structure	Removal to shore for either re-use or recycling	February 2017
Janice James and Affleck **(PDF, 3.8MB, 115 pages)**	Maersk Oil UK Limited	-	FPSO	Removal for recycling	September 2016
			Subsea Equipment	Removal to shore for either re-use or recycling	September 2016
			Pipelines	Removal to shore for either re-use or recycling; buried	September 2016

				pipelines to be left in-situ	
Athena Decommissioning Programmes **(PDF, 3.88MB, 70 pages)**	Ithaca Energy (UK) Limited	-	FPSO	Removal for re-use at different location	September 2016
			Subsea Equipment	Removal to shore for either re-use or recycling	September 2016
			Pipelines	All 32 pipeline to be removed and returned to shore for re-use or recycling	September 2016
Viking Platforms **(PDF, 3.53MB, 40 pages)**	ConocoPhillips (U.K.) Limited	-	5 x fixed platforms Viking CD, DD, ED, GD, HD	Removal to shore of topsides and jackets for recycling/disposal	September 2016
Leadon **(PDF, 1.71MB, 53 pages)**	Maersk Oil North Sea UK Limited	-	FPSO	Removal for re-use at different location	March 2016
			Subsea	Removal of 2 x bundle towheads and mid-line structure to shore for disposal; removal of 2 x drill centres to shore for disposal	March 2016
			Pipelines	2 x Pipeline bundles to be left in-situ, partial removal of gas import pipeline	March 2016
Harding STL **(PDF, 2.61MB, 73 pages)** Harding STL Close-Out Report **(PDF, 1.62MB, 26 pages)**	TAQA Bratani Limited	-	Harding Submerged Turret Loading (STL) System	Harding Submerged Turret Loading (STL) System to be replaced by new Offshore Loading System. STL to be removed to shore for recycling/disposal and shuttle tanker mooring and loading buoy interfaces returned to owner	2015
Thames Area – Horne and Wren **(PDF, 1.57MB, 48 pages)**	Tullow Oil SK Limited	-	1x fixed platform	Removal of topsides and jackets to shore for recycling/disposal	November 2015
			Pipelines	To remain buried in situ	November 2015
Thames Area – Orwell **(PDF, 828KB, 42 pages)**	Tullow Oil SK Limited	-	Subsea Installations	Removal to shore for recycling/disposal	November 2015
			Pipelines	To remain buried in situ	November 2015
Thames Area – Wissey **(PDF, 1.26MB, 43 pages)**	Tullow Oil SK Limited	-	Subsea Installations	Removal to shore for recycling/disposal	November 2015
			Pipelines	To remain buried in situ	November 2015
Thames Area – Thames Complex **(PDF, 15.9MB, 76 pages)**	Perenco UK Limited	-	3x fixed platforms	Removal of topsides and jackets to shore for recycling/disposal	October 2015
			Subsea Installations	Removal to shore for recycling/disposal	October 2015
			Pipelines	To remain buried in situ	October 2015

Thames Area – Gawain (PDF, 3.8MB, 47 pages)	Perenco UK Limited	-	Subsea Installations	Removal to shore for recycling/disposal	October 2015
			Pipelines	To remain buried in situ	October 2015
Thames Area – Arthur (PDF, 4.41MB, 46 pages)	Perenco UK Limited	-	Subsea Installations	Removal to shore for recycling/disposal	October 2015
			Pipelines	To remain buried in situ	October 2015
Brent - Brent Delta Topside (PDF, 3.55MB, 72 pages) **Brent Delta Topside Interim Close Out Report (PDF, 3.39MB, 49 pages)**	Shell U.K. Limited	-	Brent Delta Topside	Removal of topside to shore for recycling and disposal	July 2015
Rose Decommissioning Programmes (PDF, 2.87MB, 42 pages) **Rose Close Out Report (PDF, 3.31MB, 36 pages)**	Centrica Resources Limited	-	Subsea Installations	Removal to shore for recycling/disposal	May 2015 Close Out Report Approved October 2018
			Pipelines	Removal of Sections of un-trenched pipelines; trenched pipelines decommissioned in situ	May 2015 Close Out Report Approved October 2018
Stamford (PDF, 2.71MB, 39 pages) **Stamford Close Out Report (PDF, 2.66MB, 36 pages)**	Centrica North Sea Gas Limited	-	Subsea Installations	Removal to shore for recycling/disposal	April 2015 Close Out Report approved February 2019
			Pipelines	Removal of Sections of un-trenched pipelines; trenched pipelines decommissioned in situ	April 2015 Close Out Report approved February 2019
Murchison (PDF, 2.37MB, 70 pages)	CNR	-	Large Steel Platform	Topsides and jacket to top of footings to be removed to shore for recycling/disposal. Footings to remain in situ	August 2014
			Pipelines	Export pipeline decommissioned in situ with remedial rock placement. Infield Flowlines to be removed for recycling/disposal.	August 2014
Rubie and Renee (PDF, 2.47MB, 50 pages)	Endeavour Energy UK Limited	-	Subsea Installations	Removal to shore for recycling/disposal	April 2014
			Pipelines	Selective Recovery	April 2014
Miller (PDF, 6.57MB, 198 pages)	BP Exploration (Alpha) Limited		Large Steel Platform	Footings to remain in place, steel topsides and jacket to top of footings to be removed to shore	December 2013
Schiehallion and Loyal Phase One (PDF, 1.84MB, 60 pages)	Britoil Limited	-	Schiehallion FPSO	Removal for potential re-use	2013, Close Out Report

Schiehallion and Loyal Phase One Close Out Report (PDF, 1010KB, 22 pages)					Approved May 2019
			Pipelines	Recovery where possible. Production flowlines to be left in situ	2013, Close Out Report Approved May 2019
IVRR - decommissoning programme (PDF, 1.57MB, 102 pages) IVRR Close Out Report (PDF, 4.74MB, 35 pages)	Hess limited	-	FPSO	Removal for re-use at different location	2013
			Subsea installations	Removal to shore for recycling/disposal	2013
			Pipelines	Selective recovery	2013
Camelot (PDF, 488KB, 39 pages) Camelot Close out report (PDF, 2.27MB, 41 pages)	Energy Resource Technology (UK) Limited	-	Small Steel Platform	Removal to shore for recycling / disposal	2012
			Pipelines	Pipelines decommissioned in situ	2012
Fife, Flora, Fergus, Angus: decommissioning programme (PDF, 8.36MB, 135 pages) FFFA Close Out Report (PDF, 1.49MB, 33 pages)	Hess Limited	-	FPSO	Removed for re-use at different location	2012
			Subsea installations	Removal to shore for recycling / disposal	2012
			Pipelines	Full removal of un-trenched pipelines; trenched pipelines decommissioned in situ	2012
Don	Britoil Public Limited Company	-	Subsea installation	Removal to shore for recycling / disposal	2011
			Pipelines	Decommissioned in situ with selective recovery	2011
Welland	Perenco UK Limited	Perenco UK Limited	Small Steel Platform	Removal for re-use outside of UK waters	2010
			Pipelines	Decommissioned in situ with selective recovery	2010
Tristan NW Close out report	Silverstone Energy Limited	Bridge Energy UK Limited	Subsea installation	Removal to shore for recycling	2010; close-out report received January 2011
			Pipelines	Production pipeline with piggy-backed umbilical - leave in situ; jumpers, spool pieces and associated pipeline equipment - remove to shore for re-use or recycling	2010; close-out report received January 2011
Shelley Close out report	Premier Oil	-	Sevan Voyageur FPSO	Tow away for future use at another location	2010; close-out report received February 2012
			Manifold and Wellhead	Remove to shore for re-use, recycling or disposal	2010; close-out report received February 2012
			Pipelines	Production pipeline - leave in situ;	2010; close-out

				umbilical - remove in Sections	report received February 2012
Kittiwake SAL Export System Close out report	Venture North Sea Oil Limited	-	Kittiwake SAL Assembly	SAL Assembly - removal to shore for re-use. Revision to approved decommissioning programme: Completion of the removal of the SAL Assembly extended to 31 July 2012	2009; close-out report received July 2012
			Pipelines	Pipeline - flexible flowline removed to shore for re-use	2009; close-out report received July 2012
MCP-01 Close out report	Total Eand P UK Limited	-	Manifold and Compression Platform	Permit granted for the disposal in-situ of the concrete substructure; topsides to be removed to shore for re-use, recycling or disposal	2008; close-out report received March 2013
Kittiwake Loading Buoy	Venture North Sea Oil Limited	-	Exposed Location Single Buoy Mooring System (ELSBM)	Removals to shore for recycling or disposal	2008
Linnhe **(PDF, 2.25MB, 66 pages)</p>**Linnhe Close Out Report **(PDF, 1000KB, 22 pages)**	Mobil North Sea LLC	-	Wellhead Protection Structure	Removal to shore. Revision to approved decommissioning programme: completion of the removal of the Wellhead Protection Structure extended to 30 June 2010	2008; year of revised approval: 2010
			Pipelines	Decommissioned in situ; pipeline Sections outside trenches removed to shore. Revision to approved decommissioning programme: completion of the abandonment of the pipelines extended to 30 June 2010	2008; year of revised approval: 2010
Indefatigable (Shell) **(PDF, 11.6MB, 224 pages)</p>**Close Out Report **(PDF, 2.47MB, 64 pages)**	Shell U.K. Limited	-	6 x fixed steel platforms	Removal to shore	2007
			Pipelines	2 x hose bundles removal to shore; 5 x infield + export decommissioned in situ	2007
NW Hutton: decommissioning programme **(PDF, 14.9MB, 320 pages)** Close Out Report **(PDF, 2.52MB, 32 pages)**	Amoco (U.K.) Exploration Company - now a subsidiary of BP plc	-	Large Steel Platform	Footings to remain in place, steel topsides and jacket to top of footings to be removed to shore	2006
			Pipelines	Decommissioned in situ	2006

Brent	Shell	-	Brent Flare	Removals to shore for recycling and disposal	2004
Frigg TP1, QP and CDP1 Close out report	Total EandP Norge AS	-	Treatment Platform 1 (TP1), Quarters Platform (QP) and Concrete Drilling Platform 1 (CDP1)	Concrete substructures to remain in place; concrete topsides to be removed to shore; steel installations to be removed to shore; infield pipelines to be removed to shore	2003
Maureen and Moira	Phillips	-	Large Steel Gravity Platform	Removal to shore for re-use or recycling	2000
			Concrete Loading Column	Removal to shore for re-use or recycling	2000
			Pipelines	2 x removal to shore;1 x decommissioned in situ	2000

Table B-2 – List of Additional Cases and Documents Used For in this Research (OPRED 2019)

Field Name	Field Operator	Status	Main points of the programme	Detail
Victoria	NEO Energy (SNS) Limited	Draft programmes under consideration	Wellhead protection structure will be recovered to shore for re-use, recycling or disposal. Trenched and buried sections of pipelines will be left in situ, removing the pipeline ends. Exposed concrete mattresses and grout bags will be recovered to shore for re-use, recycling or disposal.	Victoria Decommissioning Programmes (PDF, 5.05MB, 47 pages) Victoria Comparative Assessment (PDF, 3.18MB, 76 pages) Victoria Environmental Assessment (PDF, 5.53MB, 118 pages)
Northern Producer FPF	Qualimar Shipping Company Limited submitted jointly by Qualimar and EnQuest Heather Limited	Draft programmes under consideration	Complete removal of the Northern Producer FPF, mooring and anchor systems will be recovered to shore for reuse, recycling if disposal. The riser system and pipeline sections within the 500m zone will be disconnected and recovered to shore. Exposed concrete mattresses and grout bags will be recovered to shore for re-use, recycling or disposal. Existing rock will remain in situ.	Northern Producer FPF Decommissioning Programmes (PDF, 3.62MB, 52 pages)
Conrie, Don South West, West Don and Ythan	EnQuest Heather Limited	Draft programmes under consideration	Wellhead protection structures will be recovered to shore for re-use, recycling or disposal. Surface laid pipelines will be cleaned, flushed and fully removed. Trenched and buried sections of pipelines will be left in situ. Associated concrete mattresses and grout bags will be recovered to shore for re-use, recycling or disposal. Existing rock dump will be left in situ.	Conrie, Don SW, W Don & Ythan Decommissioning Programmes (PDF, 5.18MB, 79 pages) Conrie, Don SW, W Don & Ythan Comparative Assessment (PDF, 5.08MB, 76 pages) Conrie, Don SW, W Don & Ythan Environmental Appraisal (PDF, 7.15MB, 134 pages)
Hunter & Rita	Premier Oil E&P UK Limited	Draft programmes under consideration	Subsea installations will be returned to shore for recycling or appropriate treatment and disposal. Trenched and buried pipelines and Trenched and buried Flexible Flowlines (Failed) and umbilical will be left in situ. Exposed ends & areas of exposure to be removed & returned to shore for recycling or appropriate treatment and disposal. Local rock placement will be used to mitigate snag hazard from cut ends. Trenched & Buried Flexible Flowlines & Umbilicals Rigid Spool pieces and jumpers shall be fully removed and returned to shore for recycling.	Hunter & Rita Decommissioning Programmes (PDF, 1.95MB, 41 pages) Hunter & Rita Comparative Assessment (PDF, 1.99MB, 79 pages) Hunter and Rita Environmental Appraisal (PDF, 4.96MB, 131 pages)
Fulmar and Auk North Topsides, Subsea Facilities and Pipelines	Repsol Sinopec Resources UK Limited	Draft programmes under consideration	The topsides will be transported ashore for dismantling. Cleaned equipment refurbished for re-use where possible. Equipment which cannot be re-used will be recycled or other disposal routes as appropriate. Subsea installations will be returned to shore for recycling or appropriate treatment and	Fulmar and Auk North Topsides, Subsea Facilities and Pipelines Decommissioning Programmes (PDF, 1.91MB, 69 pages) Auk, Fulmar and Auk North Subsea and Pipelines InfrastructureComparative Assessment (PDF, 4.38MB, 144 pages)

			disposal. Trenched and buried stable pipelines will be left in situ. The tie-in spools and trench transition sections of the pipelines shall be cut, recovered and returned to shore for recycling. The exposed and insufficiently covered remaining sections of pipe shall be rock covered.	Auk, Fulmar & Auk North Area Environmental Appraisal Report (PDF, 5.18MB, 114 pages)
Topaz	INEOS UK SNS Limited	Draft programmes under consideration	The subsea installation, a Wellhead Protection Structure, will be returned to shore for recycling or appropriate treatment and disposal. The trenched and buried, stable pipeline and umbilcal will both be left in situ.	Topaz DP (PDF, 1.42MB, 25 pages) Topaz CA (PDF, 1.02MB, 15 pages) Topaz EA (PDF, 1.89MB, 37 pages)
Balmoral	Premier Oil E&P UK Limited	Draft programmes under consideration	The Balmoral FPV will be towed to a suitable location for re-sale, re-use, recycling or disposal. The mooring chains will be recovered to the point of burial at the anchor pile. The anchor piles will remain in situ as the tops of the piles are buried 6m below seabed, and the remaining sections of chains will be sufficiently buried. Subsea installations will be returned to shore for recycling or appropriate treatment and disposal. Trenched and buried rigid, stable pipelines will be left in situ. Trench and Buried flexible pipelines, umbilicals, spools and jumpers will be removed to shore for recycling or appropriate treatment and disposal.	Balmoral DP (PDF, 1.86MB, 59 pages) Balmoral Area CA (PDF, 2.56MB, 116 pages) Balmoral Area EA (PDF, 8.03MB, 196 pages)
Brenda	Premier Oil E&P UK Limited	Draft programmes under consideration	The subsea installations will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal. The rigid trenched and buried pipelines will be cut and the surface remediated with the trenched and buried sections of the pipelines remaining in situ. Trenched and buried flexible pipelines and umbilicals will be fully removed by reverse reeling, with deburial, and returned to shore for reuse, recycling or appropriate treatment and disposal. All spools, jumpers and flexible risers are surface laid and will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal.	Brenda DP (PDF, 1.16MB, 46 pages) Balmoral Area CA (PDF, 2.56MB, 116 pages) Balmoral Area EA (PDF, 8.03MB, 196 pages)
Nicol	Premier Oil E&P UK Limited	Draft programmes under consideration	The subsea installations will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal. The rigid trenched and buried pipelines will be cut and the surface remediated with the trenched and buried section of the pipeline remaining in situ.	Nicol DP (PDF, 1MB, 44 pages) Balmoral Area CA (PDF, 2.56MB, 116 pages) Balmoral Area EA (PDF, 8.03MB, 196 pages)

			Trenched but not backfilled umbilicals will be fully removed by reverse reeling, with deburial, and returned to shore for reuse, recycling or appropriate treatment and disposal. All spools and jumpers are surface laid and will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal.	
Glamis	Premier Oil E&P UK Limited	Draft programmes under consideration	The subsea installations will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal. Trenched & Buried Rigid Flowlines will be cut and the surface remediated with the trenched and buried section of the pipeline remaining in situ. Trenched & Buried Flexible Flowlines & Umbilicals will be fully removed by deburial and reverse reeling then returned to shore for reuse, recycling or appropriate treatment and disposal Surface Laid Flowlines & Umbilicals will be fully removed by reverse reeling then returned to shore for reuse, recycling or appropriate treatment and disposal All spools and jumpers are surface laid and will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal.	Glamis DP (PDF, 1.24MB, 44 pages) Balmoral Area CA (PDF, 2.56MB, 116 pages) Balmoral Area EA (PDF, 8.03MB, 196 pages)
Stirling	Premier Oil E&P UK Limited	Draft programme under consideration	Trenched and buried flexible pipelines and umbilicals will be fully removed by reverse reeling, with deburial, and returned to shore for reuse, recycling or appropriate treatment and disposal. All spools and jumpers are surface laid and will be fully removed and returned to shore for reuse, recycling or appropriate treatment and disposal.	Stirling DP (PDF, 1.11MB, 40 pages) Balmoral Area CA (PDF, 2.56MB, 116 pages) Balmoral Area EA (PDF, 8.03MB, 196 pages)
LOGGS PR, LOGGS PC, LOGGS PP, LOGGS PA, North Valiant PD, & Associated Pipelines – LDP5	Chrysaor Production (U.K.) Limited	Draft programmes under consideration	All topsides and jackets will be recovered to shore for re-use or recycling. Buried pipelines associated with PP will be left in situ and the riser sections of pipelines will be removed to shore for re-use or recycling with the PP and PR jackets.	LOGGS - LDP5 DP (PDF, 6.09MB, 77 pages) LOGGS - LDP5 EA (PDF, 3.37MB, 155 pages) LOGGS - LDP5 CA (PDF, 3.35MB, 201 pages)
Huntington	Premier Oil E&P UK Limited	Draft programmes under consideration	Subsea installations will be returned to shore for recycling or appropriate treatment and disposal. Trenched and buried rigid, stable pipelines will be left in situ. Trench and Buried flexible pipelines, umbilicals, spools and jumpers will be removed to shore for recycling or appropriate treatment and disposal.	Huntington CA (PDF, 1.86MB, 62 pages) Huntington EA (PDF, 4.2MB, 119 pages) Huntington DP (PDF, 1.06MB, 38 pages)

PL301 Heimdal to Brae Pipeline	Equinor Energy AS	Draft programmes under consideration	Majority of pipeline will be left in situ with rock placement over spans/exposures. 20m surface laid section of pipeline out with the existing trench to be removed and recovered to shore. Remaining section of pipeline within the Brae Alpha 500m safety zone will be left exposed and decommissioned at a later date.	Decommissioning Programme - PL301 (PDF, 4.27MB, 50 pages) Environmental Appraisal - PL301 (PDF, 5.91MB, 111 pages) Comparative Assessment - PL301 (PDF, 3.59MB, 55 pages)
Hewett	ENI Hewett Limited	Draft programmes under consideration	Six platforms to be removed and returned to shore for processing/recycling/disposal.	Hewett Decommissioning Programme (PDF, 11.9MB, 66 pages) Hewett Environment Appraisal (PDF, 16.6MB, 134 pages)
Gaupe	A/S Norske Shell	Draft programmes under consideration	Full removal of SSIV, full removal of risers PL2783 and PLU2786. Partial removal of pipelines PL2781, PL2782 and umbilicals PLU2784 and PLU2785	Gaupe DP (PDF, 1.53MB, 45 pages) Gaupe EA (PDF, 6.4MB, 105 pages) Gaupe CA (PDF, 1.53MB, 52 pages)
Kingfisher	Shell U.K. Limited	Draft programmes under consideration	All installations will be recovered to shore for re-use or recycling. Surface laid Sections of pipelines and umbilical will be recovered to shore for recycling or disposal. Trenched and/or buried pipeline Sections will be decommissioned in situ. The end of the pipelines will be cut, and additional rock cover will be added to cut ends to reduce snagging risk.	Kingfisher Decommissioning Programme (PDF, 2.8MB, 72 pages) Kingfisher CA (PDF, 2.25MB, 41 pages) Kingfisher EA (PDF, 3.43MB, 118 pages)
Buchan and Hannay	Repsol Sinopec Resources UK Limited	Draft programmes under consideration	Subsea installations will be removed to shore for either re-use, disposal or recycling. Buried and stable pipelines will be left in situ. Surface laid pipelines will be removed to shore for re-use, disposal or recycling.	Buchan and Hannay Decommissioning Programmes (PDF, 2.52MB, 53 pages) Buchan and Hannay Comparative Assessment (PDF, 3.83MB, 91 pages) Buchan and Hannay Environmental Appraisal (PDF, 8.29MB, 115 pages)
Ensign Field Installation and Pipelines	Spirit Energy North Sea Limited	Draft programmes under consideration	Topsides and jacket will be removed and transported to shore for recycling. All wells will be plugged and abandoned. Buried pipelines will be left in situ except the exposed ends which will be cut and removed. All exposed grout bags will be recovered to shore for re-use, recycling or disposal. All exposed concrete mattresses will be recovered to shore for re-use, recycling or disposal. Concrete Plinths will be left in situ. Existing rock will be left in situ.	Ensign Installation DP (PDF, 2.16MB, 30 pages) Ensign Pipelines DP (PDF, 1.65MB, 35 pages) Ensign Environmental Appraisal (PDF, 8.53MB, 134 pages) Ensign Comparative Assessment (PDF, 1.53MB, 48 pages)
Dunlin Alpha Field	Fairfield Betula Limited	Draft programme under consideration	Decommissioning in situ of Dunlin Alpha concrete gravity based structure and storage cells.	Dunlin Alpha Decommissioning Programme (PDF, 6.5MB, 77 pages) Dunlin Alpha Decommissioning Comparative Assessment Report (PDF, 3.66MB, 133 pages) Dunlin Alpha Decommissioning Environmental Appraisal (PDF, 5.04MB, 155 pages)
Windermere Field	INEOS UK SNS Limited	Draft programmes under consideration	Topsides and jacket will be removed and recycled or disposed onshore. The pipelines will be partially removed, the	Windermere Decommissioning Programme (PDF, 2.39MB, 38 pages) Windermere Comparative Assessment (PDF, 1.49MB, 34

			exposed Sections adjacent to the platforms will be removed and recycled or disposed onshore. The exposed ends will be lowered to achieve adequate depth of coverage. The existing buried Sections of umbilical will be left in situ. All concrete mattresses and grout bags will be recovered to shore for reuse, recycling or disposal.	pages) Windermere Environmental Statement (PDF, 10.2MB, 235 pages)
Brae Alpha, Brae Bravo, Central Brae, West Brae and Sedgwick	Marathon Oil UK LLC	Draft programmes under consideration	Removal of Brae Alpha and Brae Bravo jackets to the top of the footings. Removal of Central Brae, West Brae and Sedgwick subsea installations. Pipelines to be decommissioned in a variety of ways including removal, trenching and leave in situ.	Brae Alpha, Brae Bravo, Central Brae, West Brae and Sedgwick Decommissioning Programmes (PDF, 15.3MB, 120 pages) Brae A etc, Environmental Statement – Main Report (PDF, 14.6MB, 80 pages) Brae A etc. Environmental Statement - Technical Appendices (PDF, 13.3MB, 96 pages) Brae A Substructure Comparative Assessment (PDF, 1.7MB, 30 pages) Brae B Substructure Comparative Assessment (PDF, 1.59MB, 30 pages) Brae Area Subsea Assets Comparative Assessment (PDF, 6.84MB, 43 pages)
Brent	Shell U.K. Limited	Draft programmes under consideration	Decommissioning in situ of Brent Bravo, Charlie and Delta concrete gravity based structures.	Brent Decommissioning Programme (PDF, 12MB, 322 pages) Brent ES (PDF, 12.5MB, 475 pages) Brent EIA (PDF, 5.05MB, 429 pages) Brent ES Appendix (PDF, 2.52MB, 45 pages) A suite of detailed Technical Documents which support the Decommissioning Programmes documents are available on the Shell Website
Atlantic and Cromarty	BG Global Energy Limited and Hess Limited	Draft programmes under consideration	Manifold and Well head Protection structures (WHPS) to be removed for recycling/disposal. Partial removal of pipelines and remaining Section of buried/trenched pipelines to remain in situ.	Atlantic and Cromarty Decommissioning Programmes (PDF, 1.76MB, 50 pages) Atlantic and Cromarty Stakeholder Report (PDF, 1.11MB, 32 pages) Atlantic and Cromarty Environmental Impact Assessment (PDF, 4.5MB, 109 pages) Atlantic and Cromarty Comparative Assessment (PDF, 2.06MB, 110 pages)

Field name	Operator at Approval	Operator Following Licence / Company Change	Main Installations Decommissioned	Approved Option	Year of Approval
North Cormorant DP **(PDF, 2.56MB, 50 pages)** North Cormorant EA **(PDF, 7.26MB, 93 pages)**	TAQA Bratani Limited	-	North Cormorant Topsides	Removal to shore for recycling or re-use	November 2020
Tern Topsides - Decommissioning Programme **(PDF, 2.84MB, 52 pages)** Tern Topsides EA **(PDF, 7.03MB, 91 pages)**	TAQA Bratani Limited	-	Tern Topsides	Removal to shore for recycling or re-use	November 2020
Fulmar & Auk North Preparation Work Scopes Decommissioning Programme **(PDF, 1.53MB, 35 pages)**	Repsol Sinopec North Sea Limited	-	N/A	This Decommissioning Programme is specifically for preparation work scopes relating to the Fulmar and Auk North installations	November 2020
East Brae and Braemar Decommissioning Programmes **(PDF, 3.88MB, 62 pages)**	RockRose UKCS8 LLC	-	East Brae Topsides and Jackets	Removal to shore for re-use or recycling.	September 2020
			Subsea Installations	Removal to shore for recycling or re-use.	September 2020
			Pipelines	Removal to shore of surface laid pipelines. Trenched and buried pipelines to remain in situ	September 2020
Brent Alpha Jacket **(PDF, 2.82MB, 101 pages)**	Shell U.K. Limited	-	Brent Alpha Jacket	Jacket to be removed to 84.5m below sea level for removal to shore for recycling/disposal. Footings to remain in situ	July 2020
Amethyst A1D, A2D, B1D & C1D Topsides **(PDF, 2.42MB, 43 pages)**	Perenco UK Limited	-	Topsides	Removal to shore for re-use, recycling or disposal	July 2020
Anglia Decommissioning Programme **(PDF, 2.18MB, 61 pages)** Anglia CA **(PDF, 3.74MB, 49 pages)** Anglia EA **(PDF, 5.83MB, 120 pages)**	Ithaca Energy UK Limited	-	Topside and Jackets	Removal to shore for recycling or re-use	June 2020
			Pipelines	Pipelines will remain in-situ. All tie-in spools for the 8" import line, 12" export line and	June 2020

				3" Methanol line will be completely removed. Partial removal of 6" umbilical.	
Brynhild Pipelines (PDF, 1.98MB, 50 pages)	Lundin Energy Norway AS	-	Pipelines	The trenched and buried Sections of pipelines and umbilicals will be decommissioned in situ. The exposed Sections will be remediated by either cut with removal to shore, trench and burial or rock cover. Exposed mattresses will be removed to shore for re-use, recycling or disposal. The PLET, support frames and protection covers will be completely removed to shore for re-use, recycling or disposal	June 2020
Cormorant Alpha Derrick Structure Removal (PDF, 4.28MB, 57 pages)	TAQA Bratani Limited	-	Removal of drilling derrick structure and installation of modular drilling rig to facilitate well PandA	Removal to Shore of drilling derrick structure	June 2020
Cavendish (PDF, 2.4MB, 40 pages)	INEOS UK SNS Limited	-	Topsides and jacket	Removal to shore	June 2020
			Pipelines	Partial removal (buried Sections left it situ)	June 2020
Banff and Kyle FPSO and FSO Float Off (PDF, 3.45MB, 39 pages)	CNR International (U.K.) Limited.	-	FPSO and FSO	Removal to shore for redeployment.	May 2020
			Subsea Installations	The STL Buoy and associated mooring lines will be removed to shore for recycling	May 2020
			Riser Sections	Associated riser Sections and umbilicals within the water column will be removed to shore for recycling	May 2020
Eider Topsides DP (PDF, 2.38MB, 50 pages)	TAQA Bratani Limited	-	Eider Topsides	Removal to shore for	May 2020

				recycling or re-use	
Ganymede, Europa, Callisto and NW Bell – LDP3 **(PDF, 4.85MB, 101 pages)**	Chrysaor Production (U.K.) Limited	-	Topside and Jackets	Removal to shore for recycling or re-use	May 2020
			Pipelines	NW Bell pipelines will be recovered to shore for re-use or recycling. Ganymede, Europa and Callisto interfield pipelines will be decommissioned in situ	May 2020
Ganymede ZD Topsides - LDP3b **(PDF, 2.31MB, 46 pages)**	Chrysaor Production (U.K.) Limited	-	Ganymede Topsides	Removal to shore for recycling or re-use	April 2020
Huntington FPSO (Voyageur Spirit) **(PDF, 1.19MB, 21 pages)**	Premier Oil EandP UK Limited	-	FPSO	The Huntington FPSO (Voyageur Spirit) is to be floated off station and redeployed	April 2020
			Pipelines	The risers, PL2805 (ident 2), PL2806 (ident 3), PL2807 (ident 2), PL2808 (ident 2) and PL2809 (ident 2) and mooring system will be removed and taken to shore	April 2020
Alma and Galia DPs **(PDF, 4.34MB, 61 pages)**	EnQuest Heather Limited	-	FPSO	Removal to shore for recycling.	March 2020
			Subsea Installations	Partial removal of the mooring anchor piles. The mooring chain will be cut locally to the mooring pile and buried to 1m below seabed. Removal of manifolds and wellhead protection structures.	March 2020
			Pipelines	Removal to shore.	March 2020
Brent Field Pipelines **(PDF, 4.05MB, 130 pages)**	Shell U.K. Limited	-	Pipelines	Removal to shore for recycling/disposal, trench/backfill, buried pipelines left in situ	March 2020

Thistle COS Tanks (PDF, 3.34MB, 59 pages)	EnQuest Heather Limited	-	Crude Oil Storage Tanks	Removal to shore for recycling	January 2020
Banff SAL Buoy (PDF, 996KB, 20 pages)	CNR International (U.K.) Limited. Decommissioning Programmes submitted by Teekay Petrojarl Floating Production UK Ltd.	-	Subsea installations	Removal to shore for either re-use or recycling	November 2019
			Pipelines	Part of pipeline to be returned to shore for recycling	November 2019
MacCulloch Decommissioning Programmes (PDF, 1.36MB, 40 pages)	Chrysaor Production (U.K.) Limited	-	Subsea installations	The anchors will be decommissioned in situ. All other installations will be removed to shore for either re-use or recycling	November 2019
			Pipelines	Removal to shore for either re-use or recycling	November 2019
Goldeneye (PDF, 3.41MB, 53 pages)	Shell U.K. Limited	-	Topsides and Jacket	Removal to shore for re-use or recycling	November 2019
			Pipelines	Sections of pipelines from the Goldeneye Platform up to but excluding the main pipeline tie-in flanges – removal to shore for re-use or recycling	November 2019
Brae Alpha West Drilling Rig (PDF, 2.2MB, 24 pages)	RockRose Energy UKCS8 LLC	-	Drilling Rig	Removal to shore for recycling or disposal	September 2019
South Morecambe DP3/DP4 (PDF, 2.72MB, 57 pages)	Spirit Energy Production UK Limited	-	Topsides and Jackets	Removal to shore for either re-use or recycling	September 2019
			Pipelines	Buried and stable pipelines left in situ, exposed pipeline ends cut and recovered to shore for either re-use or recycling	September 2019
Pickerill AandB Installations (PDF, 1.79MB, 54 pages)	Perenco Gas (UK) Limited	-	Topsides and jackets	Removal to shore for re-use, recycling or disposal	September 2019
Minke Decommissioning Programmes (PDF, 8.56MB, 59 pages)	Neptune EandP UKCS Limited	-	WHPS	Removal to shore for re-use or recycling	September 2019
			Pipelines	buried Sections of pipelines to be decommissione	September 2019

				d in situ small surface laid Sections of pipelines to be removed to shore for re-use or recycling	
Ketch **(PDF, 2.65MB, 60 pages)** Schooner **(PDF, 4.97MB, 63 pages)**	DNO North Sea (ROGB) Limited	-	Topsides, jackets and subsea installation	Removal to shore for re-use, recycling or disposal	August 2019
			Pipelines	Trenched and buried and left in situ	August 2019
Juliet **(PDF, 6.16MB, 47 pages)**	Neptune EandP UKCS Limit ed	-	Subsea Installations	Removal to shore for recycling/dispo sal	August 2019
			Pipelines	Removal to shore for small surface laid Sections of the pipeline and umbilical for either re-use or recycling; buried Sections to be left in-situ	August 2019
Dunlin Alpha to Cormorant Alpha Pipeline - PL5 **(PDF, 4.36MB, 73 pages)**	Fairfield Betula Limited	-	Pipelines	Trenched Sections will be left in situ, exposed pipeline ends cut and recovered and severed ends rock dumped	July 2019
Ninian Northern Platform **(PDF, 2.34MB, 70 pages)**	CNR International (U.K.) Limited	-	Large Steel Platform	Topsides and jacket to top of footings to be removed to shore for recycling/dispo sal. Footings to remain in situ.	June 2019
Nevis N11 WHPS **(PDF, 1.66MB, 26 pages)**	Apache Beryl I Limited	-	Nevis N11 WHPS	Removal to shore for re-use or recycling	June 2019
Dunlin Alpha Topsides **(PDF, 4.97MB, 44 pages)**	Fairfield Betula Limited	-	Dunlin Alpha Topsides	Removal to shore for recycling or disposal	May 2019
Hewett **(PDF, 1.5MB, 21 pages)**	Eni Hewett Limited	-	Vent Stack (2 x 19m pipes) and other preparatory works on 48/29B Platform and PL84	Removal to shore for recycling or disposal	April 2019
Pickerill A and B **(PDF, 1.26MB, 21 pages)**	Perenco Gas (UK) Limited	-	Telecommunicati on towers, sub-cellar deck equipment, appurtenances, caissons, associated tanks and lift pumps, supply hoses, a pipeline riser emergency shutdown valve	Removal to shore for reuse, recycling or disposal	March 2019

			and tertiary steelwork		
Curlew B, C and D **(PDF, 2.4MB, 61 pages)**	Shell U.K. Limited	-	FPSO	Removal to shore for recycling/disposal	March 2019
			Subsea Installations	Removal to shore for recycling/disposal	March 2019
			Pipelines	Removal to shore for either re-use or recycling; buried pipelines to be left in-situ	March 2019
Viking Platforms, Vixen and associated Pipelines (VDP2) **(PDF, 33.3MB, 84 pages)**	ConocoPhillips (U.K.) Limited	-	Viking Satellites KD, LD, AR, Viking Bravo Hub BA, BC, BP, BD and Vixen sub-sea tieback	Removal to shore for re-use, recycling or disposal	January 2019
			Pipelines	Decommissioned in situ	January 2019
Victor (VDP3) **(PDF, 21.1MB, 55 pages)**	ConocoPhillips (U.K.) Limited	-	Victor Platform and subsea installation	Removal to shore for re-use, recycling or disposal	January 2019
			Pipelines	Decommissioned in situ	January 2019
Tyne South Installations **(PDF, 1.83MB, 42 pages)**	Perenco UK Limited	-	Topsides, jacket and subsea installation	Removal to shore for reuse, recycling or disposal	January 2019
Guinevere Installation **(PDF, 2.05MB, 43 pages)**	Perenco UK Limited	-	Topsides and jacket	Removal to shore for reuse, recycling or disposal	January 2019
Beatrice Decommissioning Programmes **(PDF, 4.45MB, 88 pages)**	Repsol Sinopec Resources UK Limited	-	Beatrice AP Topsides; AD, Bravo and Charlie Platforms and AD Drilling Template	Removal to shore for re-use/recycling	January 2019
			Pipelines	Buried pipelines will be left in situ. Remediation for any exposed Sections.	January 2019
Bains Decommissioning Programmes **(PDF, 2.57MB, 36 pages)**	Spirit Energy Production UK Limited	-	Subsea Installation	Removal to shore for re-use/recycling	January 2019
			Pipelines	Decommissioned in situ	January 2019
Jacky **(PDF, 2.34MB, 52 pages)**	Ithaca Energy (UK) Limited	-	Wellhead Platform and Midline Tee Structure	Removal to shore for either re-use or recycling	October 2018
			Pipelines	Pipelines are trenched and buried and will be left in situ	October 2018
Brae Bravo Topsides, Flare Bridge, Flare Tower and Flare Jacket and Substructure **(PDF, 4.9MB, 52 pages)**	Marathon Oil UK LLC	-	Brae Bravo Topsides, Flare Bridge, Flare Tower and Flare Jacket/Substructure	Removal to shore for either re-use or recycling	August 2018

Brent Alpha, Bravo and Charlie Topsides (PDF, 3.34MB, 81 pages)	Shell U.K. Limited	-	Brent Alpha, Brent Bravo and Brent Charlie Topsides	Removal to shore for recycling/disposal	August 2018

Table B-3 – List of Cases from Source Not-Used in Research Due to Absence of Relevant Documents (OPRED 2019)

Field name	Operator at Approval	Operator Following Licence / Company Change	Main Installations Decommissioned	Approved Option	Year of Approval
Ardmore	British American Offshore Limited	-	Mobile Jack-Up Rig	Re-use	2005
Ardmore	Ugland Nordic Shipping AS	-	Single Anchor Loading Systems	Re-use/removal to shore	2005
			Pipelines	Re-use	2005
Ardmore	Acorn Oil and Gas Limited	-	Subsea equipment including guide frame	Removal to shore	2005
Beatrice	Talisman Energy (UK) Limited	-	Fixed Steel Platforms	Re-use	2004
Forbes and Gordon Infield Pipelines	BHP Billiton	-	Infield Pipelines	Decommission in situ - retrench any area of pipeline with less than 0.4m depth of cover	2003; close-out report received May 2005
Durward and Dauntless	Amerada Hess	-	Pipelines	Decommissioned in situ	2002
Hutton	Kerr-McGee	-	Tension Leg Platform	Re-use	2002; close-out report received July 2004
			Pipelines	1 x removal to shore; 1 x decommissioned in situ (with future monitoring programme)	2002; close-out report received July 2004
Camelot CB	ExxonMobil	-	Fixed Steel Platform	Re-use or removal to shore for recycling. Revision to approved decommissioning option: removal to shore for dismantling and recycling	2001. Year of revised approval: 2002
Blenheim and Bladon	Talisman	-	FPSO	Re-use	2000
			Pipelines	Removal to shore	2000
Durward and Dauntless	Amerada Hess	-	FPSO	Re-use	2000
			Subsea Facilities	Removal to shore	2000
Brent Spar	Shell	-	Oil Storage and Loading Facility	Re-use as part of quay extension. Revision to approved decommissioning option: Brent Spar Anchor Blocks - removal to shore for reuse, recycling or disposal 1998	Year of revised approval: 2004
Donan	BP	-	FPSO	Re-use	1998
Fulmar SALM	Shell	-	Single Anchor Leg Mooring Buoy	Removal to shore	1998
			16" Pipeline	Decommissioned in situ	1998
Emerald	MSR	-	FPSO	Re-use	1996
			Pipeline	Decommissioned in situ	1996
Frigg FP	Elf Norge	TotalFinaElf Norge	Flare Column	Removal to shore	1996
Leman BK	Shell	-	Fixed Steel Platform	Removal to shore	1996
Staffa	Lasmo	-	Pipelines	Removal to shore	1996
Viking AC, AD, AP and FD	Conoco	-	4 x Fixed Steel Platform	Removal to shore	1996
Esmond CP and CW	BHP	-	2 x Fixed Steel Platform	Removal to shore	1995
Gordon BW	BHP	-	Fixed Steel Platform	Removal to shore	1995
Angus	Amerada Hess	-	Floating Production, Storage and	Re-use	1993

			Offloading (FPSO) Vessel		
Forbes AW	Hamilton	BHP	Fixed Steel Platform	Removal to shore	1993
Argyll, Duncan and Innes	Hamilton	BHP	Floating Production, Facility (FPF)	Removal to shore	1992
			Catenary Anchor Leg Mooring (CALM) Buoy	Removal to shore	1992
			Pipelines	Removal to shore	1992
Blair	Sun Oil	AGIP	Pipelines	1 x Re-use; 1 x Decommissioned in situ	1992
Crawford	Hamilton Oil	BHP	Floating Production, Facility (FPF)	Removal to shore	1991
			Catenary Anchor Leg Mooring (CALM) Buoy	Removal to shore	1991
			Subsea Facilities	Removal to shore	1991
Piper Alpha	Occidental	Talisman	Fixed Steel Platform	Toppling	1988

Appendix C – Classification of Cases

Table C-1 – Classification of Decommissioning Programmes Cases Based on the Precise Decommissioning Option of the Substructure

Leave-In-Place	Partially Leave-In-Place	Complete Removal
Frigg TP1 (Total)	NW Hutton (Amoco)	Maureen (Phillips)
Frigg QP (Total)	Miller (BP)	Moira (Phillips)
Frigg CDP1 (Total)	Murchison (CNR)	Indefatigable (Shell)
MCP-01 (Total)	Ninian Northern (CNR)	Linnhe (Mobil)
Brent Bravo (Shell)	Brent Alpha (Shell)	Shelley (Premier Oil)
Brent Charlie (Shell)		Tristan NW (Silverstone Energy)
Brent Delta (Shell)		Welland (Perenco)
Dunlin Alpha (Fairfield)		Don (Britoil)
		Fife (Hess)
		Flora (Hess)
		Fergus (Hess)
		Angus (Hess)
		Camelot (Energy Resource Technology)
		Ivanhoe (Hess)
		Rob Roy (Hess)
		Schiehallion (Britoil)
		Loyal (Britoil)
		Rubie (Endeavour Energy)
		Renee (Endeavour Energy)
		Stamford (Centrica)
		Rose (Centrica)
		Thames – Arthur (Perenco)
		Thames – Gawain (Perenco)
		Thames – Wissey (Tullow Oil)
		Thames – Orwell (Tullow Oil)
		Thames – Horne (Tullow Oil)
		Thames – Wren (Tullow Oil)
		Leadon (Maersk)
		Viking CD (ConocoPhillips)
		Viking DD (ConocoPhillips)
		Viking ED (ConocoPhillips)
		Viking GD (ConocoPhillips)
		Viking HD (ConocoPhillips)
		Athena (Ithaca)
		Janice (Maersk)
		James (Maersk)
		Affleck (Maersk)
		Ettrick (Nexen)
		Blackbird (Nexen)
		Leman BH (Shell)
		Vulcan UR (ConocoPhillips)
		Viscount VO (ConocoPhillips)
		Vampire OD (ConocoPhillips)
		Merlin (Fairfield)
		Osprey (Fairfield)
		Markham ST-1 (Centrica)
		Audrey (Spirit Energy)
		Saturn (Spirit Energy)
		Ann (Spirit Energy)
		Alison (Spirit Energy)
Total Cases = 8	**Total Cases = 5**	**Total Cases = 50**

Appendix D – Recorded Details from Case Studies

Table D-1 – Recorded Details for Frigg TP1 Decommissioning Programme on Microsoft Excel (An Example of a Leave-In-Place Case)

Activity	Start Date	End Date	Stakeholders Involved Identified (From Report)
Assessment and Simulation of Production Performance of Frigg Reservoir			
Comparative Assessment of Future Production Strategy of Frigg Reservoir			(Total EandP Norge (Operator), Norsk Hydro Produksjon, Statoil, Elf Exploration UK, Total EandP UK)
Assessment of Reuse Potential of Facilities			
Conduct Inventory of Materials Calculations			
Assessment of Reuse and Recylcable Potential of Materials			
Decommissioning Method Assessment for TP1 Platform Topside			
Decommissioning Method Assessment for TP1 Platform Substructure			
Decommissioning Method Assessment for Pipeline and Cables			
Write up of Environmental Impact Assessment Programme			Det Norske Veritas (Environmental Impact Assessment Certifying Body)
Submission of Environmental Impact Assessment Programme	11-Jun-99	11-Jun-99	Ministry of Petroleum and Energy (Norway), Deparment of Trade and Industry (UK)
Public Consultation in UK	14-Jul-99	14-Jul-99	Wilkinson Environmental Consulting, Joint Nature Conservation Committee, Marine Conservation Society, National Federation of Fishermen's Organization.
Public Consultation in Norway	15-Oct-99	15-Oct-99	Norwegian Ministry of the Environment, Norwegian Ministry of Fisheries, Norwegian Ministry of Defense, Norwegian Fishermen's Federation.
Assessment of Comments by stakeholders	14-Jul-99	1-Sep-00	
First Draft of Disposal Plan Environmental Impact Assessment Programme	1-Sep-00	17-May-01	
Stakeholder Consultation in UK	17-May-01	1-Sep-01	UK Statutory Consultees, BT Worldwide, Environmental Agency-Radioactive Substances Regulation Section, Greenpeace UK, Institue of Petroleum, International Association of Oil and Gas Producers, Joint Links Oil and Gas Environmental Consortium, KIMO-Local Authorities International Environmental Organization, Royal SOciety for the Protection of Birds, Orkney Fishermen's Association.
Stakeholder Consultation in Norway	17-May-01	2-Sep-01	Norwegian Governmental Organizations, Norwegian Local Authorities, Norwegian Fishermen's Federation, Nature and Youth, Bellona Foundation, Norges Miljovernforbund, Greenpeace Norway
Second Draft of Disposal Plan and Environmental Impact Assessment Programme	1-Sep-01	1-Nov-01	
Stakeholder Consultation in UK	1-Nov-01	28-Feb-02	UK Statutory Consultees, BT Worldwide, Environmental Agency-Radioactive Substances Regulation Section, Greenpeace UK, Institue of Petroleum, International Association of Oil and Gas Producers, Joint Links Oil and Gas Environmental Consortium, KIMO-Local Authorities

			International Environmental Organization, Royal SOciety for the Protection of Birds, Orkney Fishermen's Association.
Stakeholder Consultation in Norway	1-Nov-01	28-Feb-02	Norwegian Governmental Organizations, Norwegian Local Authorities, Norwegian Fishermen's Federation, Nature and Youth, Bellona Foundation, Norges Miljovernforbund, Greenpeace Norway
Stakeholder Consultation in Denmark	1-Nov-01	28-Feb-02	Danish Fishermen's Federation
Stakeholder Consultation in Germany	1-Nov-01	28-Feb-02	World Wide Fund for Nature, Bremen
Hiring of Contractors and Subcontractors	1-Feb-02	1-Oct-04	
Addressing of Comments by stakeholders	28-Feb-02	6-Aug-02	
Write up of Final Proposal for Disposal and Environmental Impact Assessment Programme	28-Feb-02	6-Aug-02	
Submission and seeking of Approval of Proposals for Disposal to OSPAR Consultation	6-Aug-02	20-Sep-02	
16 Week Consultation Period of OSPAR	20-Sep-02	9-May-03	
Submission and seeking of Approval of Decommissioning Plan (UK)	9-May-03	18-Nov-03	
Submission and seeking of Approval of Decommissioning Plan (Norway)	9-May-03	23-Apr-04	Ministry of Petroleum and Energy
Pre-Removal Survey	May-03	May-03	
Detailed Engineering of Decommissioning Methodology	1-Mar-04	1-Dec-06	
Prototype Development of Navigation Aid	1-Mar-04	1-Mar-05	The Norwegian Coastal Directorate, UK Northern Lighthouse Board
Shut-In of Production	26-Oct-04	26-Oct-04	
Final Production of Navigation Aid	Feb-05	1-Mar-07	The Norwegian Coastal Directorate, UK Northern Lighthouse Board
Removal of Bridge connecting TCP2 to TP1	Feb-05		Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Removal of TP1 Topside			Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
During Removal Phase Environmental Survey	May-06	May-06	
Checking of Exact Centre of Gravity for Module Support Frame		1-Jan-07	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Cutting of 2 Concrete Columns	May-07	May-07	
Single Lift of 3016 tonne Module Support Frame by S7000	1-Jan-07	1-Jan-07	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Installation of Navigation Aids on Concrete Substructures	1-Jan-07	1-Jan-07	The Norwegian Coastal Directorate, UK Northern Lighthouse Board, The UK Hydrographic Office, The Norwegian Hydrographic Services
Removal of External Risers Entering the Concrete Columns at the top of the Caisson	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)
Removal of Utility Risers from the Topside	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)
Removal of Boat Bumpers	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)
Removal of External Ladders and Platforms (Emergency	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)

Evacuation Platforms and Ladders)			
Removal of Vent Pipes and Supports	Aug-07	Aug-07	DeepOcean (External Steelwork Contractor)
Removal of Sheave Assemblies, Roller Guides, and Blocks	Aug-07	Aug-07	Ministry of Petroleum and Energy, TOTAL Norge (Shareholders)
Removal 26"pipeline from CDP1 at the entrance point on the TP1 Concrete Slab	Aug-07	Aug-07	Ministry of Petroleum and Energy, Scottish Fishermen's Federation, Norwegian Fishermen's Federation
Informing of Scottish Fishermen's Federation and Norges Fiskartag about Concrete Slab	Aug-07	Aug-07	Ministry of Petroleum and Energy, Scottish Fishermen's Federation, Norwegian Fishermen's Federation
Transport of Steel in Containers to Onshore Disposal Facility	1-Mar-07	Nov-10	
Debris Recovery 1	Jun-08	Jun-08	
Removal of R5 (451.2 metres of 26" Gas Line) connecting CDP1 to TP1	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R6 (481.8 metres of 26" Gas Line) connecting CDP1 to TP1	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of J4 (564.9 metres of 8" Condensate Line) connecting CDP1 to TP1	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of J5 (492.1 metres of 4" Mud Line) connecting CDP1 to TP1	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of J5 (545.0 metre of 3" Electrical Cable) connecting CDP1 to QP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of J5 (425.0 metres of 1 5/8" Telecom Cable) connecting CDP1 to QP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R7 (464.5 metres of 24" Flare Pipeline) connecting TP1 to FP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R7 (422.0 metres of 2" Air Pipeline) connecting TP1 to FP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R7 (456.3 metres of 2" Gas Pipeline) connecting TP1 to FP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R7 (574.0 metres of 3" Electrical Pipeline) connecting TP1 to FP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Removal of R7 (384.0 metres of 4" Telecom Pipeline) connecting TP1 to FP	Aug-08	Aug-08	Sonsub Ltd (Pipeline and Cable Removal Contractor)
Trawling Test for Fishing Activity 1	1-Sep-08	1-Sep-08	Scottish Fishermen's Federation, Norwegian Fishermen's Federation, SFF Services Limited (Trawler Supplier), FishSAFE
Transport of TP1 Module Support Frame to Aker Stord in Norway	1-Mar-07	Nov-10	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Saipem UK (Subcontractor)
Below-Water Inspection of Concrete Substructures of TP1	1-Jan-10	1-Jan-10	
Debris Recovery 2	Feb-10	Feb-10	
Post Removal Survey	May-10	May-10	
Above-Water Inspection of TP1 by Helicopter Photo Survey	1-Sep-10	1-Sep-10	

Trawling Test for Fishing Activity 2	1-Sep-10	1-Sep-10	Scottish Fishermen's Federation, Norwegian Fishermen's Federation, SFF Services Limited (Trawler Supplier), FishSAFE
Onshore Demolition of TP1 Module Support Frame	Nov-10	Nov-10	Aker Kvaerner Offshore Partner (Topside and Jacket Removal Main Contractor), Aker Stord (Subcontractor), Shetland Decommissioning (Subcontractor)
Submission of Closing Report	19-Jan-11	19-Jan-11	

Table D-2 – Recorded Details for North-West Hutton Decommissioning Programme on Microsoft Excel (An Example of a Partially Leave-In-Place Case)

Activity	Start Date	End Date	Stakeholders Involved Identified (From Report)
Pre-Removal Survey	2002	2002	
Production Performance Measure and Future Strategy Decision			Amoco UK, CIECO Exploration and Production UK, Enterprise Oil UK, Mobil North Sea Ltd.
Approval for Cease of Production	May-02	25-Jun-02	Department of Energy and Climate Change
Plugging and Abandonment of 24 Wells	Jan-02	1-Dec-04	UKOOA (OGUK), DNV
Removal of Tubing, Casing and Conductors of 40 Wells	Jan-02	1-Dec-04	UKOOA (OGUK), DNV
Identification of Interested Parties, Establishment of Stakeholder Register	Jul-02	Sep-02	Scottish Fishermen's Federation, National Federation of Fishermen's Organizations, The Fishermen's Association, The Northern Ireland Fish Producers Organization, Global Marine Systems, South Devon and Channel Shellfishermen, The Scallop Association, Greenpeace UK.
Contact of Stakeholders by Letter or Telephone	Oct-02	Dec-02	Scottish Fishermen's Federation, National Federation of Fishermen's Organizations, The Fishermen's Association, The Northern Ireland Fish Producers Organization, Global Marine Systems, South Devon and Channel Shellfishermen, The Scallop Association, Greenpeace UK.
Establishment of Public Website	Oct-02	Dec-02	
Independent Review Group	Oct-02	Apr-04	Norwegian Institute of Water Research, University of Glasgow, University College London, University of Oldenburg, University of Reading, University of Newcastle.
Cessation of Production	Jan-03	Jan-03	Department of Energy and Climate Change
Stakeholder Meeting at Aberdeen	Apr-03	Apr-04	Scottish Fishermen's Federation, National Federation of Fishermen's Organizations, The Fishermen's Association, The Northern Ireland Fish Producers Organization, Global Marine Systems, South Devon and Channel Shellfishermen, The Scallop Association, Greenpeace UK.
Comparative Assessment of Topside Decommissioning Method			
Comparative Assessment of Jacket Decommissioning Method			
Comparative Assessment of Drill Cuttings Decommissioning Method			
Comparative Assessment of Pipelines Decommissioning Method			
Calculation of Inventory of Materials			
Detailed Decommissioning Programme Published		14-Feb-05	
30 Day Public Consultation in UK	14-Feb-05	18-Mar-05	Department of Energy and Climate Change, DNV
Submission of Decommissioning Programme for Approval	7-Feb-06	12-Apr-06	Department of Energy and Climate Change, DNV
Module Separation of Topside Components			Heerema Marine Contractors
Removal of Topside by Lift Vessel Hermod	1-May-08	26-Dec-08	Heerema Marine Contractors
Transport of Topside by Lift Vessel Hermod to Teeside UK			Heerema Marine Contractors
Approval of Change of Decommissioning Method for Footings	14-Jan-09	14-Jan-09	Department of Energy and Climate Change, DNV

Cutting and lift of Jacket by Lift Vessel Hermod	8-Apr-09	17-Jul-09	Heerema Marine Contractors
Transport of Jacket by Lift Vessel Hermod to Teeside UK			Heerema Marine Contractors
Cutting of the Footings to 95m below surface			Heerema Marine Contractors
Request for Caissons to be left in-situ		9-May-11	Department of Energy and Climate Change, DNV
Trenching of 13km of (10"Concrete Coated Section) of PL 148	16-Jul-11	17-Aug-11	Heerema Marine Contractors
Trenching of 13km of (10"Concrete Coated Section) of PL 147			Heerema Marine Contractors
Removal of 209m of (6"Flexible Section) of PL 147			Heerema Marine Contractors
Removal of SSIV Umbilical of PL 147			Heerema Marine Contractors
Searching of Spool piece			Department of Energy and Climate Change, DNV
Trenching of 13km of (10"Concrete Coated Section) of PL 148	8-Apr-12	24-Apr-12	Department of Energy and Climate Change, DNV
Debris Clearance	1-Nov-12	1-Nov-12	Department of Energy and Climate Change, DNV
Trawling Test	1-Nov-12	1-Nov-12	Scottish Fishermen's Federation, National Federation of Fishermen's Organizations, The Fishermen's Association, The Northern Ireland Fish Producers Organization, Global Marine Systems, South Devon and Channel Shellfishermen, The Scallop Association, Greenpeace UK.
Backfill of Trenched Sections		15-Jul-13	Department of Energy and Climate Change, DNV
Survey of Backfilled Sections	15-Jul-13	15-Jul-13	Department of Energy and Climate Change, DNV
Closing Report Submission		6-Jul-05	Department of Energy and Climate Change, DNV

Table D-3 – Recorded Details of Indefatigable Juliet Decommissioning Programme on Microsoft Excel (An Example of a Complete Removal Case – Pre-2013)

Activity	Start Date	End Date	Stakeholders Involved Identified (From Report)
Assessment of Production Performance and Simulation			Shell UK, ExxonMobil
Assessment and Decision to Decommissioning			
Calculation of Inventory of Materials			
Comparative Assessment of Decommissionig Method of Topside			Shell UK, ExxonMobil
Comparative Assessment of Decommissioning Method of Substructure			Shell UK, ExxonMobil
Comparative Assessment of Decommissioning Method of Risers and Umbilicals			Shell UK, ExxonMobil
Comparative Assessment of Decommissioning Methods of Pipelines and Cables			Shell UK, ExxonMobil
Well Plugging and Abandonment of Wells (7 Wells)			
Pre-Decommissioning Environmental Seabed Survey	2006	2006	NFFO UK
Debris Clearance by GB Diving	Sep-05		
Application to Approval for Cease of Production		5-Jul-05	Department of Trade and Industry
Submission to Approval of Final Decommissioning Programme Document	30-May-07	6-Aug-07	
Conceptual Engineering Studies	2005	Jun-07	ODE UK
Remove Flowlines	Apr-05		AJS UK
Performe Overdue Maintenance - Helicopter Landing Systems and Live Saving Systems	Apr-05		AJS UK
Fabric Maintenance on Secondary Steel	Apr-05		AJS UK
Install New Diesel Generator Set	Apr-05		AJS UK
Cleaning of 16"Lima to Juliet Pipeline (PL82)	Apr-07	17-Apr-07	
Offloading of Cleaning Liquid for Injection			BW Carmen Norway
Debris Clearance by DSV Billy Topaz	Sep-08	Oct-08	NFFO UK
Cleaning of Umbilical Cores	Apr-09	May-09	HAK NL
Collection and Transporation of Pipeline Cleaning Liquid			BW Carmen Norway
Cleaning of 12"Mike to Juliet Pipeline (PL302)	29-May-09	31-May-09	
Flush clean or ensure adequate containment of any hazardous fluids of mateirsl	Jun-09	Sep-09	
Disconnect Caissons, Risers and J-tubes from topsides	Jun-09	Sep-09	

Perform Non-Destructive Testing on Critical Structural Members and Joints	Jun-09	Sep-09	
Make Access to and install lifting pad-eyes	Jun-09	Sep-09	
Install Structural Reinforcements	Jun-09	Sep-09	
Install Scaffolding Starters on Transitions pieces	Jun-09	Sep-09	
Install Temporary pig launchers and receivers for the pipeline cleaning campaign	Jun-09	Sep-09	
Remove Sections of risers and umbilicals connected to the transition legs between the jackets and topsides	Jun-09	Sep-09	
Remove all loose items	Jun-09	Sep-09	
Lower caissons into the jacket and secure for lifting	Jun-09	Sep-09	
Debris Clearance by DSV Toisa Polaris	Aug-09	Sep-09	NFFO UK
Cleaning of 20"Juliet to Perenco 23A Pipeline (PL80)	Sep-09	Sep-09	
Removal of 12 Modules on Juliet-D and Julet-P	Sep-09	Mar-10	
Cutting and Transpoting of Riser and Umbilical of PL81 and PL402 to Vessel	Dec-09	Apr-10	
Debris Clearance by DSV Toisa Polaris	Apr-10	Apr-10	NFFO UK
Remove of Hazardous Objects	Jul-10	21-May-10	AF Decom Norway, Seaway Heavy Lifting NL
Install Scaffolding around the legs of the Topsides at the Cutline Positions	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Weld Guide Plates at the Cutline Positions of the Legs of the Topsides	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Remove Conductors	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Install Rigging, Lift topsides and fix topsides (by welding) on grillages beams on barge	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Remove Transition pieces and check by lowering a chaser into the jacket piles	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Remove the soil in the legs till a level of 5m below the seabed	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Cut the holes for the shackle pins at the upper end of the jacket legs	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Install rigging, lift jacket, cut pile stubs at the same level and fix jackets (by welding) on grillages beams on barge	Mar-11	11-Jul-11	AF Decom Norway, Seaway Heavy Lifting NL
Removal of Substucture and Subsea Facilities	26-Jun-11	11-Jul-11	Subsea7 UK
Removal of Risers and Umbilicals	26-Jun-11	11-Jul-11	Subsea7 UK
Trenching of Pipelines to be left in-situ			Subsea7 UK
Backfill of Pipelines to be left in-situ			Subsea7 UK

Transportation of Juliet P Topside and Jacket to Onshore (Newcastle)	11-Apr-11	18-Apr-11	
Transportation of Juliet D Topside (Modules and Modular Support Frames) to Onshore (Newcastle)	11-May-11	18-May-11	
Transportation of Juliet D Jackets to Onshore (Newcastle)	22-May-11	30-May-11	
Onshore Load-In, Dismantling and Disposal			Veolia UK
Final Debirs Recovery	8-Jun-12	27-Jul-12	NFFO UK
Post-Decommissioning Environmental Survey	Sep-12	Nov-12	
Seabed Survey of Buried Pipelines	8-Aug-13	8-Aug-13	
Trawl Test	8-Aug-13	8-Aug-13	National Federation of Fisherman's Organizations
Submission of Closing Report	21-Jan-14	21-Jan-14	

Table D-4 – Recorded Details of Leman BH Decommissioning Programme on Microsoft Excel (An Example of a Complete Removal Case – Post-2013)

Activity	Start Date	End Date	Stakeholders Involved Identified (From Report)
Assessment of Production Performance and Simulation			Shell U.K. Limited, Perenco UK Limited, Esso Exploration and Production UK Limited, SSE EandP UK Limited.
Lifting Concept and Detailed Engineering	Jan 2014	Mar 2014	
Financial Approval to Decommissioning		7th Jul 2015	Shell U.K. Limited, Perenco UK Limited, Esso Exploration and Production UK Limited, SSE EandP UK Limited.
Seabed Survey	Oct 2015	Feb 2016	
Seafox 4 Arrival for Enabling Scope	20th Oct 2015	20th Oct 2015	
Calculation of Inventory of Materials			
Comparative Assessment of Decommissioning Method of Topside			
Comparative Assessment of Decommissioning Method of Substructure			
Comparative Assessment of Decommissioning Method of Risers and Umbilicals			
Comparative Assessment of Decommissioning Methods of Pipelines and Cables			
Develop Decommissioning Programme	Jan 2015	Sep 2015	
Detailed Removal Engineering	Feb 2015	Nov 2015	
Tender and Award	Nov 2014	Jun 2015	
Completion of Leman BH Enabling Scope	23rd May 2016	23rd May 2016	
Clean and Make Safe	Nov 2015	Nov 205	
Refurbishment Campaign for Leman BT	Nov 2015	May 2016	
Release of 1st Draft of Decommissioning Programme	6th Aug 2016		
Stakeholder Consultation	6th Aug 2016		
Environmental Impact Assessment	22nd Dec 2016		
Submission to Approval of Decommissioning Safety	Feb 2017	2nd May 2017	Health and Safety Executive (HSE)
Submission to Approval of Final Decommissioning Programme	5th Apr 2017	27th Apr 2017	Department of Business, Energy and Industrial Strategy (BEIS)
Supply Chain Engagement with Waste Management Contractors	May 2017		Veolia (UK), Great Yarmouth Outer Harbour

Engagement with Waste Management Regulators	May 2017		Scottish Environmental Protection Agency (SEPA), Environment Agency (EA).
Installation of Leg Scaffold for Final Leg Cut	5th July 2017		
Removal of Stair Access from Cellar Deck to Spider Deck			
Fit Lifting of Rigging Equipment for Topside Lift			
Cutting of the 4 Legs Above Spider Deck			
Submission to Approval of Updated Safety Case	28th Sep 2017	5th Dec 2017	
Depressurization of Pipelines			
Topsides Lift with Heavy Lift Vessel Taklift4			
Transport of Topsides to Decommissioning Facility			Veolia (UK), Great Yarmouth Outer Harbour
Taklift 4 Return to Leman BH			
Depressurization of Pipelines			
Dredge Sand Plug (4 Legs) in Preparation to Cut at 3 meter below Seabed Level			
Cut Piles at 3 meter below Seabed Level			
Insert Lifting Pins			
Jacket Lift			
Transport of Jacket to Decommissioning Facility			Veolia (UK), Great Yarmouth Outer Harbour
Soft Strip of Topside		Nov 2017	Veolia (UK), Great Yarmouth Outer Harbour, Health and Safety Executive (HSE), Scottish Environmental Protection Agency (SEPA), Environment Agency (EA).
Felling, Dismantling and Disposal of Jacket		Nov 2017	Veolia (UK), Great Yarmouth Outer Harbour, Health and Safety Executive (HSE), Scottish Environmental Protection Agency (SEPA), Environment Agency (EA).
Dismantling and Disposal of the Topside		Nov 2017	Veolia (UK), Great Yarmouth Outer Harbour, Health and Safety Executive (HSE), Scottish Environmental Protection Agency (SEPA), Environment Agency (EA).
Post-Decommissioning Survey			
Project Close-Out		Dec 2017	Department of Business, Energy and Industrial Strategy (BEIS)

Appendix E – List of Assumptions for the Stakeholder-Oriented Critical Paths

Table E-1 – List of Assumptions Made for the Initial and Robust United Kingdom Stakeholder-Oriented Critical Paths

Activity	Assumption Made	Other Possible Variations
-	There is no association of the Facility with previous Public Stakeholder Interaction.	1) Public Stakeholder Interaction in the Past Associated with the Facility.
-	Main Facility is a Fixed Platform Weighing more than 10,000 tonnes in air.	2) Fixed Platform Weighing Less than 10,000 tonnes in air. 3) Floating Facilities: Spar Platforms, Floating Production Storage and Offloading (FPSO) Units, etc. 4) Subsea Facilities 5) Decommissioning Programme doesn't involve a Platform.
-	Facility Has Wells Required to be Plugged and Abandoned.	1) Facility does not have Wells.
-	Decommissioning Programmes involves Associated Pipelines.	2) Decommissioning Programme does not involve associated pipelines.
-	Decommissioning Programmes involves associated Subsea Facilities.	1) Decommissioning Programme does not involve Subsea Facilities.
-	Decommissioning Programmes involves Drill Cuttings.	1) Decommissioning Programmes does not involve Drill Cuttings.
-	There are other Neighbouring Facilities Depending on the Main Platform for Production.	1) Facility is Standalone (i.e. No Dependent Facilities).
Continuous Engagement with Joint-Venture Partners (Asset Management) Engagement with Joint-Venture Partners (Philosophy and Strategy)	The Arrangement of the Facility is a Joint-Venture Partnership.	1) Facility is Solely Owned and Operated by one Operator.
Engagement with Other Operators (Alternative Late-Life Production Strategy)	Outcome from the Engagement is that Decommissioning of the Facility is the Best Option.	1) Transfer of License to Other Operators. 2) Life-Extension Projects. 3) Decommissioning Alternatives – Reused for Other Purposes.
Early Engagement with Other Operators (Collaboration Opportunities) Early Engagement with Supply Chain (Collaboration Opportunities)	Project Scheduling Remains Unchanged.	1) Project Schedule Changed due to collaboration (eg. Change of Cessation of Production Date, Removal Execution Date, etc.)

Confirmation of Well Integrity	Outcome is that All Wells are in Good Condition.	1)	Some or All of the Wells have Poor Integrity.
Formation Evaluation	Formation is Sandstone and have a Normal Pore Pressure and Fracture Pressure Gradient.	1) 2)	Variance in Reservoir Rock Type (Carbonates, Shale, etc.) Abnormal Formation Pressure (eg. Fractured Formations, Higher Pressure-High Temperature Zones, etc.)
Preparation / Upgrade of Offshore Facility for Well Plugging and Abandonment	Well Plugging and Abandonment Operation Requires a Rig.	1)	Rigless Well Plugging and Abandonment.
Preparation / Upgrade of Offshore Facility for Well Plugging and Abandonment	Main Facility Has a Working Rig that Requires 60 days for Preparation / Upgrade.	1) 2)	Variance in Preparation and Upgrading Activities Depending on Condition of the Rig. Usage of Mobile Rigs (Jack-Up Rigs, Semi-Submersibles, etc.)
Continuous Regulatory Engagement with OGA (Diminishing Window for Cessation of Production)	Oil Price Remains Unchanged Throughout the Diminishing Window.	1) 2)	Oil Price Decrease and Cessation of Production Shifts to the Left. Oil Price Increase and Cessation of Production Shifts to the Right.
Well Plugging and Abandonment Operation.	12 Wells at 30 days per Well, No Delays and Zero Downtime.	1) 2)	Variance in Total Number of Wells to be Plugged and Abandoned. Variance in Days Required per Well due to Various Factors (eg. Rig Breakdown, Fractured Formation, Stuck Pipe, etc.)
Well Plugging and Abandonment Operation. (MILESTONE 10: Complete Cessation of Production of the Facility)	Well Plugging and Abandonment Operation Starts before Cessation of Production.	1)	Variation to Start Date of Well Plugging and Abandonment.
Verification of Well Barriers	No Issues with Well Barriers	1)	Issues with Well Barriers (Well Leak, Unsatisfactory Cement-Bond Log Results, etc.)
Integrity Inspection of Infrastructure	Condition of all of the Infrastructure is in Good Condition.	1)	Poor Infrastructure Integrity of Some parts or all of the Facility.
Public Engagement with Statutory Consultees Public Engagement with Non-Statutory Consultees Official Public Consultation Address Stakeholder Concerns	No Major Public Stakeholder Interaction, Challenges, and Concerns.	2)	Major / Significant Public Stakeholder Interaction, Challenges, and Concerns.
Address Stakeholder Concerns	No Outstanding Stakeholder Concerns at the End of the Public Consultation Period.	3)	Presence of Outstanding Stakeholder Concerns that are Not Yet Resolved.

(MILESTONE 13: Release of Draft Decommissioning Programme for Public Consultation) Subsequent Iteration and Review of Decommissioning Programme	No Major Changes to Comparative Assessment Outcomes and Decommissioning Programme.	1) Recycle the Comparative Assessment.
OSPAR Derogation Review	Decommissioning Programme is seeking for Derogation. Derogation Case is Approved.	1) Non-Derogation Case. 2) Derogation Case Not Approved.
OSPAR Derogation Review	No queue in the funnel for derogation application. Timing for Derogation Approval is 1 year.	1) Extension for OSPAR Review. 2) Other Projects in Queue for Derogation Review.
Cleaning and Preparation of Facility	Cleaning and Preparation of Facility Starts prior to Cessation of Production and Ends After Completion of Well Plugging and Abandonment of All Wells.	1) Variation to the Start Date for Cleaning and Preparation of Facility for Removal Execution.
Cleaning, Flushing, and Pigging of Pipelines	Cleaning, Flushing, and Pigging of Pipelines Starts prior to Cessation of Production and Ends After Completion of Well Plugging and Abandonment of All Wells.	1) Variation to the Start Date for Cleaning, Flushing, and Pigging of Pipelines
Decommissioning Execution	Decommissioning Removal Done in the Following Order: 1) Removal of Topside 2) Removal of Substructure Components to be Removed 3) Removal of Pipelines 4) Removal of Subsea Facilities 5) Trenching and Burying of Pipelines and other Infrastructure Left In-Situ	1) Variation to the sequence, timing, and methodology of removal depending on the facility.
Installation of By-Pass Pipelines for Neighbouring Facilities	Installation of By-Pass Pipelines is the Chosen Arrangement for the Remaining Neighbouring Facilities.	1) Other Alternative Production Arrangements (FPSOs, Transport Vessels, etc.) 2) No Arrangements for Remaining Neighbouring Facilities.
Removal of Substructure Components to be Removed	Partial Removal Option – Approval of Derogation Case.	1) Complete Removal of Substructure. 2) Substructure Fully Left-In-Situ.
Removal of Pipelines	Some Pipelines are Removed to Shore.	1) All Pipelines to be Left-In-Situ.
Trenching and Burying of Pipelines and other Infrastructure to be Left In-situ	Some Pipelines and other Infrastructure are Left-In-Situ and Required Trenching.	1) No Trenching Required. 2) All Pipelines and other Infrastructures to be removed to shore.
Installation and Testing of Navigation Aids	Required Installation of Navigation Aids.	1) Does not Required the Installation of Navigation Aids.
Further Ongoing Survey and Monitoring	Further Ongoing Survey and Monitoring for 2 years before Close-Out of the Project.	1) Post-Decommissioning Survey and Monitoring Arrangement Varies Depending on Agreement with BEIS.

Table E-2 – List of Assumptions Made for the Robust Australian Stakeholder-Oriented Critical Paths

Activity	Assumption Made	Other Possible Variations
-	There is no association of the Facility with previous Public Stakeholder Interaction.	1) Public Stakeholder Interaction in the Past Associated with the Facility.
-	Main Facility is a Fixed Platform Weighing more than 10,000 tonnes in air.	1) Fixed Platform Weighing Less than 10,000 tonnes in air. 2) Floating Facilities: Spar Platforms, Floating Production Storage and Offloading (FPSO) Units, etc. 3) Subsea Facilities 4) Decommissioning Programme doesn't involve a Platform.
-	Facility Has Wells Required to be Plugged and Abandoned.	1) Facility does not have Wells.
-	Decommissioning Programmes involves Associated Pipelines.	1) Decommissioning Programme does not involve associated pipelines.
-	Decommissioning Programmes involves associated Subsea Facilities.	1) Decommissioning Programme does not involve Subsea Facilities.
-	Decommissioning Programmes involves Drill Cuttings.	1) Decommissioning Programmes does not involve Drill Cuttings.
-	There are other Neighbouring Facilities Depending on the Main Platform for Production.	1) Facility is Standalone (i.e. No Dependent Facilities).
-	Part of the Facility is located in Commonwealth Waters and the remaining Facility is located in State Waters.	1) Facility is located in Commonwealth Waters Only. 2) Facility is located in State Waters Only. 3) Facility is located in a Joint-Development Area with Timor Leste.
Continuous Engagement with Joint-Venture Partners (Asset Management) Engagement with Joint-Venture Partners (Philosophy and Strategy)	The Arrangement of the Facility is a Joint-Venture Partnership.	1) Facility is Solely Owned and Operated by one Operator.
Engagement with Other Operators (Alternative Late-Life Production Strategy)	Outcome from the Engagement is that Decommissioning of the Facility is the Best Option.	1) Transfer of License to Other Operators. 2) Life-Extension Projects. 3) Decommissioning Alternatives – Reused for Other Purposes.
Early Engagement with Other Operators (Collaboration Opportunities)	Project Scheduling Remains Unchanged.	1) Project Schedule Changed due to collaboration (eg. Change of Cessation of

Early Engagement with Supply Chain (Collaboration Opportunities)			Production Date, Removal Execution Date, etc.)
Confirmation of Well Integrity	Outcome is that All Wells are in Good Condition.	1)	Some or All of the Wells have Poor Integrity.
Formation Evaluation	Formation is Sandstone and have a Normal Pore Pressure and Fracture Pressure Gradient.	1) 2)	Variance in Reservoir Rock Type (Carbonates, Shale, etc.) Abnormal Formation Pressure (eg. Fractured Formations, Higher Pressure-High Temperature Zones, etc.)
Preparation / Upgrade of Offshore Facility for Well Plugging and Abandonment	Well Plugging and Abandonment Operation Requires a Rig.	1)	Rigless Well Plugging and Abandonment.
Preparation / Upgrade of Offshore Facility for Well Plugging and Abandonment	Main Facility Has a Working Rig that Requires 60 days for Preparation / Upgrade.	1) 2)	Variance in Preparation and Upgrading Activities Depending on Condition of the Rig. Usage of Mobile Rigs (Jack-Up Rigs, Semi-Submersibles, etc.)
Continuous Regulatory Engagement with Joint-Authority – NOPTA and State Regulator (Diminishing Window for Cessation of Production)	Oil Price Remains Unchanged Throughout the Diminishing Window.	1) 2)	Oil Price Decrease and Cessation of Production Shifts to the Left. Oil Price Increase and Cessation of Production Shifts to the Right.
Well Plugging and Abandonment Operation.	12 Wells at 30 days per Well, No Delays and Zero Downtime.	1) 2)	Variance in Total Number of Wells to be Plugged and Abandoned. Variance in Days Required per Well due to Various Factors (eg. Rig Breakdown, Fractured Formation, Stuck Pipe, etc.)
Well Plugging and Abandonment Operation. (MILESTONE 8: Complete Cessation of Production of the Facility)	Well Plugging and Abandonment Operation Starts before Cessation of Production.	1)	Variation to Start Date of Well Plugging and Abandonment.
Verification of Well Barriers	No Issues with Well Barriers	1)	Issues with Well Barriers (Well Leak, Unsatisfactory Cement-Bond Log Results, etc.)
Integrity Inspection of Infrastructure	Condition of all of the Infrastructure is in Good Condition.	1)	Poor Infrastructure Integrity of Some parts or all of the Facility.
Public Engagement with Public Stakeholders Address Stakeholder Concerns	No Major Public Stakeholder Interaction, Challenges, and Concerns.	1)	Major / Significant Public Stakeholder Interaction, Challenges, and Concerns.
Address Stakeholder Concerns	No Outstanding Stakeholder Concerns at the End of the Public Consultation Period.	1)	Presence of Outstanding Stakeholder Concerns that are Not Yet Resolved.

(MILESTONE 11: Release of Draft Decommissioning and Rehabilitation Plan for Public Comments) Subsequent Iteration and Review of Decommissioning and Rehabilitation Plan	No Major Changes to Comparative Assessment Outcomes and Decommissioning and Rehabilitation Plan.	1) Recycle the Comparative Assessment.
Cleaning and Preparation of Facility	Cleaning and Preparation of Facility Starts prior to Cessation of Production and Ends After Completion of Well Plugging and Abandonment of All Wells.	1) Variation to the Start Date for Cleaning and Preparation of Facility for Removal Execution.
Cleaning, Flushing, and Pigging of Pipelines	Cleaning, Flushing, and Pigging of Pipelines Starts prior to Cessation of Production and Ends After Completion of Well Plugging and Abandonment of All Wells.	1) Variation to the Start Date for Cleaning, Flushing, and Pigging of Pipelines
Decommissioning Execution	Decommissioning Removal Done in the Following Order: 6) Removal of Topside 7) Removal of Substructure Components to be Removed 8) Removal of Pipelines 9) Removal of Subsea Facilities 10) Trenching and Burying of Pipelines and other Infrastructure Left In-Situ	1) Variation to the sequence, timing, and methodology of removal depending on the facility.
Installation of By-Pass Pipelines for Neighbouring Facilities	Installation of By-Pass Pipelines is the Chosen Arrangement for the Remaining Neighbouring Facilities.	1) Other Alternative Production Arrangements (FPSOs, Transport Vessels, etc.) 2) No Arrangements for Remaining Neighbouring Facilities.
Removal of Substructure Components to be Removed	Partial Removal Option – Approval of Derogation Case.	1) Complete Removal of Substructure. 2) Substructure Fully Left-In-Situ.
Removal of Pipelines	Some Pipelines are Removed to Shore.	1) All Pipelines to be Left-In-Situ.
Trenching and Burying of Pipelines and other Infrastructure to be Left In-situ	Some Pipelines and other Infrastructure are Left-In-Situ and Required Trenching.	1) No Trenching Required. 2) All Pipelines and other Infrastructures to be removed to shore.
Further Ongoing Survey and Monitoring	Further Ongoing Survey and Monitoring for 2 years before Close-Out of the Project.	1) Post-Decommissioning Survey and Monitoring Arrangement Varies Depending on Agreement with Regulators.

Appendix F – Microsoft Project Input Data for the Initial Stakeholder-Oriented Critical Paths

Table F-1 – Microsoft Project Input Data for Initial Stakeholder Oriented Critical Path – Leave-In-Place (United Kingdom)

No.	Activity	Duration	Predesessor
1	Assessment of Production Performance and Simulations	30 days	
2	Assessment of Infrastructure Condition	30 days	
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	1,2
4	Application to Approval to Cease Production	14 days	
5	Independent Study and Research on Decommissiong	90 days	3
6	Inventory Calculation of Materials	30 days	3
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	4,29,30,31
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	4,29,30,31
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	4,29,30,31
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	7,8,9
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	10
12	Notification of Decommissioning to Interest Parties	30 days	3
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	7,8,9,21
14	Public Consultation	30 days	12,13
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	5,11,14,
16	Formal Stakeholder Consultation	30 days	15
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	16
18	16-Week OSPAR Consultation Period	112 days	17
19	Application to Approval of Permit for Disposal at Sea (Leave in Place)	90 days	8
20	Submission to Approval of Final Decommissioning Programme Document	90 days	17
21	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	7,8,9
22	Detailed Engineering and Planning for Decommissioning	500 days	18
23	Health, Safety, and Environment Risk Study and Approval	90 days	22
24	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	
25	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	24
26	Well Plugging and Abandonment	600 days	25
27	Integrity Assessment of Well Plugs	180 days	26
28	Making Facility Cold and Safe	90 days	37
29	Pre-Decommissioning Environmental (Surface) Survey	60 days	3
30	Pre-Decommissioning Environmental (Seabead) Survey	30 days	3
31	Pre-Decommissioning Structural Survey	30 days	3
32	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	3
33	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	3
34	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	3
35	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	3
36	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	
37	Shut-In of Production Pipelines	3 days	27,4,41
38	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	
39	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	37,38
40	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	39
41	Rerouting and By-Pass of Pipelines still in used	60 days	4,22,23
42	Removal of Topside Facilities to Transport Vessel	100 days	28,22,23
43	Transport of Topside Facilities to Designated Location	30 days	42,22,23,36
44	Seperation of Topside Structures and Modules to Transport Vessel	400 days	42,22,23
45	Transport of Topside Structures and Modules to Designated Location	30 days	44,22,23,36
46	Removal of Substructure Steel Materials to Transport Vessel	100 days	52,53,54,44,22,23
47	Transport of Substructure Steel Materials to Designated Location	30 days	52,53,54,47,22,23,36
48	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	52,53,54,46,22,23,26,39
49	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	52,53,54,48,22,23,26,39,36
50	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	52,53,54,48,22,23,26,39
51	Transport of Removable Pipelines and Cables to Designated Location	30 days	52,53,54,48,22,23,26,39,36
52	During-Decommissioning Environmental (Surface) Survey	60 days	45
53	During-Decommissioning Environmental (Seabed) Survey	30 days	45
54	During-Decommissioning Structural Survey	30 days	45
55	Removal of Subsea Equipments to Transport Vessel	30 days	52,53,54,50,22,23,26,39
56	Transport of Subsea Equipments to Designated Location	30 days	52,53,54,50,22,23,26,39,36
57	Trenching of Unremovable Pipelines	90 days	52,53,54,55,46,48,50
58	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	52,53,54,55,46,48,50,57
59	Installation of Navigation Aids on Structure	2 days	43,45,47,49,51
60	Testing of Navigation Aids on Structure	1 day	59
61	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	60
62	Final Debris Recovery Programme	60 days	43,45,47,49,51,58
63	Post-Decommissioning Environmental (Surface) Survey	30 days	62
64	Post-Decommissioning Environmental (Seabed) Survey	3 days	62
65	Post-Decommissioning Structural Survey	3 days	62
66	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 day	63,64,65
67	Application to Approval for Certification Of Cleared Seabed	1 day	66,68
68	Trawling Test	3 days	63,64,65
69	Onshore Load-In, Dismantling and Disposal	10 days	43,45,47,49,51,58
70	Write Up and Submission of Decommissioning Programme Closing Report	120 days	69,67

Table F-2 – Microsoft Project Input Data for Initial Stakeholder-Oriented Critical Path – Partially Leave-In-Place (United Kingdom)

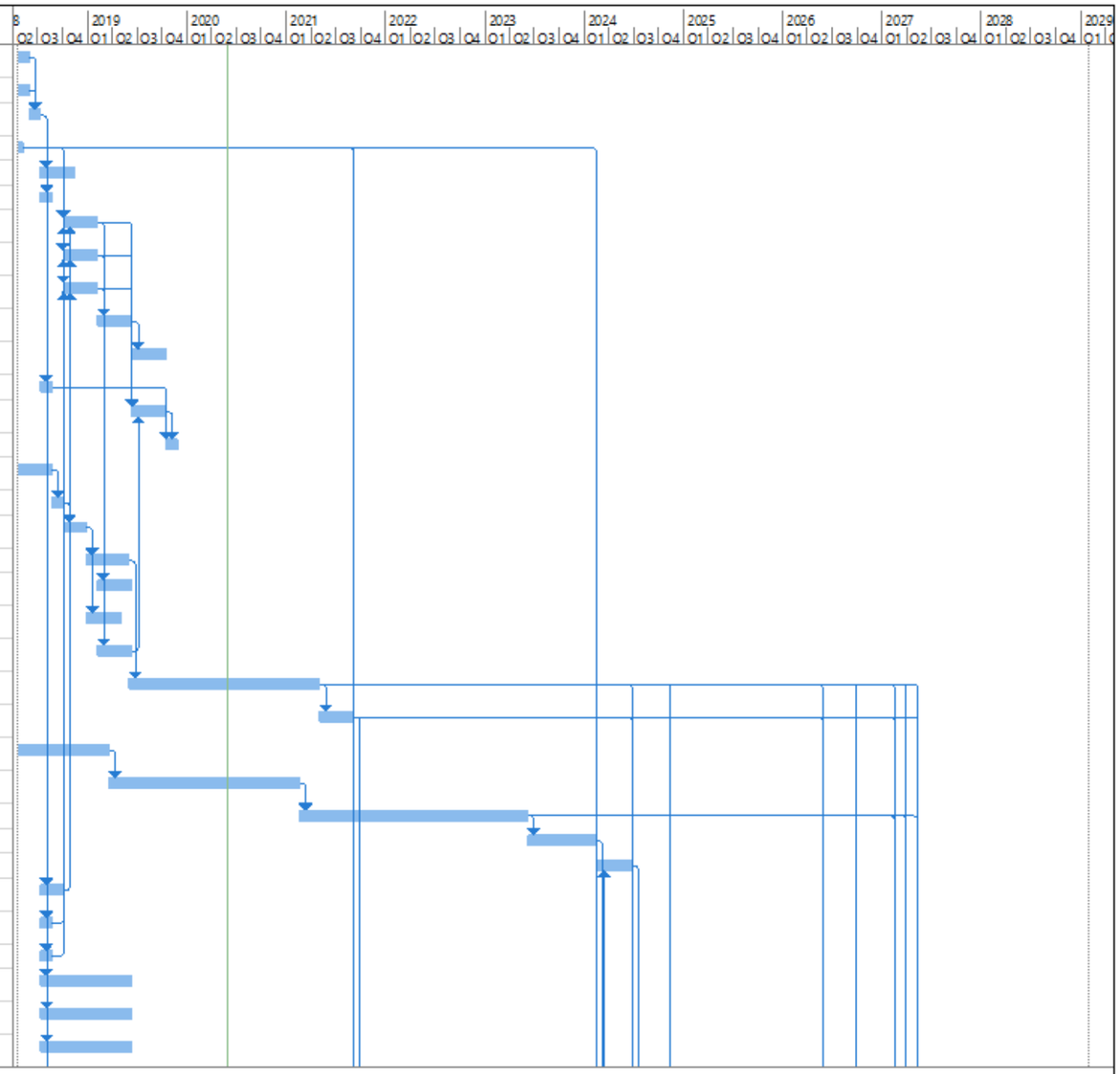
No.	Activity	Duration	Predesessor
1	Assessment of Production Performance and Simulations	30 days	
2	Assessment of Infrastructure Condition	30 days	
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	1,2
4	Application to Approval to Cease Production	14 days	
5	Independent Study and Research on Decommissiong	90 days	3
6	Inventory Calculation of Materials	30 days	3
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	4,29,30,31
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	4,29,30,31
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	4,29,30,31
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	7,8,9
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	10
12	Notification of Decommissioning to Interest Parties	30 days	3
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	7,8,9,21
14	Public Consultation	30 days	12,13
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	5,11,14,
16	Formal Stakeholder Consultation	30 days	15
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	16
18	16-Week OSPAR Consultation Period	112 days	17
19	Application to Approval of Permit for Pipeline Cleaning Works	90 days	8
20	Application to Approval of Permit for Decommissioning Works		
21	Submission to Approval of Final Decommissioning Programme Document	90 days	17
22	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	7,8,9
23	Detailed Engineering and Planning for Decommissioning	500 days	18
24	Health, Safety, and Environment Risk Study and Approval	90 days	22
25	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	
26	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	24
27	Well Plugging and Abandonment	600 days	25
28	Integrity Assessment of Well Plugs	180 days	26
29	Making Facility Cold and Safe	90 days	37
30	Pre-Decommissioning Environmental (Surface) Survey	60 days	3
31	Pre-Decommissioning Environmental (Seabead) Survey	30 days	3
32	Pre-Decommissioning Structural Survey	30 days	3
33	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	3
34	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	3
35	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	3
36	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	3
37	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	
38	Shut-In of Production Pipelines	3 days	27,4,41
39	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	
40	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	37,38
41	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	39
42	Rerouting and By-Pass of Pipelines still in used	60 days	4,22,23
43	Removal of Topside Facilities to Transport Vessel	100 days	28,22,23
44	Transport of Topside Facilities to Designated Location	30 days	42,22,23,36
45	Seperation of Topside Structures and Modules to Transport Vessel	400 days	42,22,23
46	Transport of Topside Structures and Modules to Designated Location	30 days	44,22,23,36
47	Removal of Substructure Steel Materials to Transport Vessel	100 days	52,53,54,44,22,23
48	Transport of Substructure Steel Materials to Designated Location	30 days	52,53,54,47,22,23,36
49	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	52,53,54,46,22,23,26,39
50	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	52,53,54,48,22,23,26,39,36
51	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	52,53,54,48,22,23,26,39
52	Transport of Removable Pipelines and Cables to Designated Location	30 days	52,53,54,48,22,23,26,39,36
53	Cutting of Substructure to Separate Section to be Removed and Section to be Left in Place		
54	Removal of Substructure to Transport Vessel		
55	Transport of Substructure to Designated Location		
56	During-Decommissioning Environmental (Surface) Survey	60 days	45
57	During-Decommissioning Environmental (Seabed) Survey	30 days	45
58	During-Decommissioning Structural Survey	30 days	45
59	Removal of Subsea Equipments to Transport Vessel	30 days	52,53,54,50,22,23,26,39
60	Transport of Subsea Equipments to Designated Location	30 days	52,53,54,50,22,23,26,39,36
61	Trenching of Unremovable Pipelines	90 days	52,53,54,55,46,48,50
62	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	52,53,54,55,46,48,50,57
63	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	60
64	Final Debris Recovery Programme	60 days	43,45,47,49,51,58
65	Post-Decommissioning Environmental (Surface) Survey	30 days	62
66	Post-Decommissioning Environmental (Seabed) Survey	3 days	62
67	Post-Decommissioning Structural Survey	3 days	62
68	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 day	63,64,65
69	Application to Approval for Certification Of Cleared Seabed	1 day	66,68
70	Trawling Test	3 days	63,64,65
71	Onshore Load-In, Dismantling and Disposal	10 days	43,45,47,49,51,58
72	Write Up and Submission of Decommissioning Programme Closing Report	120 days	69,67

Table F-3 – Microsoft Project Input Data for Initial Stakeholder-Oriented Critical Path – Complete Removal (United Kingdom)

No.	Activity	Duration	Predesessor
1	Assessment of Production Performance and Simulations	30 days	
2	Assessment of Infrastructure Condition	30 days	
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	1,2
4	Application to Approval to Cease Production	14 days	
5	Independent Study and Research on Decommissiong	90 days	3
6	Inventory Calculation of Materials	30 days	3
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	4,29,30,31
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	4,29,30,31
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	4,29,30,31
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	7,8,9
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	10
12	Notification of Decommissioning to Interest Parties	30 days	3
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	7,8,9,21
14	Public Consultation	30 days	12,13
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	5,11,14,
16	Formal Stakeholder Consultation	30 days	15
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	16
18	16-Week OSPAR Consultation Period	112 days	17
19	Application to Approval of Permit for Pipeline Cleaning Works	90 days	8
20	Application to Approval of Permit for Decommissioning Works		
21	Submission to Approval of Final Decommissioning Programme Document	90 days	17
22	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	7,8,9
23	Detailed Engineering and Planning for Decommissioning	500 days	18
24	Health, Safety, and Environment Risk Study and Approval	90 days	22
25	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	
26	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	24
27	Well Plugging and Abandonment	600 days	25
28	Integrity Assessment of Well Plugs	180 days	26
29	Making Facility Cold and Safe	90 days	37
30	Pre-Decommissioning Environmental (Surface) Survey	60 days	3
31	Pre-Decommissioning Environmental (Seabead) Survey	30 days	3
32	Pre-Decommissioning Structural Survey	30 days	3
33	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	3
34	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	3
35	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	3
36	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	3
37	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	
38	Shut-In of Production Pipelines	3 days	27,4,41
39	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	
40	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	37,38
41	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	39
42	Rerouting and By-Pass of Pipelines still in used	60 days	4,22,23
43	Removal of Topside Facilities to Transport Vessel	100 days	28,22,23
44	Transport of Topside Facilities to Designated Location	30 days	42,22,23,36
45	Seperation of Topside Structures and Modules to Transport Vessel	400 days	42,22,23
46	Transport of Topside Structures and Modules to Designated Location	30 days	44,22,23,36
47	Removal of Substructure Steel Materials to Transport Vessel	100 days	52,53,54,44,22,23
48	Transport of Substructure Steel Materials to Designated Location	30 days	52,53,54,47,22,23,36
49	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	52,53,54,46,22,23,26,39
50	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	52,53,54,48,22,23,26,39,36
51	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	52,53,54,48,22,23,26,39
52	Transport of Removable Pipelines and Cables to Designated Location	30 days	52,53,54,48,22,23,26,39,36
53	Cutting of Substructure Piles		
54	Removal of Substructure to Transport Vessel		
55	Transport of Substructure to Designated Location		
56	During-Decommissioning Environmental (Surface) Survey	60 days	45
57	During-Decommissioning Environmental (Seabed) Survey	30 days	45
58	During-Decommissioning Structural Survey	30 days	45
59	Removal of Subsea Equipments to Transport Vessel	30 days	52,53,54,50,22,23,26,39
60	Transport of Subsea Equipments to Designated Location	30 days	52,53,54,50,22,23,26,39,36
61	Trenching of Unremovable Pipelines	90 days	52,53,54,55,46,48,50
62	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	52,53,54,55,46,48,50,57
63	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	60
64	Final Debris Recovery Programme	60 days	43,45,47,49,51,58
65	Post-Decommissioning Environmental (Surface) Survey	30 days	62
66	Post-Decommissioning Environmental (Seabed) Survey	3 days	62
67	Post-Decommissioning Structural Survey	3 days	62
68	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 day	63,64,65
69	Application to Approval for Certification Of Cleared Seabed	1 day	66,68
70	Trawling Test	3 days	63,64,65
71	Onshore Load-In, Dismantling and Disposal	10 days	43,45,47,49,51,58
72	Write Up and Submission of Decommissioning Programme Closing Report	120 days	69,67

Appendix G – Initial Stakeholder-Oriented Critical Paths

ID	Task Name	Duration	Start	Finish
1	Assessment of Production Performance and Simulations	30 days	Fri 20/04/18	Thu 31/05/18
2	Assessment of Infrastructure Condition	30 days	Fri 20/04/18	Thu 31/05/18
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	Fri 1/06/18	Thu 12/07/18
4	Application to Approval to Cease Production	14 days	Fri 20/04/18	Wed 9/05/18
5	Independent Study and Research on Decommissiong	90 days	Fri 13/07/18	Thu 15/11/18
6	Inventory Calculation of Materials	30 days	Fri 13/07/18	Thu 23/08/18
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	Fri 5/10/18	Thu 7/02/19
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	Fri 5/10/18	Thu 7/02/19
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	Fri 5/10/18	Thu 7/02/19
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	Fri 8/02/19	Thu 13/06/19
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	Fri 14/06/19	Thu 17/10/19
12	Notification of Decommissioning to Interest Parties	30 days	Fri 13/07/18	Thu 23/08/18
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	Fri 14/06/19	Thu 17/10/19
14	Public Consultation	30 days	Fri 18/10/19	Thu 28/11/19
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	Fri 20/04/18	Thu 23/08/18
16	Formal Stakeholder Consultation	30 days	Fri 24/08/18	Thu 4/10/18
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	Fri 5/10/18	Thu 27/12/18
18	16-Week OSPAR Consultation Period	112 days	Fri 28/12/18	Mon 3/06/19
19	Application to Approval of Permit for Disposal at Sea (Leave in Place)	90 days	Fri 8/02/19	Thu 13/06/19
20	Submission to Approval of Final Decommissioning Programme Document	90 days	Fri 28/12/18	Thu 2/05/19
21	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	Fri 8/02/19	Thu 13/06/19
22	Detailed Engineering and Planning for Decommissioning	500 days	Tue 4/06/19	Mon 3/05/21
23	Health, Safety, and Environment Risk Study and Approval	90 days	Tue 4/05/21	Mon 6/09/21
24	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	Fri 20/04/18	Thu 21/03/19
25	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	Fri 22/03/19	Thu 18/02/21
26	Well Plugging and Abandonment	600 days	Fri 19/02/21	Thu 8/06/23
27	Integrity Assessment of Well Plugs	180 days	Fri 9/06/23	Thu 15/02/24
28	Making Facility Cold and Safe	90 days	Wed 21/02/24	Tue 25/06/24
29	Pre-Decommissioning Environmental (Surface) Survey	60 days	Fri 13/07/18	Thu 4/10/18
30	Pre-Decommissioning Environmental (Seabead) Survey	30 days	Fri 13/07/18	Thu 23/08/18
31	Pre-Decommissioning Structural Survey	30 days	Fri 13/07/18	Thu 23/08/18
32	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	Fri 13/07/18	Thu 13/06/19
33	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	Fri 13/07/18	Thu 13/06/19
34	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	Fri 13/07/18	Thu 13/06/19



Project: First Draft Design of Cr
Date: T

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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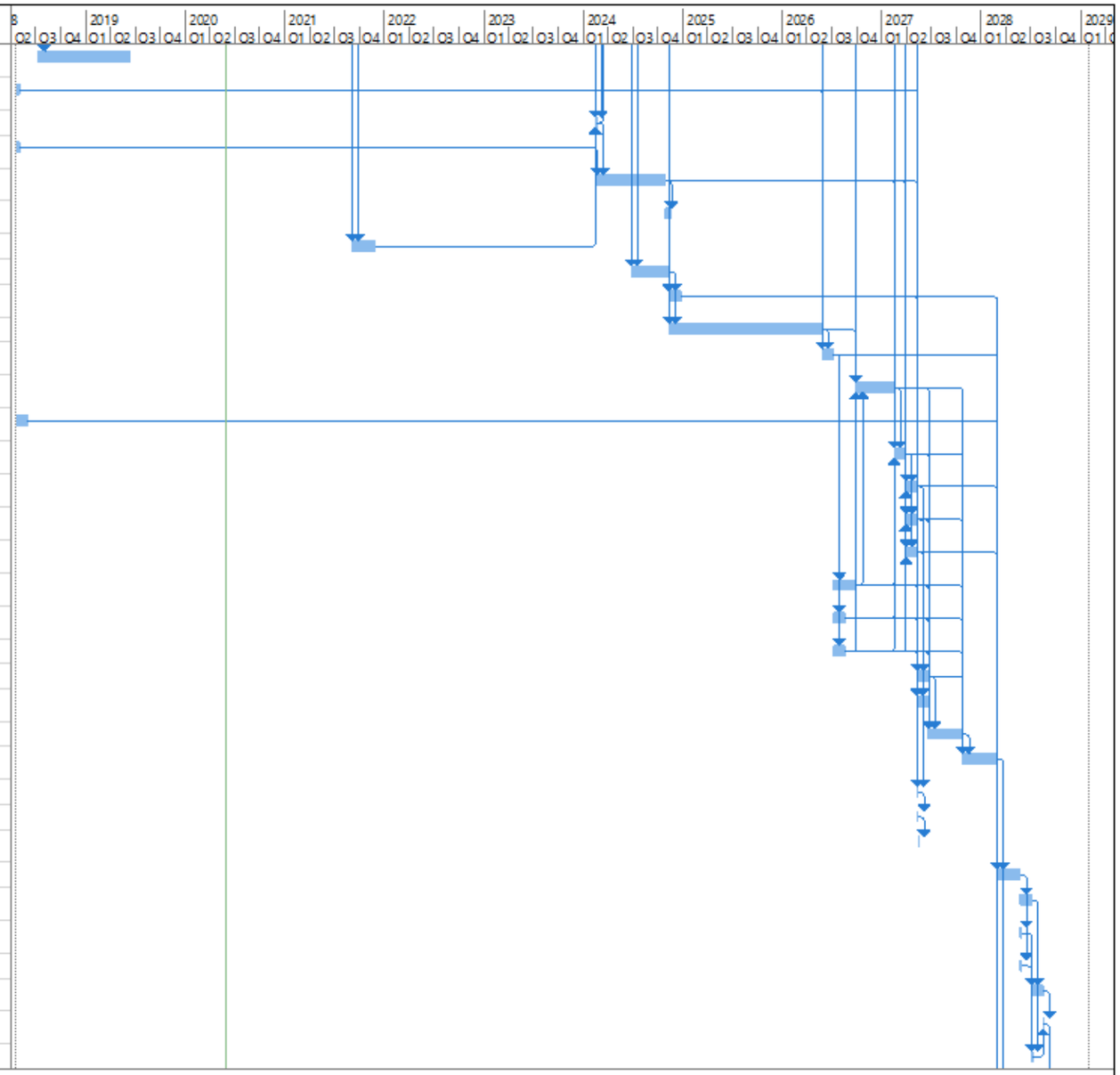
Figure G-1 – Initial Stakeholder-Oriented Critical Path (Leave-In-Place) – Part 1

ID	Task Name	Duration	Start	Finish
35	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	Fri 13/07/18	Thu 13/06/19
36	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	Fri 20/04/18	Thu 3/05/18
37	Shut-In of Production Pipelines	3 days	Fri 16/02/24	Tue 20/02/24
38	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	Fri 20/04/18	Thu 3/05/18
39	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	Wed 21/02/24	Tue 29/10/24
40	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	Wed 30/10/24	Tue 19/11/24
41	Rerouting and By-Pass of Pipelines still in used	60 days	Tue 7/09/21	Mon 29/11/21
42	Removal of Topside Facilities to Transport Vessel	100 days	Wed 26/06/24	Tue 12/11/24
43	Transport of Topside Facilities to Designated Location	30 days	Wed 13/11/24	Tue 24/12/24
44		400 days	Wed 13/11/24	Tue 26/05/26
45	Transport of Topside Structures and Modules to Designated Location	30 days	Wed 27/05/26	Tue 7/07/26
46	Removal of Substructure Steel Materials to Transport Vessel	100 days	Wed 30/09/26	Tue 16/02/27
47	Transport of Substructure Steel Materials to Designated Location	30 days	Fri 20/04/18	Thu 31/05/18
48	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	Wed 17/02/27	Tue 30/03/27
49	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	Wed 31/03/27	Tue 11/05/27
50	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	Wed 31/03/27	Tue 11/05/27
51	Transport of Removable Pipelines and Cables to Designated Location	30 days	Wed 31/03/27	Tue 11/05/27
52	During-Decommissioning Environmental (Surface) Survey	60 days	Wed 8/07/26	Tue 29/09/26
53	During-Decommissioning Environmental (Seabed) Survey	30 days	Wed 8/07/26	Tue 18/08/26
54	During-Decommissioning Structural Survey	30 days	Wed 8/07/26	Tue 18/08/26
55	Removal of Subsea Equipments to Transport Vessel	30 days	Wed 12/05/27	Tue 22/06/27
56	Transport of Subsea Equipments to Designated Location	30 days	Wed 12/05/27	Tue 22/06/27
57	Trenching of Unremovable Pipelines	90 days	Wed 23/06/27	Tue 26/10/27
58	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	Wed 27/10/27	Tue 29/02/28
59	Installation of Navigation Aids on Structure	2 days	Wed 12/05/27	Thu 13/05/27
60	Testing of Navigation Aids on Structure	1 day	Fri 14/05/27	Fri 14/05/27
61	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	Mon 17/05/27	Wed 19/05/27
62	Final Debris Recovery Programme	60 days	Wed 1/03/28	Tue 23/05/28
63	Post-Decommissioning Environmental (Surface) Survey	30 days	Wed 24/05/28	Tue 4/07/28
64	Post-Decommissioning Environmental (Seabed) Survey	3 days	Wed 24/05/28	Fri 26/05/28
65	Post-Decommissioning Structural Survey	3 days	Wed 24/05/28	Fri 26/05/28
66	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 days	Wed 5/07/28	Tue 15/08/28
67	Application to Approval for Certification Of Cleared Seabed	1 day	Wed 16/08/28	Wed 16/08/28
68	Trawling Test	3 days	Wed 5/07/28	Fri 7/07/28



Project: First Draft Design of Cr
Date

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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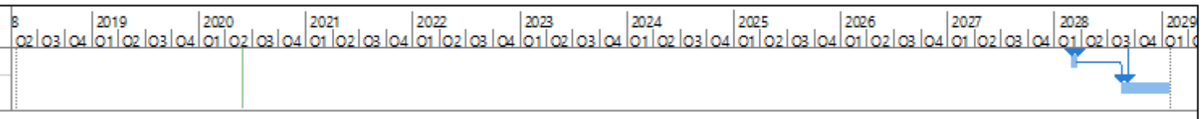
Figure G-2 – Initial Stakeholder-Oriented Critical Path (Leave-In-Place) – Part 2

ID	Task Name	Duration	Start	Finish
69	Onshore Load-In, Dismantling and Disposal	10 days	Wed 1/03/28	Tue 14/03/28
70	Write Up and Submission of Decommissioning Programme Closing Report	120 days	Thu 17/08/28	Wed 31/01/29



Project: First Draft Design of Cr
Date: Thu 28/05/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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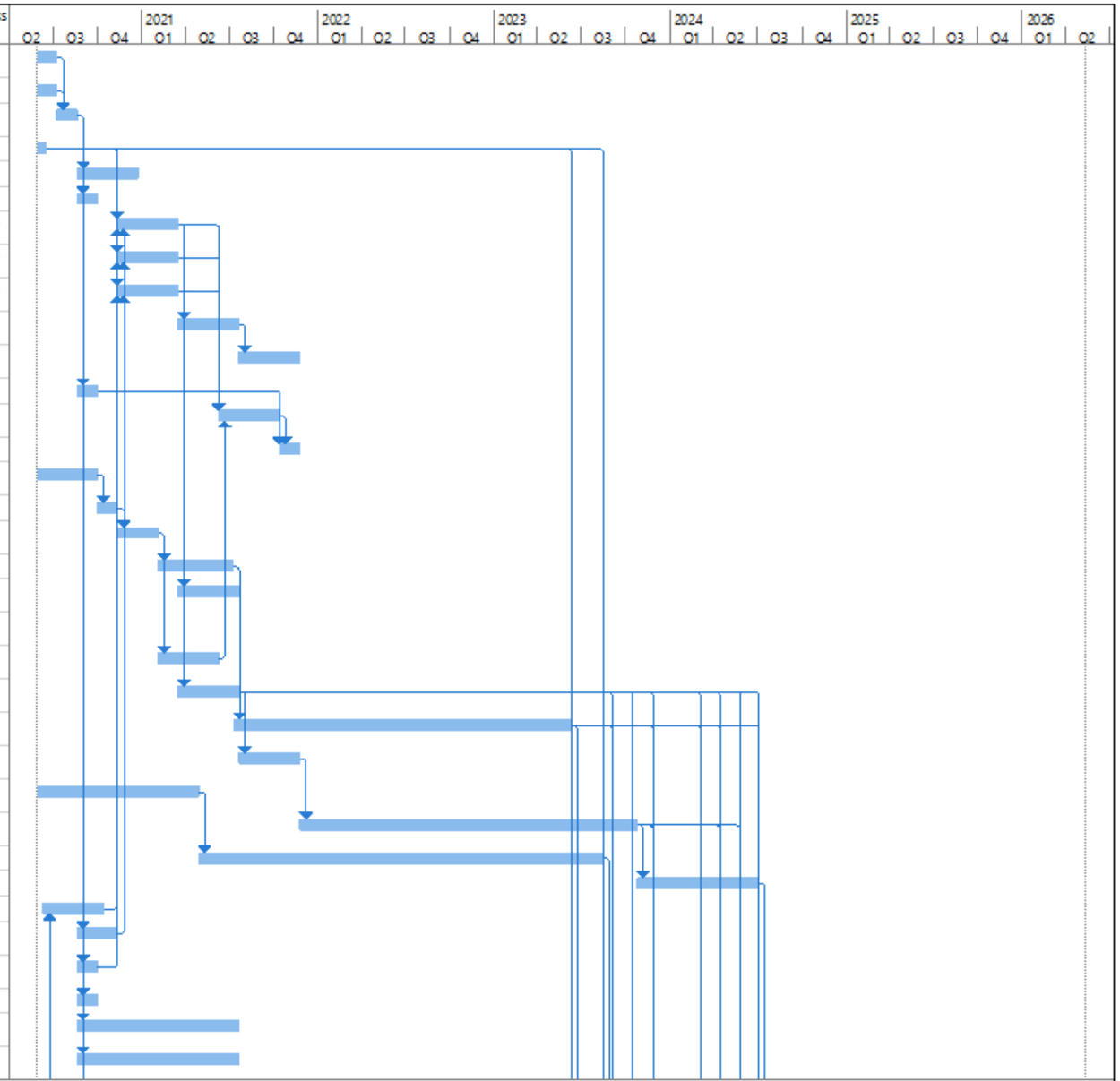
Figure G-3 – Initial Stakeholder Oriented Critical Path (Leave-In-Place) – Part 3

ID	Task Name	Duration	Start	Finish	Predecess
1	Assessment of Production Performance and Simulations	30 days	Thu 28/05/20	Wed 8/07/20	
2	Assessment of Infrastructure Condition	30 days	Thu 28/05/20	Wed 8/07/20	
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	Thu 9/07/20	Wed 19/08/20	1,2
4	Application to Approval to Cease Production	14 days	Thu 28/05/20	Tue 16/06/20	
5	Independent Study and Research on Decommissiong	90 days	Thu 20/08/20	Wed 23/12/20	3
6	Inventory Calculation of Materials	30 days	Thu 20/08/20	Wed 30/09/20	3
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	Thu 18/03/21	Wed 21/07/21	7,8,9
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	Thu 22/07/21	Wed 24/11/21	10
12	Notification of Decommissioning to Interest Parties	30 days	Thu 20/08/20	Wed 30/09/20	3
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	Thu 10/06/21	Wed 13/10/21	7,8,9,21
14	Public Consultation	30 days	Thu 14/10/21	Wed 24/11/21	12,13
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	Thu 28/05/20	Wed 30/09/20	
16	Formal Stakeholder Consultation	30 days	Thu 1/10/20	Wed 11/11/20	15
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	Thu 12/11/20	Wed 3/02/21	16
18	16-Week OSPAR Consultation Period	112 days	Thu 4/02/21	Fri 9/07/21	17
19	Application to Approval of Permit for Pipeline Cleaning Works	90 days	Thu 18/03/21	Wed 21/07/21	8
20	Application to Approval of Permit for Decommissioning Works	1 day	Thu 28/05/20	Thu 28/05/20	
21	Submission to Approval of Final Decommissioning Programme Document	90 days	Thu 4/02/21	Wed 9/06/21	17
22	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	Thu 18/03/21	Wed 21/07/21	7,8,9
23	Detailed Engineering and Planning for Decommissioning	500 days	Mon 12/07/21	Fri 9/06/23	18
24	Health, Safety, and Environment Risk Study and Approval	90 days	Thu 22/07/21	Wed 24/11/21	22
25	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	Thu 28/05/20	Wed 28/04/21	
26	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	Thu 25/11/21	Wed 25/10/23	24
27	Well Plugging and Abandonment	600 days	Thu 29/04/21	Wed 16/08/23	25
28	Integrity Assessment of Well Plugs	180 days	Thu 26/10/23	Wed 3/07/24	26
29	Making Facility Cold and Safe	90 days	Thu 11/06/20	Wed 14/10/20	37
30	Pre-Decommissioning Environmental (Surface) Survey	60 days	Thu 20/08/20	Wed 11/11/20	3
31	Pre-Decommissioning Environmental (Seabead) Survey	30 days	Thu 20/08/20	Wed 30/09/20	3
32	Pre-Decommissioning Structural Survey	30 days	Thu 20/08/20	Wed 30/09/20	3
33	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	Thu 20/08/20	Wed 21/07/21	3
34	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	Thu 20/08/20	Wed 21/07/21	3



Project: Project1
Date:

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

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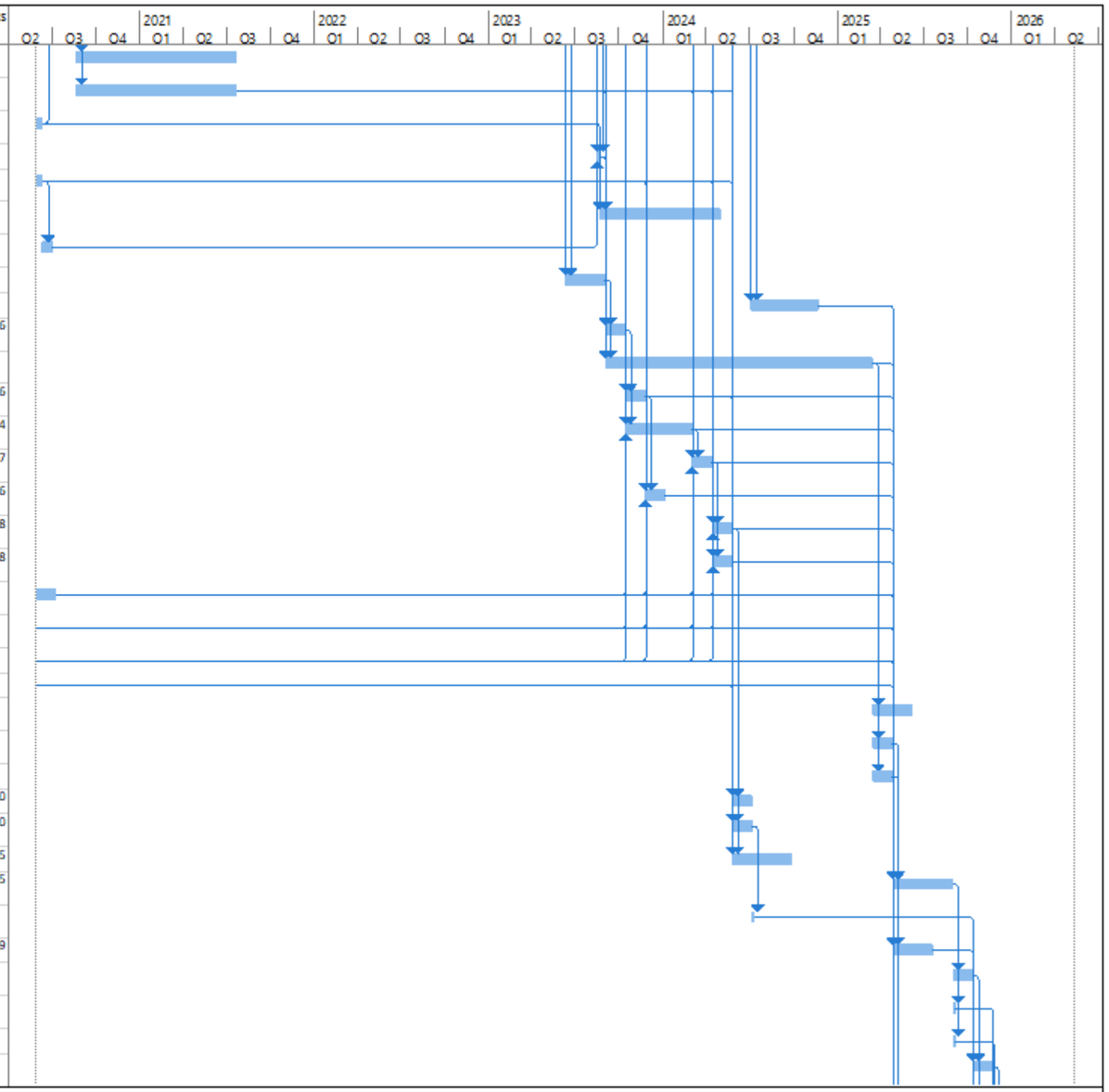
Figure G-4 – Initial Stakeholder-Oriented Critical Path (Partially Leave-In-Place) – Part 1

ID	Task Name	Duration	Start	Finish	Predecess
35	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	Thu 20/08/20	Wed 21/07/21	3
36	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	Thu 20/08/20	Wed 21/07/21	3
37	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	Thu 28/05/20	Wed 10/06/20	
38	Shut-In of Production Pipelines	3 days	Thu 17/08/23	Mon 21/08/23	27,4,41
39	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	Thu 28/05/20	Wed 10/06/20	
40	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	Tue 22/08/23	Mon 29/04/24	37,38
41	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	Thu 11/06/20	Wed 1/07/20	39
42	Rerouting and By-Pass of Pipelines still in used	60 days	Mon 12/06/23	Fri 1/09/23	4,22,23
43	Removal of Topside Facilities to Transport Vessel	100 days	Thu 4/07/24	Wed 20/11/24	28,22,23
44	Transport of Topside Facilities to Designated Location	30 days	Mon 4/09/23	Fri 13/10/23	42,22,23,36
45	Seperation of Topside Structures and Modules to Transport Vessel	400 days	Mon 4/09/23	Fri 14/03/25	42,22,23
46	Transport of Topside Structures and Modules to Designated Location	30 days	Mon 16/10/23	Fri 24/11/23	44,22,23,36
47	Removal of Substructure Steel Materials to Transport Vessel	100 days	Mon 16/10/23	Fri 1/03/24	52,53,54,44
48	Transport of Substructure Steel Materials to Designated Location	30 days	Mon 4/03/24	Fri 12/04/24	52,53,54,47
49	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	Mon 27/11/23	Fri 5/01/24	52,53,54,46
50	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	Mon 15/04/24	Fri 24/05/24	52,53,54,48
51	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	Mon 15/04/24	Fri 24/05/24	52,53,54,48
52	Transport of Removable Pipelines and Cables to Designated Location	30 days	Thu 28/05/20	Wed 8/07/20	
53	Cutting of Substructure to Separate Section to be Removed and Section to be Left in Place	1 day	Thu 28/05/20	Thu 28/05/20	
54	Removal of Substructure to Transport Vessel	1 day	Thu 28/05/20	Thu 28/05/20	
55	Transport of Substructure to Designated Location	1 day	Thu 28/05/20	Thu 28/05/20	
56	During-Decommissioning Environmental (Surface) Survey	60 days	Mon 17/03/25	Fri 6/06/25	45
57	During-Decommissioning Environmental (Seabed) Survey	30 days	Mon 17/03/25	Fri 25/04/25	45
58	During-Decommissioning Structural Survey	30 days	Mon 17/03/25	Fri 25/04/25	45
59	Removal of Subsea Equipments to Transport Vessel	30 days	Mon 27/05/24	Fri 5/07/24	52,53,54,50
60	Transport of Subsea Equipments to Designated Location	30 days	Mon 27/05/24	Fri 5/07/24	52,53,54,50
61	Trenching of Unremovable Pipelines	90 days	Mon 27/05/24	Fri 27/09/24	52,53,54,55
62	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	Mon 28/04/25	Fri 29/08/25	52,53,54,55
63	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	Mon 8/07/24	Wed 10/07/24	60
64	Final Debris Recovery Programme	60 days	Mon 28/04/25	Fri 18/07/25	43,45,47,49
65	Post-Decommissioning Environmental (Surface) Survey	30 days	Mon 1/09/25	Fri 10/10/25	62
66	Post-Decommissioning Environmental (Seabed) Survey	3 days	Mon 1/09/25	Wed 3/09/25	62
67	Post-Decommissioning Structural Survey	3 days	Mon 1/09/25	Wed 3/09/25	62
68	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 days	Mon 13/10/25	Fri 21/11/25	63,64,65



Project: Project1
Date:

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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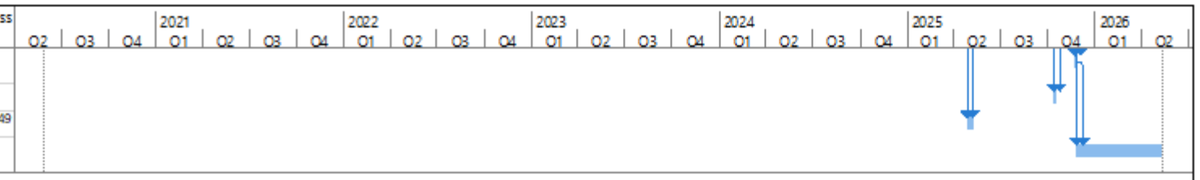
Figure G-5 – Initial Stakeholder-Oriented Critical Path (Partially Leave-In-Place) – Part 2

ID	Task Name	Duration	Start	Finish	Predecess
69	Application to Approval for Certification Of Cleared Seabed	1 day	Mon 24/11/25	Mon 24/11/25	66,68
70	Trawling Test	3 days	Mon 13/10/25	Wed 15/10/25	63,64,65
71	Onshore Load-In, Dismantling and Disposal	10 days	Mon 28/04/25	Fri 9/05/25	43,45,47,49
72	Write Up and Submission of Decommissioning Programme Closing Report	120 days	Tue 25/11/25	Mon 11/05/26	69,67



Project: Project1
Date: T

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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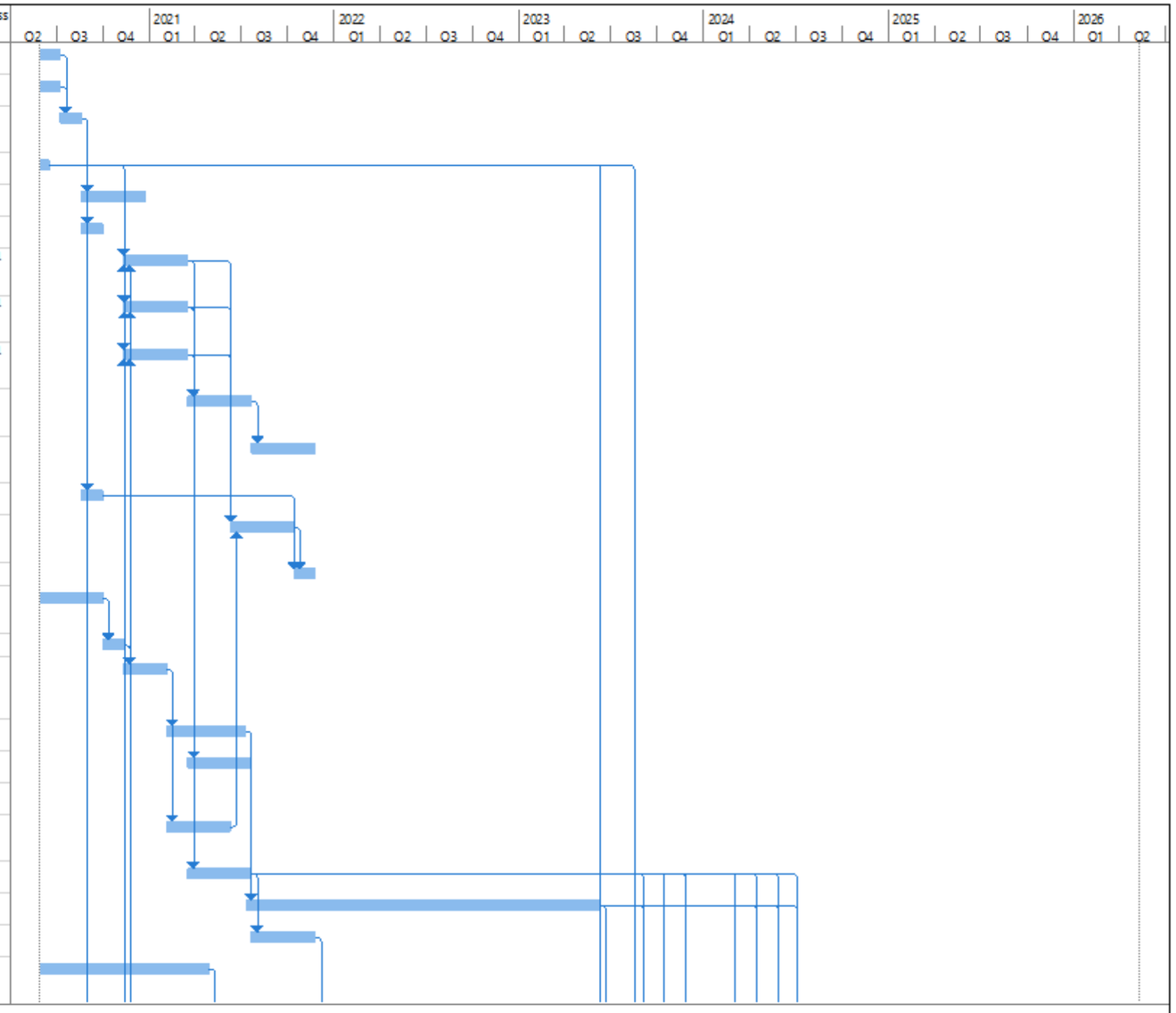
Figure G-6 – Initial Stakeholder-Oriented Critical Path (Partially Leave-In-Place) – Part 3

ID	Task Name	Duration	Start	Finish	Predecess
1	Assessment of Production Performance and Simulations	30 days	Thu 28/05/20	Wed 8/07/20	
2	Assessment of Infrastructure Condition	30 days	Thu 28/05/20	Wed 8/07/20	
3	Future Strategy Planning / Assessment of Final Decision to Decommissiong Facility	30 days	Thu 9/07/20	Wed 19/08/20	1,2
4	Application to Approval to Cease Production	14 days	Thu 28/05/20	Tue 16/06/20	
5	Independent Study and Research on Decommissiong	90 days	Thu 20/08/20	Wed 23/12/20	3
6	Inventory Calculation of Materials	30 days	Thu 20/08/20	Wed 30/09/20	3
7	Comparative Assessment of Decommissioning Methods - Topside	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
8	Comparative Assessment of Decommissioning Methods - Substructure	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
9	Comparative Assessment of Decommissioning Methods - Pipelines and Cables	90 days	Thu 12/11/20	Wed 17/03/21	4,29,30,31
10	Research and Write-Up of Environmental Impact Assessment Programme	90 days	Thu 18/03/21	Wed 21/07/21	7,8,9
11	Submission to Approval of Environmental Impact Assessment Programme	90 days	Thu 22/07/21	Wed 24/11/21	10
12	Notification of Decommissioning to Interest Parties	30 days	Thu 20/08/20	Wed 30/09/20	3
13	Write Up and Release of First Draft of Decommissioning Programme Document	90 days	Thu 10/06/21	Wed 13/10/21	7,8,9,21
14	Public Consultation	30 days	Thu 14/10/21	Wed 24/11/21	12,13
15	Write Up and Release of Second Draft of Decommissioning Programme Doument	90 days	Thu 28/05/20	Wed 30/09/20	
16	Formal Stakeholder Consultation	30 days	Thu 1/10/20	Wed 11/11/20	15
17	Write Up of Final Decommissioning Programme Document and Submission to OSPAR	60 days	Thu 12/11/20	Wed 3/02/21	16
18	16-Week OSPAR Consultation Period	112 days	Thu 4/02/21	Fri 9/07/21	17
19	Application to Approval of Permit for Pipeline Cleaning Works	90 days	Thu 18/03/21	Wed 21/07/21	8
20	Application to Approval of Permit for Decommissioning Works	1 day	Thu 28/05/20	Thu 28/05/20	
21	Submission to Approval of Final Decommissioning Programme Document	90 days	Thu 4/02/21	Wed 9/06/21	17
22	Conceptual Engineering Studies (Infrastructure Decommissioning)	90 days	Thu 18/03/21	Wed 21/07/21	7,8,9
23	Detailed Engineering and Planning for Decommissioning	500 days	Mon 12/07/21	Fri 9/06/23	18
24	Health, Safety, and Environment Risk Study and Approval	90 days	Thu 22/07/21	Wed 24/11/21	22
25	Tendering to Award of Contractors and Subcontractors (Well Plugging and Abandonment)	240 days	Thu 28/05/20	Wed 28/04/21	



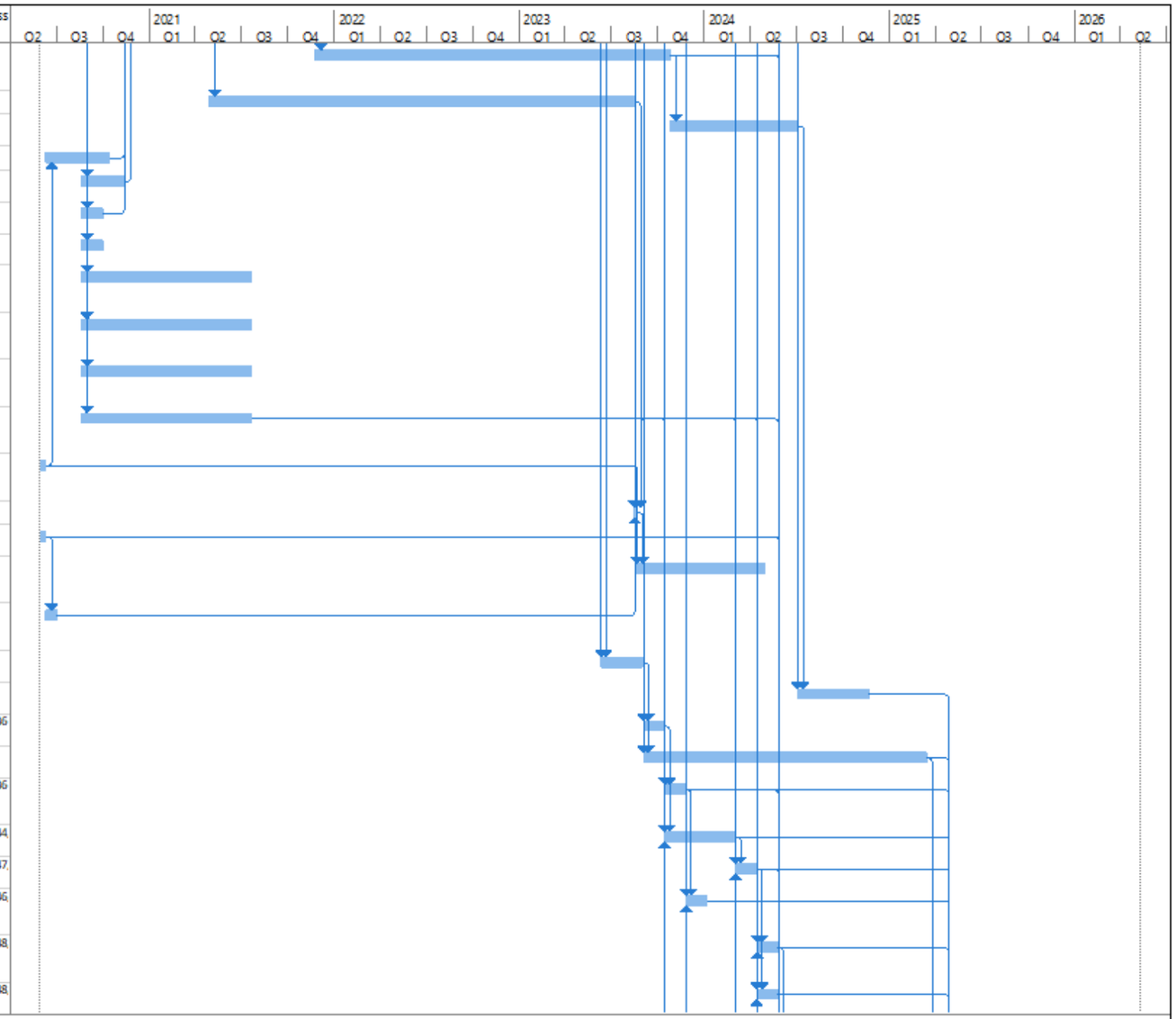
Project
Date: Tl

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

Page 1

Figure G-7 – Initial Stakeholder-Oriented Critical Path (Complete Removal) – Part 1

ID	Task Name	Duration	Start	Finish	Predecess
26	Detailed Engineering and Planning for Well Plugging and Abandonment	500 days	Thu 25/11/21	Wed 25/10/23	24
27	Well Plugging and Abandonment	600 days	Thu 29/04/21	Wed 16/08/23	25
28	Integrity Assessment of Well Plugs	180 days	Thu 26/10/23	Wed 3/07/24	26
29	Making Facility Cold and Safe	90 days	Thu 11/06/20	Wed 14/10/20	37
30	Pre-Decommissioning Environmental (Surface) Survey	60 days	Thu 20/08/20	Wed 11/11/20	3
31	Pre-Decommissioning Environmental (Seabead) Survey	30 days	Thu 20/08/20	Wed 30/09/20	3
32	Pre-Decommissioning Structural Survey	30 days	Thu 20/08/20	Wed 30/09/20	3
33	Tendering to Award of Contractors and Subcontractors (Lifting and Transport Vessel)	240 days	Thu 20/08/20	Wed 21/07/21	3
34	Tendering to Award of Contractors and Subcontractors (Onshore Disposal)	240 days	Thu 20/08/20	Wed 21/07/21	3
35	Tendering to Award of Contractors and Subcontractors (Pipeline Decommissioning)	240 days	Thu 20/08/20	Wed 21/07/21	3
36	Tendering to Award of Contractors and Subcontractors (Structural Decommissioning)	240 days	Thu 20/08/20	Wed 21/07/21	3
37	Application to Approval of Permit to Transport Materials by Vessel to Designated Location	10 days	Thu 28/05/20	Wed 10/06/20	
38	Shut-In of Production Pipelines	3 days	Thu 17/08/23	Mon 21/08/23	27,4,41
39	Transport of Pipeline Cleaning Equipment and Liquids to Site	10 days	Thu 28/05/20	Wed 10/06/20	
40	Cleaning of Pipelines and Umbilical Cores to be Decommissioned	180 days	Tue 22/08/23	Mon 29/04/24	37,38
41	Collection and Transportation of Pipeline Clearing Materials to Onshore	15 days	Thu 11/06/20	Wed 1/07/20	39
42	Rerouting and By-Pass of Pipelines still in used	60 days	Mon 12/06/23	Fri 1/09/23	4,22,23
43	Removal of Topside Facilities to Transport Vessel	100 days	Thu 4/07/24	Wed 20/11/24	28,22,23
44	Transport of Topside Facilities to Designated Location	30 days	Mon 4/09/23	Fri 13/10/23	42,22,23,36
45	Seperation of Topside Structures and Modules to Transport Vessel	400 days	Mon 4/09/23	Fri 14/03/25	42,22,23
46	Transport of Topside Structures and Modules to Designated Location	30 days	Mon 16/10/23	Fri 24/11/23	44,22,23,36
47	Removal of Substructure Steel Materials to Transport Vessel	100 days	Mon 16/10/23	Fri 1/03/24	52,53,54,44
48	Transport of Substructure Steel Materials to Designated Location	30 days	Mon 4/03/24	Fri 12/04/24	52,53,54,47
49	Removal of Risers, Umbilicals, and Conductors to to Transport Vessel	30 days	Mon 27/11/23	Fri 5/01/24	52,53,54,46
50	Transport of Risers, Umbilicals, and Conductors to Designated Location	30 days	Mon 15/04/24	Fri 24/05/24	52,53,54,48
51	Removal of Removable Pipelines and Cables to Transport Vessel	30 days	Mon 15/04/24	Fri 24/05/24	52,53,54,48



Project: Project2
Date:

Task		Project Summary		Manual Task		Start-only		Deadline	
Split		Inactive Task		Duration-only		Finish-only		Progress	
Milestone		Inactive Milestone		Manual Summary Rollup		External Tasks		Manual Progress	
Summary		Inactive Summary		Manual Summary		External Milestone			

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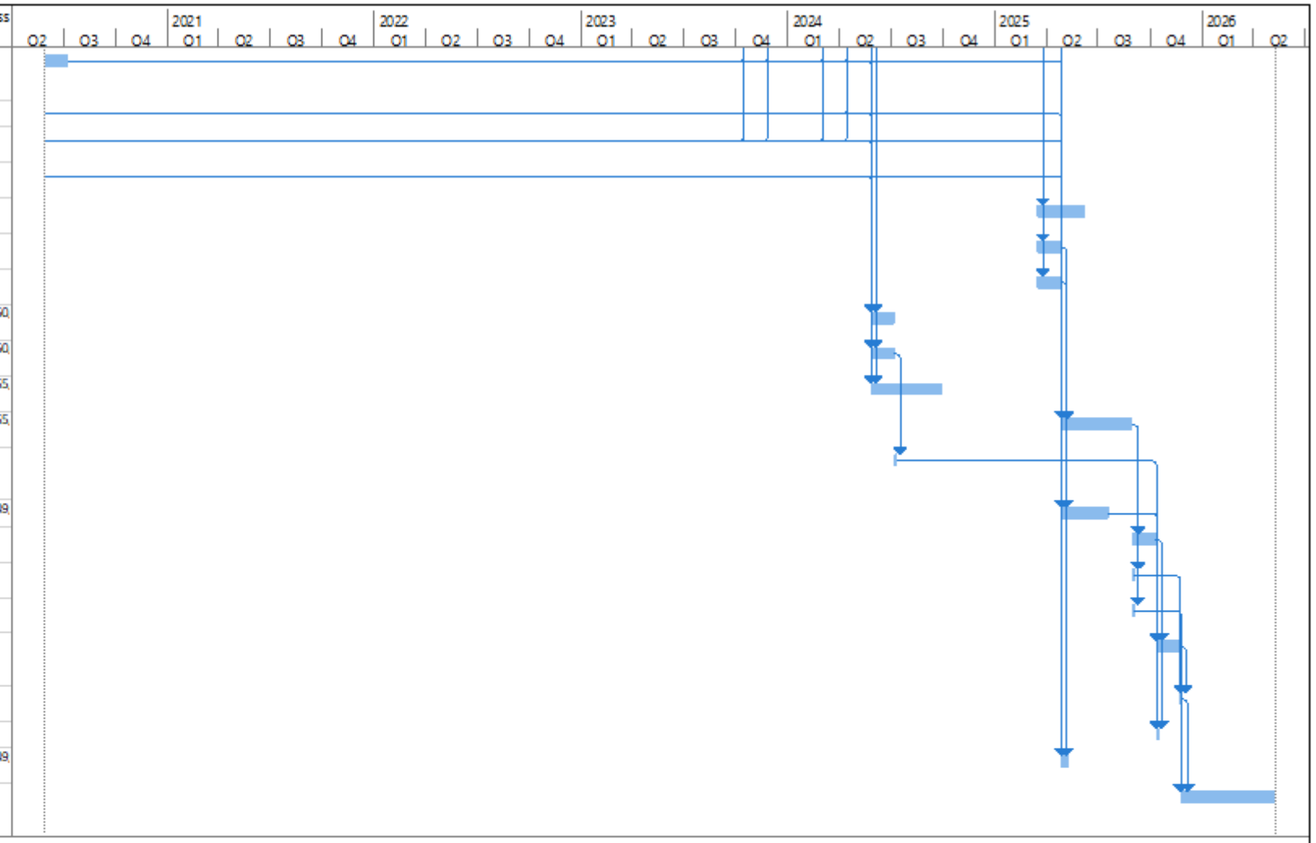
Figure G-8 – Initial Stakeholder-Oriented Critical Path (Complete Removal) – Part 2

ID	Task Name	Duration	Start	Finish	Predecess
52	Transport of Removable Pipelines and Cables to Designated Location	30 days	Thu 28/05/20	Wed 8/07/20	
53	Cutting of Substructure Piles	1 day	Thu 28/05/20	Thu 28/05/20	
54	Removal of Substructure to Transport Vessel	1 day	Thu 28/05/20	Thu 28/05/20	
55	Transport of Substructure to Designated Location	1 day	Thu 28/05/20	Thu 28/05/20	
56	During-Decommissioning Environmental (Surface) Survey	60 days	Mon 17/03/25	Fri 6/06/25	45
57	During-Decommissioning Environmental (Seabed) Survey	30 days	Mon 17/03/25	Fri 25/04/25	45
58	During-Decommissioning Structural Survey	30 days	Mon 17/03/25	Fri 25/04/25	45
59	Removal of Subsea Equipments to Transport Vessel	30 days	Mon 27/05/24	Fri 5/07/24	52,53,54,50
60	Transport of Subsea Equipments to Designated Location	30 days	Mon 27/05/24	Fri 5/07/24	52,53,54,50
61	Trenching of Unremovable Pipelines	90 days	Mon 27/05/24	Fri 27/09/24	52,53,54,55
62	Backfill of Trenches to Bury Pipelines to be Left in-situ	90 days	Mon 28/04/25	Fri 29/08/25	52,53,54,55
63	Notification to Relevant Authorities to Update Sea Navigation Charts	3 days	Mon 8/07/24	Wed 10/07/24	60
64	Final Debris Recovery Programme	60 days	Mon 28/04/25	Fri 18/07/25	43,45,47,49
65	Post-Decommissioning Environmental (Surface) Survey	30 days	Mon 1/09/25	Fri 10/10/25	62
66	Post-Decommissioning Environmental (Seabed) Survey	3 days	Mon 1/09/25	Wed 3/09/25	62
67	Post-Decommissioning Structural Survey	3 days	Mon 1/09/25	Wed 3/09/25	62
68	Write Up and Submission of Final Status Report of Structure Disposed at Sea	30 days	Mon 13/10/25	Fri 21/11/25	63,64,65
69	Application to Approval for Certification Of Cleared Seabed	1 day	Mon 24/11/25	Mon 24/11/25	66,68
70	Trawling Test	3 days	Mon 13/10/25	Wed 15/10/25	63,64,65
71	Onshore Load-In, Dismantling and Disposal	10 days	Mon 28/04/25	Fri 9/05/25	43,45,47,49
72	Write Up and Submission of Decommissioning Programme Closing Report	120 days	Tue 25/11/25	Mon 11/05/26	69,67



Project: Project2
Date: T

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

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Figure G-9 – Initial Stakeholder-Oriented Critical Path (Complete Removal) – Part 3

Appendix H – Similar Frameworks from Industry Literature

Table H-1 – Oil and Gas UK Decommissioning Work Breakdown Structure (OGUK 2013)

Operator Project Management	Post-CoP Facility Running / Owner Cost	Well Abandonments	Facilities / Pipeline de-energising	Topside Preparation	Topside Removal	Substructure Removal	Topside and Substructure Onshore Recycling	Subsea Infrastructure (incl. structures, pipelines, umbilicals, mattresses)	Site Remediation	Post-Decommissioning Monitoring
Proj. Management Core Team (excl. mgmt. allocated elsewhere) Decommissioning Programme Preparation Studies/Surveys to support Decom Programme, scope definition and method development Decom Programme reporting and close-out (incl. Admiralty char updates, FishSafe, etc.	Management associated with activities below Operations Team Deck Crew Integrity Management – Inspection and Maintenance Baseload Platform Utilities (incl. power, water, air) Logistics / accommodation associated with activities above	Management associated with activities below Studies to support well programmes Well Decommissioning (incl. Spread-rate*Time) Operations Support for PandA Specialist PandA services, equipment and materials (e.g. wireline, cementing) Casing, conductor and wellhead recovery Rig Upgrades/ Refurbishment Cleaning and Recycling of Tubulars Vessels (e.g. rigs and DSVs, PSVs, LWIVs) Logistics / accommodation associated with activities above	Management associated with activities below Process, Flowline and Pipeline Drain, Flush, Purge and Vent Engineering Down – Physical Isolation, de-energise, vent and drain Engineering Down – Cleaning Pipeline Pigging Recycling and Waste mgmt. associated with activities above Logistics / accommodation associated with activities above	Management associated with activities below Module, Process and Utilities Separation Upgraded Platform Utilities (eg. Power, Water, Air) Logistics / accommodation associated with activities above	Management associated with activities below Preparation for Removal e.g. reinforcements, lift-point (re-) instatement Structural Separation for Removal Removal Rigs / DSV / PSV / FPV moving off-station Sea-Fastening and Transportation Load-In Vessels (e.g. Lift Vessels) Logistics / accommodation associated with activities above	Management associated with activities below Preparation for Removal e.g. Lift-point (re-) instatement Cutting and Separation Removal Sea-Fastening and Transportation Load-In Vessels (e.g. Lift Vessels) Logistics / accommodation associated with activities above	Management associated with activities below Cleaning and Handling of Hazardous Waste Deconstruction Re-use, Recycle, Disposal Waste Management Accounting Transportation to Point of Sale/ Disposal Cost to Incorporate Impact of Eventual Re-sale/ Disposal of Materials if Known	Management associated with activities below Preparatory Surveys and Work Sea-Fastening Transportation and Load-In Removals: Subsea Structures (e.g. WHPS, Manifolds, Pipelines, Mattresses) Specialist Subsea Services Load-In Vessels (e.g. DSVs, Rock-Dumpers, etc.) Logistics / accommodation associated with activities above	Management associated with activities below Pile Management Oilfield Debris Clearance Overtrawl Surveys Recycling and Waste Management of Recovered Debris Load-In Logistics / accommodation associated with activities above	Management associated with activities below Monitoring Required for Residual Infrastructure/ Material Navigation Aids (incl. maintenance) Logistics / accommodation associated with activities above

Table H-2 – Decom North Sea Late-Life Planning Portal (L2P2) (Esson 2017)

	PRE-LATE LIFE	MORE THAN 10 YEARS BEFORE COP	10 TO 5 YEARS BEFORE COP	5 TO 3 YEARS BEFORE COP	3 YEARS BEFORE COP	POST COP
BUSINESS STRATEGY	ASSET RETENTION OR DISPOSITION	MONITOR IMPACT AND OPTIONALITY	MONITOR IMPACT AND VALUE			
COMMERCIAL	NEW COMMERCIAL AGREEMENTS	VALIDATE COMMERCIAL AGREEMENTS	DRAFT AGREEMENT AMENDMENTS	AGREE COMMERCIAL AGREEMENTS	EXECUTE COMMERCIAL AGREEMENTS	MANAGE COMMERCIAL AGREEMENTS
LIABILITY ECONOMICS	ARO ESTIMATE STRATEGY	VALIDATE STRATEGY ESTIMATE TO ASSET	METERIC BASED ARO ESTIMATE	QUANTITY BASED ARO ESTIMATE	ALIGN ESTIMATES WITH METHOD	COST MANAGEMENT
REGULATORY COMPLIANCE	MONITOR REGULATIONS	ROLES AND RESPONSIBILITIES	PREMINARY DISCUSSIONS	DRAFT DECOM PROGRAMME	SUBMIT DECOM PROGRAMME	MANAGE REGULATORY COMPLIANCE
PROJECT MANAGEMENT	DEFINE DECOM PM PROCESS		DEPLOY STRATEGY TEAM	DEPLOY PLANNING TEAM	DEPLOY EXECUTION TEAM	
PRODUCTION OPERATIONS	CHANGE AND RECORDS MANAGEMENT		EARLY LATE LIFE OPERATIONS	FULL LATE LIFE OPERATIONS	TRANSITIONAL OPERATIONS	OPERATIONAL SUPPORT
WELL PLUG AND ABANDONMENT	MANAGE WELL STOCK		DEFINE WELL P&A STRATEGY	IMPLEMENT WELL P&A STRATEGY	PRE-COP WELL P&A	POST-COP WELL P&A
CONTRACTING STRATEGY	SUPPLY CHAIN ANALYSIS		DEFINE CONTRACTING STRATEGY	IMPLMEMENT CONTRACTING STRATEGY	EXECUTE KEY CONTRACTS	CONTRACTS MANAGEMENT
TECHNOLOGY	MONITOR TECHNOLOGY DEVELOPMENT		TECHNOLOGY ASSESSMENT	TECHNOLOGY SELECTION	TECHNOLOGY CONFIRMATION	TECHNOLOGY DEPLOYMENT
STAKEHOLDERS	STAKEHOLDER MANAGEMENT		MAP AND ANALYZE STAKEHOLDERS	ENGAGE WITH KEY STAKEHOLDERS	ENGAGE WITH ALL STAKEHOLDERS	STAKEHOLDER MANAGMENT

Table H-3 – Oil and Gas Authority Decommissioning Roadmap – (OGA 2019)

ACTIVITY/ REGULATOR		ENGAGE	STUDY	CONSULT	SUBMIT	EXECUTE	MONITOR
OGA (OPERATIONS DIRECTORATE)	E&P Team	• Licence/ FDP Commitments • Asset Stewardship (EAS) • Pre-CoP well Pa&A (WONS) • Conceptual Decomm Options • Technology Options	• MER - Maximise HC Recovery • Late Life Alt Operating Modes • Campaign activity • Pre-CoP well P&A readiness • Technology readiness	• Draft CoP Document • Late Life Alt Operating Modes • CoP Economics • Data Archive Plans • Licence/ Consent Change	• Final CoP Document • Final CoP Economics • Data Archive Plans • Licence/ Consent Proposals • OSDR Notification	• CoP Agreement • Stakeholder Engagement • Data Archive Plans • Licence / Consent Change • Technology Deployment	• Licence/ Consent Closeout • Data Archive Completion • Re-licence Options • Closeout and Lessons Learnt • OSDR Compliance
	Decom Team	• Concept Decomm Options • Delivery Strategy (CCFU) • Well P&A Optimisation • Basis of Estimate • Industry Engagement	• Cost Estimate and Report • Draft Decomm Prog Discussion • Pre-CoP Well P&A Readiness • Supply Chain Delivery • Best Practice/ and Re-Use Options	• Cost Estimate Benchmark • Draft Decomm Prog Review • CoP Document Review • Well P&A Assurance • Supply Chain Collaboration	• Cost Estimate Notification • Decomm Prog Consultee Comment • Well P&A Policies/Proposals • Project Execution Model(s) • Supply Chain Plans	• Decomm Prog Cost Control • Well P&A Plan • Supply Chain Management • Lessons Learnt Delivery • Industry Engagement	• Decomm Prog Cost Control • Decomm Strategy Delivery • Well P&A Plan Closeout • Industry/ Supply Chain Engagement • Closeout and Lessons Learnt
BEIS (ODU, EMT, OEI)	BEIS (EMT and OEI)	• SEA/ HRA Review/ Input • Baseline Env. Studies and Surveys • Marine License/ Chemical Permits • Inspection and Monitoring Basis • Competent Authority/ OSDR	• Env. Impact Assessment • Env. Studies and Surveys • Marine / Chemical Assessments • Comparative Assessment/BAT/BEP • OEI Inspection Criteria Definition	• EIA (ES) • Comparative Assessment • Draft Decomm Prog Review • Licence / Permit / Consent Proposals • Inspection / Monitoring Proposals	• EIA (ES) and Supporting Evidence • Decomm Prog Consultee Comments • Licence/ Consent/ Permit Application • Inspection / Monitoring Proposals • OSDR Notification	• EIA (ES) Agreement • Licence, Consents, Permits Issue • Lessons Learnt Delivery • Inspection / Monitoring Plans	• EIA, ES Compliance • Decomm Prog Delivery / Change • Lessons Learnt/ Regulatory Guidance • Industry/ Engagement • OSDR Compliance
	BEIS (ODU)	• Decomm Prog Management (Ph 1) • Policy and Strategy Discussions • Conceptual Decomm Options • Initial Assessment (eg OSPAR) • Cross-Regulator Engagement	• Decomm Prog Management (Ph 2) • Draft Decomm Prog Review • Deviation Evidence (OSPAR etc) • Comparative Assessment Criteria • Stakeholder Engagement	• Decomm Prog Management (Ph 3) • Decomm Prog Issue • Comparative Assessment Issue • Decomm Funding • Stakeholder Consultation	• Decomm Prog Management (Ph 3) • Decomm Prog Approval • Decomm Cost Estimate • Financial Commitment • Legacy and Liability Mitigation	• Decomm Prog Management (Ph 4) • Decomm Prog Approval • Decomm Prog Fees • Stakeholder Feedback • OSDR Notification	• Decomm Prog Management (Ph 5) • Closeout and Post Prog Monitoring • Legacy and Liability Mitigation • X-Regulator and Stakeholder Feedback • Closeout and Lessons Learnt

HSE	• DECOMM SAFETY POLICY AND STRATEGY • LATE LIFE/ DECOMM ASSESSMENT AND DECOMM • OPTION SCREENING • SAFETY CASE MOC • COMPETENT AUTHORITY / OSDR	• SC MATERIAL CHANGE • DISMANTLEMENT SC DEVELOPMENT • APOSC 33-36 CHANGE CONTROL • WELL ABANDONMENT PLANS • INSPECTION AND MONITORING DEFINITION	• SC MATERIAL CHANGES AND REVIEWS • WORKFORCE CONSULTATION • HUMAN/ ORGANISATIONAL ASSESSMENT • WELL ABANDONMENT PLANS • INSPECTION / MONITORING PROPOSALS	• SC MATERIAL CHANGES (PER PHASE) • DISMANTLEMENT SC • WELL ABANDONMENT PLANS • DECOMM PROG CONSULTEE COMMENTS • OSDR NOTIFICATION	• SC CHANGE MANAGEMENT • WELL ABANDONMENT PLAN AGREEMENT • DECOMM PROG MANAGEMENT • INSPECTION / MONITORING PLANS	• DECOMM PROG MANAGEMENT • WELL ABANDONMENT PLANS • SC /OSD REGULATION AND COMPLIANCE • MONITORING/ INSPECTION/ ENFORCEMENT • CLOSEOUT AND LESSONS LEARNT
WASTE REGULATOR **(SEPA, EA AND ASSOCIATED WASTE AUTHORITIES)**	• Decomm Waste Policy and Strategy • Waste Framework Directive Review • Waste Screening Options • Waste Authority Engagement • Cross-Regulator Engagement	• Inventory Surveys / Evidence Base • Reuse/ Recycle/ Recovery Options • Disposal Route(s) • Comparative Assessment/BAT/BEP • Waste Stakeholders Consultation	• Waste Management Plan • Comparative Assessment • Draft Decomm Prog Review • Inspection / Monitoring Proposals • Waste Authority (UK/TFW/ Overseas)	• Active Waste Management Plans • Waste Inventories • Agreed waste Locations • Inspection / Monitoring Proposals • Decomm Prog Consultee Comments	• Active Waste Management Plans • Inspection / Monitoring Proposals • Legacy and Liability Mitigation	• Active Waste Management Plans • Duty of Care • Inspection / Enforcement • Closeout and Lessons Learnt
OTHER REGULATORS	• Policy and Strategy Discussions • Late life/ Decomm Option Assessment • Cross-Regulator Engagement	• Regulation Change Control • Surveys and Studies • Impact Assessments • Legacy and Liability Mitigation	• Draft Decomm Prog Review • Stakeholder Consultation • Impact Assessment Mitigation • Industry Collaboration	• Decomm Prog Stakeholder Comment • Regulatory MoC Plans • Inspection / Monitoring Proposals • Legacy and Liability Mitigation	• MoC Plans • Licence, Consents, Permits Issue • Inspection / Monitoring Proposals • Legacy and Liability Mitigation	• Decomm Prog and MoC Plans • Regulation Compliance • Closeout and Lessons Learnt

Appendix I – Information Sheet

Information Sheet

PhD Research Project Title:
An Exploration of Stakeholder Impacts on the Decommissioning of Offshore Facilities in the
United Kingdom and Australia

PhD Candidate/Researcher : Aaron Tung Wei Jie
Supervisor (University of Aberdeen) : Professor John Paterson
Supervisor (Curtin University) : Professor Fran Ackermann

Overview of Research

Decommissioning offshore facilities is a complex project which involves a variety of stakeholders. While stakeholder interests pervade the entire process of decommissioning, paying attention to all stakeholder interactions is a big undertaking and some form of stakeholder prioritization could prove beneficial to project managers.

This research involves 3 steps. Step 1 involves analyzing decommissioning projects and mapping out the sequence of events/critical paths for 3 main decommissioning methods (Leave in Place, Partial Removal, and Complete Removal). The level of detail of the critical paths will cover decommissioning projects starting from Late-Life Planning and Decision period until Post-Decommissioning Management Period.

Step 2 involves the confirmations and validations of the critical paths with project managers, which is then followed by Step 3, where semi-structured interviews will be conducted with project managers to identify where on the given critical path stakeholder interactions exists, determine which is the most impactful, and provide insights into how best to manage them.

Semi-Structured Interviews

Each semi-structured interview session will take about 1 hour. There are no anticipated risks associated with this participation, but you have the right to stop the interview or withdraw from this research at any time. All information collected will be treated as **confidential**.

Subject to your consent, the interview will be digitally recorded, and a transcript will be produced. Written notes will also be taken during the interview. The main purpose of the interviews is to both gain ideas and recommendations to improve the critical paths, and to gain more insight into stakeholder interactions that takes place at different points on the critical path throughout the decommissioning of offshore facilities from the perspective of the project managers.

The following questions will be covered during the interview:

4) Is the activity sequence on the critical paths correct? Is there any important activity that takes place that is left out in the critical paths?
5) Any recommendations to improve the critical path?
6) What was the most impactful stakeholder related event that occurred during decommissioning?
7) Where on the critical path did this event occur?
8) What was the reason for stakeholder interaction?
9) What was the action taken to engage the stakeholders?
10) What was the rationale behind the action made?
11) What was the stakeholder's response?
12) If the stakeholder's response was problematic, was any further action taken? What was the rationale and the response for the new action?
13) With hindsight, how would you now engage the stakeholders?

Participation

Participating in this research is voluntarily and you have the right to stop the interview or withdraw from this research at any time.

By participating in this research, we will use information collected in the interview unless you tell us not to. All information will be treated as **confidential** and will be used strictly only for this project unless otherwise specified. Access to the information will be limited to **(1) Aaron Tung Wei Jie**, and both his supervisors **(2) Professor John Paterson** from University of Aberdeen's School of Law and **(3) Professor Fran Ackermann** from Curtin Business School.

All electronic data will be password-protected. All electronic data and hard copy data will be kept under secure conditions at both the University of Aberdeen and Curtin University dedicated facility for research students for 10 years.

Any summary interview content, or direct quotations from the interview, that are made available through academic publication, conference presentations, or any other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed.

Further Information

If you have any further questions or concerns about this study, please contact:

Name of Researcher : Aaron Tung Wei Jie
Address : Room EG11, Taylor Building Block E, School of Law, University of Aberdeen, Aberdeen AB24 3UB
Tel. : +44(0)7587533391
Email : r01at18@abdn.ac.uk

You can also contact Aaron Tung Wei Jie's supervisors:

Name : Professor John Paterson
Address : Room C32, Taylor Building Block C, School of Law, University of Aberdeen, Aberdeen AB24 3UB.
Tel. : +44(0)1224273888
Email : j.paterson@abdn.ac.uk

Name : Professor Fran Ackermann
Address : Room 402.914, School of Management, Curtin Business School
Curtin University, Bentley Campus, WA 6102.
Tel. : +61(0)892661835
Email : fran.ackermann@curtin.edu.au

Appendix J – Consent Form

Interview Consent Form

PhD Research Project Title:
An Exploration of Stakeholder Impacts on the Decommissioning of Offshore Facilities in the United Kingdom and Australia

PhD Candidate/ Researcher : Aaron Tung Wei Jie
Supervisor (University of Aberdeen) : Professor John Paterson
Supervisor (Curtin University) : Professor Fran Ackermann

- I am voluntarily taking part in this project, I understand that I don't have to take part, and I can stop the interview at any time;
- I have read the **Information Sheet**;
- I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;
- I have been able to ask any questions I might have and understand that I am free to contact the researcher and/or the researcher's supervisors with any questions I may have in the future.
- I understand that this research has been reviewed and approved by both
  - Curtin University's Human Research Ethics Committee, and
  - University of Aberdeen's Research Ethics Committee

  And will be following ethical procedures for academic research for both UK and Australian institutions.

- I understand that I will receive a copy of the **Information Sheet** and **Interview Consent Form**.

☐ I do	☐ I do not	Consent to being audio-recorded

_____
Participant's Name

_____ _____
Participant's Signature Date

_____ _____
Researcher's Signature Date

Appendix K – List of Interviews

Table K-1 – List of Interviews – United Kingdom

Type of Company	Current Job Role	Date of Interview	Interview Duration	Experience in Multiple Roles	Worked on Critical Paths
Oil and Gas Research	Executive Management	Thursday, 16 August 2018	46 mins	Operator, Contractor	Yes
Engineering Consultancy	Discipline Engineering	Thursday, 6 September 2018	52 mins	-	Yes
Small Operator	External Relations	Monday, 17 September 2018	73 mins	Operator, Contractor	Yes
Logistics Contractor	Business Development	Friday, 21 September 2018	41 mins	-	Yes
Industry Representative Body	Executive Management	Wednesday, 26 September 2018	48 mins	Operator, Contractor	Yes
Industry Representative Body	Operations	Tuesday, 2 October 2018	39 mins	Operator, Contractor	Yes
Industry Representative Body	Operations	Tuesday, 2 October 2018	37 mins	-	Yes
Large Operator Company	Projects	Friday, 5 October 2018	41 mins	-	Yes
Engineering Consultancy	Projects	Monday, 8 October 2018	69 mins	Operator, Contractor	Yes
Very Large Operator	Projects	Wednesday, 10 October 2018	73 mins	-	Yes
Petroleum Regulator	Executive Management	Friday, 12 October 2018	54 mins	Operator, Contractor, Regulator	No

Large Operator	Projects	Tuesday, 23 October 2018	46 mins	-	Yes
Environmental Regulator	Operations	Wednesday, 24 October 2018	43 mins	-	No
Environmental Regulator	Operations	Wednesday, 24 October 2018	42 mins	-	No
Commercial Fishing Representative Body	Executive Management	Friday, 26 October 2018	195 mins	-	No
Management Consultancy	Consultant	Friday, 26 October 2018	75 mins	Operator, Contractor, Regulator	Yes
Very Large Operator	Contracts and Procurement	Monday, 29 October 2018	41 mins	Operator, Contractor	Yes
Wells Contractor	Executive Management	Monday, 29 October 2018	73 mins	Operator, Contractor	Yes
Medium Operator	Projects	Friday, 9 November 2018	35 mins	-	Yes
Petroleum Regulator	Operations	Wednesday, 14 November 2018	56 mins	-	No
Petroleum Regulator	Operations	Wednesday, 14 November 2018	51 mins	-	No
Salvage Contractor	Business Development	Wednesday, 6 February 2019	36 mins	-	Yes
Engineering Consultancy	Business Development	Monday, 11 February 2019	30 mins	Operator, Contractor	Yes

Large Operator	Projects	Tuesday, 12 February 2019	32 mins	-	Yes
Health and Safety Regulator	Executive Management	Friday, 15 February 2019	42 mins	-	No
Very Large Operator	Projects	Sunday, 24 February 2019	55 mins	-	Yes
Environmental Non-Profit Organization	Research	Monday, 25 February 2019	26 mins	-	No
Small Operator	Environment, Health, and Safety	Friday, 1 March 2019	65 mins	-	Yes
Engineering Consultancy	Consultant	Thursday, 7 March 2019	91 mins	Operator, Contractor	Yes
Engineering Consultancy	Consultant	Friday, 15 March 2019	49 mins	Operator, Contractor,	Yes

Table K-2 – List of Interviews – Australia

Type of Company	Current Job Role	Date of Interview	Interview Duration	Experience in Multiple Roles	Worked on Critical Paths
Very Large Operator	Project Management	Tuesday, 24 September 2019	63 mins		Yes
Engineering Consultancy	Management	Tuesday, 24 September 2019	45 mins	Operator, Contractor	Yes
Marine Science Research	Research	Friday, 4 October 2019	16 mins		No
Lifting Contractor	Contracts	Monday, 14 October 2019	51 mins	Operator, Contractor	No
Engineering Consultancy	Consultant	Tuesday, 15 October 2019	240 mins	Operator, Contractor	Yes
Regulator	Management	Monday, 3 February 2020	35 mins		No
Large Operator	Management	Wednesday, 5 February 2020	55 mins	Operator, Contractor	Yes
Engineering Contractor	Engineering	Friday, 15 February 2020	40 mins		No
Very Large Operator	Project Management	Thursday, 28 February 2020	62 mins		No
Industry Representative Body	Management	Tuesday, 3 March 2020	38 mins		No

Appendix L – A Machine Learning Tool to Predict Cessation of Production Dates considering Dependencies between Different Oil and Gas Facilities

Table L-1 – Input Data into the Machine Learning Algorithm

Name of Asset	Production Start Date	Oil	Gas	Condensate	Reserves	Production Rate	No. of Wells	No. of Fixed Platform	No. of Dependent Facilities	CoP Date
Alba	1994	Yes	No	No			31	1	1	
Greater Alwyn	1987	Yes	Yes	Yes		150000		4	6	
Amethyst	1990	No	Yes	No				4	2	2020
Andrew	1996	Yes	Yes	No	150000000			1	1	
Anglia	1991	No	Yes	No				1	1	2016
Montrose Arbroath	1989	Yes	Yes	No	100000000			1	3	
Armada	1997	No	Yes	Yes				1	6	
Audrey	1998	No	Yes	No				1	4	
Auk	2010	Yes	Yes	No				1	1	
Babbage	2010	No	Yes	No			5	1	1	
Balmoral	1986	Yes	No	No				1	7	
Banff	1999	Yes	Yes	No				1	1	2020
Clipper	1990	No	Yes	No				5	4	
Beatrice	1981	Yes	No	No				3	2	2015
Beryl	1983	Yes	Yes	No		11625		2	5	

Davy, Bessemer, Beaufort And Brown	1995	No	Yes	No				1	2	
Boulton	1997	Yes	Yes	No				1	1	
Brae	1983	Yes	Yes	No				3	11	2018
Breagh	2013	No	Yes	No				2	1	
Brent	1976	Yes	Yes	No				4	3	2014
Brigantine	2000	No	Yes	No				2	1	
Britannia	1998	No	Yes	No				2	3	
Bruce	1998	Yes	Yes	No			26	2	4	
Buchan	1981	Yes	Yes	No				1	2	2017
Caister Murdoch	1993	No	Yes	No				2	10	
Calder	2004	No	Yes	No			3	1	4	
Camelot	1998	No	Yes	No				1	1	
Captain	1997	Yes	No	No				1	1	
Shamrock and Caravel	2008	No	Yes	No				1	1	
Carrack	2003	No	Yes	No				1	1	
Cavendish	2007	No	Yes	No			6	2	1	
Chestnut	2008	Yes	No	No				1	0	
Clair	2005	Yes	No	No	7000000000			1	1	
Claymore	1977	Yes	Yes	No				2	2	
Cleeton	1988	No	Yes	No				2	7	
Cormorant	1981	Yes	Yes	No				3	9	2020
Curlew	1997	Yes	Yes	No				1	1	2016

Douglas	1996	Yes	No	No				1	4	
Dunlin	1978	Yes	Yes	No				1	4	2015
Eider	1988	Yes	No	No				1	3	2018
Ensign	2012	No	Yes	No			3	1	1	
Erskine	1997	Yes	Yes	No				1	2	
Marnock	1998	Yes	No	No				2	7	
Ettrick	2009	Yes	Yes	No		30000		1	1	2016
Lancelot	1993	No	Yes	No				1	5	
Everest	1992	No	Yes	Yes	25000000			1	3	
Fife, Fergus, Flora And Angus	1991	Yes	Yes	No				1	0	
Forties	1975	Yes	No	No	5.7E+13			5	3	
Elgin Franklin	2009	No	Yes	No		60000		1	1	
Fulmar	1982	Yes	Yes	No				2	6	
Galleon	1994	No	Yes	No				1	1	
Galley	1998	Yes	No	No				1	2	
Garnet	1993	Yes	Yes	No				2	7	
Garrow and Kilmar	2007	No	Yes	No				1	1	
Goldeneye	2004	No	Yes	No				1	1	2011
Grove	2007	No	Yes	No				1	1	
Hamilton	1995	No	Yes	No				2	1	
Harding	1996	Yes	Yes	No				1	1	
Heather	1978	Yes	No	No			64	1	2	
Hewett	1969	No	Yes	No				6	4	2019

North-West Hutton	1983	Yes	Yes	No				1	1	2003
Ivanhoe Rob Roy and Hamish	1986	Yes	No	No		70000		1	2	
Janice	1999	Yes	No	No				1	4	2016
Kittiwake	1990	Yes	Yes	No		29000		1	5	
Magnus	1983	Yes	Yes	No			14	1	4	
Miller	1992	Yes	Yes	No				1	1	2007
Murchison	1980	Yes	Yes	No				1	2	2014
Ninian	1977	Yes	Yes	No				3	4	2017
Pierce	1999	Yes	Yes	No		45000		1	1	
Piper	1976	Yes	Yes	No				1	7	
Ross and Blake	1999	Yes	Yes	No				1	3	
Schiehallion	1998	Yes	No	No	340000000	154000		1	1	
Scott and Telford	1993	Yes	Yes	No				1	3	
Thistle	1978	Yes	Yes	No				1	3	2020

```
lm(formula = years ~ ., data = df)

Residuals:
     Min       1Q   Median       3Q      Max
-10.1380  -1.3749   0.5907   2.1198   5.9874

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)        1905.7461   257.7305   7.394 3.38e-06 ***
ProductionStart      -0.9453     0.1285  -7.359 3.57e-06 ***
OilYes               -1.1056     3.1929  -0.346    0.734
GasYes               -1.1847     2.9199  -0.406    0.691
FixedPlatform         0.6741     1.0584   0.637    0.534
DepedentFacilities    0.6075     0.4616   1.316    0.209
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 4.502 on 14 degrees of freedom
Multiple R-squared:  0.8942,    Adjusted R-squared:  0.8564
F-statistic: 23.66 on 5 and 14 DF,  p-value: 2.286e-06
```

Figure L-1 – The Machine Learning Algorithm to Predict Cessation of Production Dates considering Dependencies between Different Oil and Gas Facilities

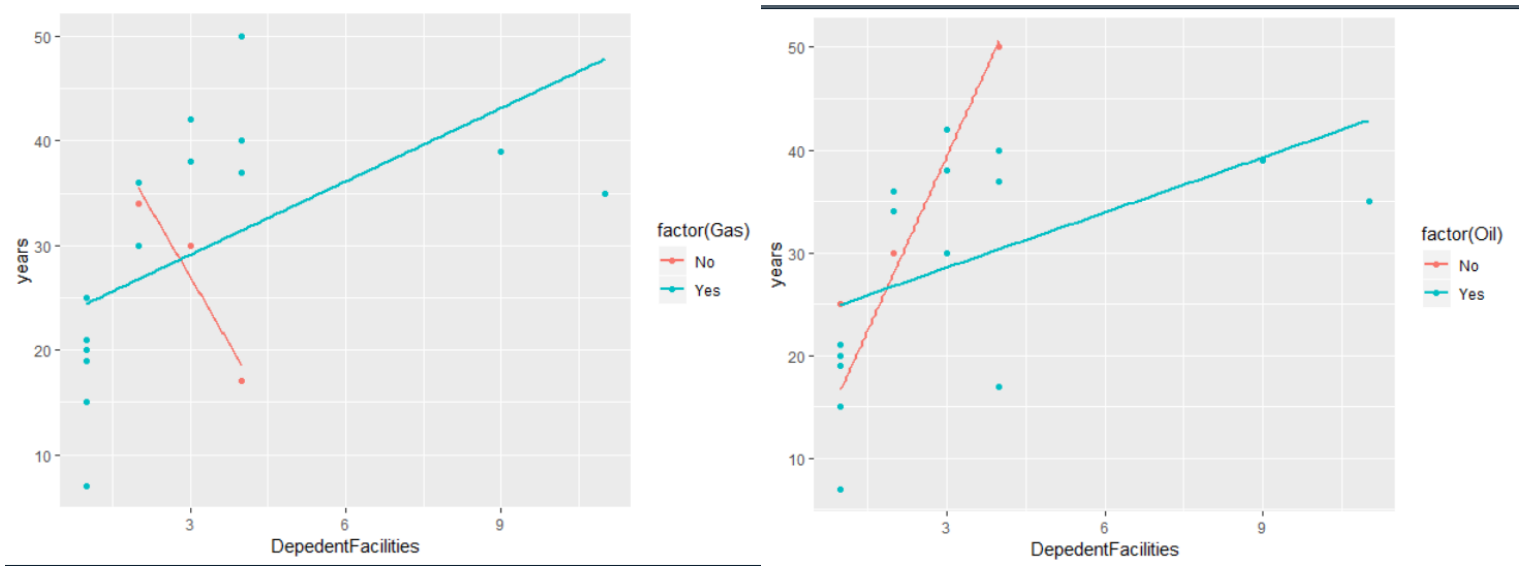


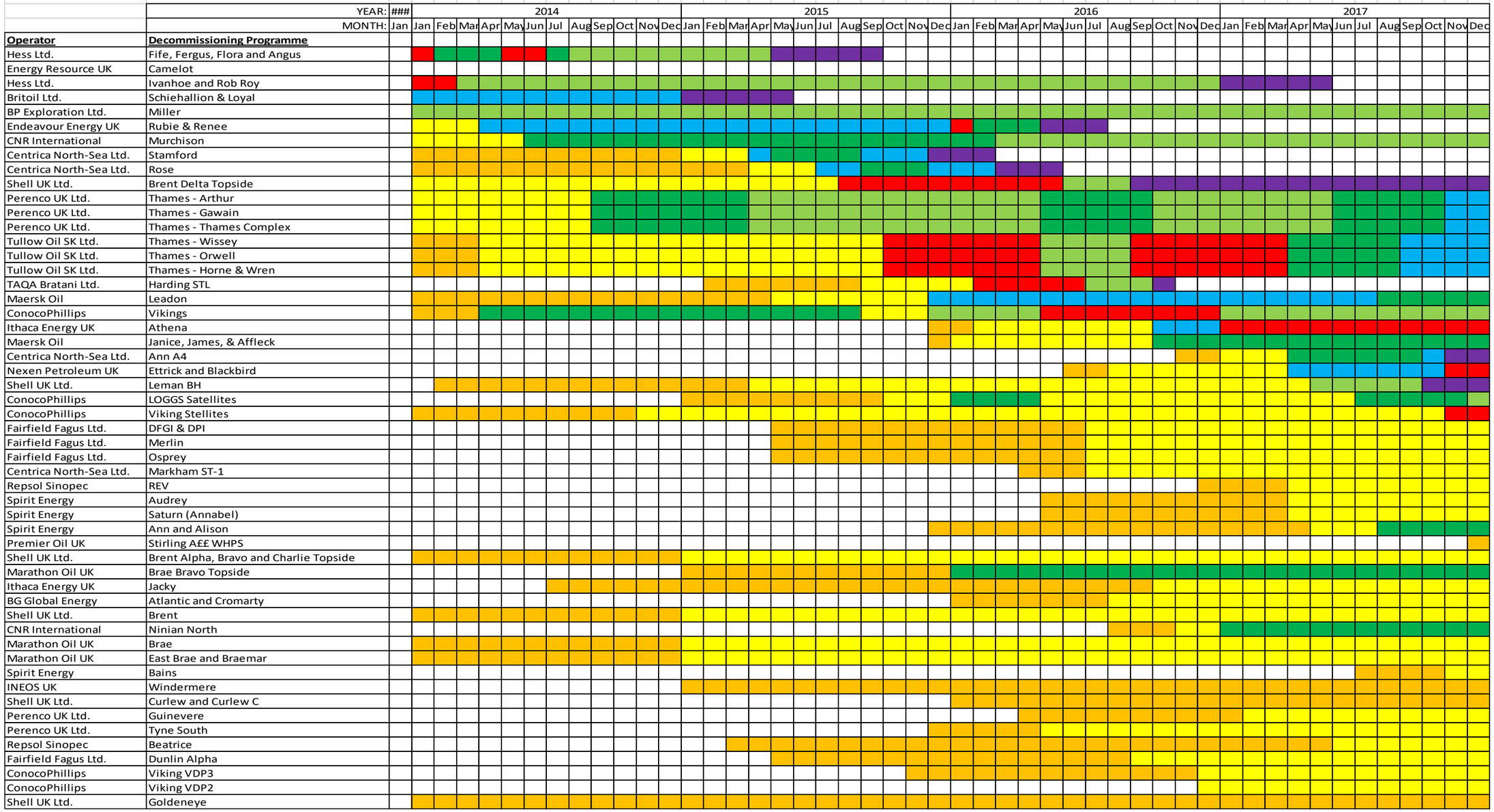
Figure L-2 – Results from the Machine Learning Algorithm to Predict Cessation of Production Dates considering Dependencies between Different Oil and Gas Facilities

The results show that there is some correlation between the number of dependent (i.e. adjacent) facilities and the actual lifespan of the oil and gas facility. In general, the higher the number of adjacent facilities, the higher the actual lifespan of the oil and gas facility. However, in comparison with other factors, as observed in Figure L-1, the number of dependent facilities is not as influencing on the lifespan of the oil and gas facility in comparison to the performance of the reservoir itself. This finding suggests that it is more important to optimise the cost of operating, maintaining, and decommissioning the oil and gas facility rather than considering the impact on adjacent facilities.

Appendix M – A Tool to Identify Synergies between Different Oil and Gas Decommissioning Projects

Table M-1 – A Tool to Identify Synergies between Different Oil and Gas Decommissioning Projects

Legend:
- PRE-PLANNING PERIOD
- STAKEHOLDER CONSULTATION & APPROVAL SEEKING PERIOD
- (NO ACTIVITY)
- WELL PLUGGING & ABANDONMENT OPERATION
- PLATFORM REMOVAL OPERATION
- SUBSEA & PIPELINE REMOVAL OPERATION
- ONSHORE DISPOSAL OPERATION



Appendix N – Risk Profiles for Starting Well Plugging and Abandonment Before and After Cessation of Production

Table N-1 – Risk Profile for Starting Well Plugging and Abandonment before Cessation of Production

Risk	Impact Severity	Likelihood of Occurrence	Mitigation Plan
Well Barrier Failure Prior to Well Plugging and Abandonment	High	Medium	Properly Maintain and Manage Down Well Throughout the Field Life
Over-Designed or Under-Design Well Barriers	High	High	Re-assess the Condition of the Wells and Reservoirs Prior to Well Engineering Early Engagement with Previous Owners and Operators to Obtain Information Consult with the Other Operators, the Supply Chain, and Regulators
Not Getting Approval from the Regulator to Plugged and Abandon the Wells	High	Low	Early Engagement with the Regulator Responsible for Approving Well Plugging and Abandonment Activities
Not Having Equipment and Vessels available to Plug and Abandon the Wells	High	Medium	Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for Well Plugging and Abandonment
Well Barrier Failure After Well Plugging and Abandonment	High	Low	Conduct a Thorough Well Testing after Well Plugging and Abandonment Operation
Losing Revenue from Lost of Production	Low	High	Early Engagement with Chief Financial Officer and other Internal Stakeholders Early Engagement with Joint-Venture Partners Early Engagement with Operators of Dependent Oil and Gas Facilities
Not Getting Approval from the Regulator to Remove the Facility by the time Well Plugging and Abandonment is Completed and the Facility is Ready for Removal	High	Low	Early Engagement with the Regulator Responsible for Approving the Removal Proposal
Not Having Equipment and Vessels available to Remove the Facility by the time Well Plugging and Abandonment is Completed and the Facility is Ready for Removal	High	Medium	Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for the Removal Operation.
Incur Additional OPEX and ABEX for Maintaining the Facility after Well Plugging and Abandonment is Completed before the Facility can be Removed	High	Medium	Early Engagement with the Regulator Responsible for Approving the Removal Proposal Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for the Removal Operation.
Well Plugging and Abandonment not Completed and Facility not Ready to be Removed by the Contractor	High	Low	Negotiate Contracture Terms with the Contractor Start Well Plugging and Abandonment Earlier
Incur Additional Cost due to Breach of Contract with Contractor	High	Low	Negotiate Contracture Terms with the Contractor Start Well Plugging and Abandonment Earlier

Table N-2 – Risk Profile for Starting Well Plugging and Abandonment after Cessation of Production

Risk	Impact Severity	Likelihood of Occurrence	Mitigation Plan
Well Barrier Failure Prior to Well Plugging and Abandonment	High	High	Properly Maintain and Manage Down Well Throughout the Field Life
Over-Designed or Under-Design Well Barriers	High	High	Re-assess the Condition of the Wells and Reservoirs Prior to Well Engineering Early Engagement with Previous Owners and Operators to Obtain Information Consult with the Other Operators, the Supply Chain, and Regulators
Not Getting Approval from the Regulator to Plugged and Abandon the Wells	High	Low	Early Engagement with the Regulator Responsible for Approving Well Plugging and Abandonment Activities
Not Having Equipment and Vessels available to Plug and Abandon the Wells	High	Medium	Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for Well Plugging and Abandonment
Well Barrier Failure After Well Plugging and Abandonment	High	Low	Conduct a Thorough Well Testing after Well Plugging and Abandonment Operation
Losing Revenue from Lost of Production	Low	Low	Early Engagement with Chief Financial Officer and other Internal Stakeholders Early Engagement with Joint-Venture Partners Early Engagement with Operators of Dependent Oil and Gas Facilities
Not Getting Approval from the Regulator to Remove the Facility by the time Well Plugging and Abandonment is Completed and the Facility is Ready for Removal	High	Low	Early Engagement with the Regulator Responsible for Approving the Removal Proposal
Not Having Equipment and Vessels available to Remove the Facility by the time Well Plugging and Abandonment is Completed and the Facility is Ready for Removal	High	Medium	Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for the Removal Operation.
Incur Additional OPEX and ABEX for Maintaining the Facility after Well Plugging and Abandonment is Completed before the Facility can be Removed	High	Medium	Early Engagement with the Regulator Responsible for Approving the Removal Proposal Early Engagement with the Supply Chain to Ensure Equipment and Vessels are Ready for the Removal Operation.
Well Plugging and Abandonment not Completed and Facility not Ready to be Removed by the Contractor	High	High	Negotiate Contracture Terms with the Contractor Start Well Plugging and Abandonment Earlier
Incur Additional Cost due to Breach of Contract with Contractor	High	High	Negotiate Contracture Terms with the Contractor Start Well Plugging and Abandonment Earlier

Appendix O – Stakeholder-Oriented Critical Paths Modification Log

Table O-1 – Stakeholder-Oriented Critical Paths Modification Log

Comments from Transcript	Changes to be Made	Rationale for Changes
"There is a whole part perhaps on the onshore decommissioning part. The activities when you get to whichever yard you want to get into. You will need to make sure that you got permit and the consents in place for the actual decommissioning processes to take place onshore."	Add in "onshore load-in, dismantling, and disposal" activity at the end of the critical path.	To complete the full decommissioning process. The decommissioning programme ends with onshore load-in, dismantling, and final disposal and waste management.
"I feel that the critical paths is very linear and it is related to one project which is absolutely how all the other operators are tackling it. Extend out the critical path to within a cluster of fields, or across the whole of the North Sea" -	"Add in "area decommissioning planning" activity before engaging the regulators.	Consider the complex issue of mature basin management and also surrounding facilities rather than just focusing on the individual asset.
"Commence engagement, because it is not just notification, and that is actually the biggest chunk. **Maybe longer for more complex programmes. Murchison did 45 days, Brent did 45 or 60 days, I remember we did 45 days for Dunlin. (30 days is the minimum)"**	Change "notification of stakeholders" activity to "commence engagement" Duration for public consultation activity kept at 30 days for Steel Jacket Platforms, and increase to 45 days for Gravity Based Concrete Platforms	Not just notifying the stakeholders, it is the whole process on engaging and dialogue and discussion with the relevant stakeholders. 30 days is the minimum number of days for public consultation. Only derogation cases would require more discussion with stakeholders and stakeholders may need more time to analyse the documents and data.
"Write and release of 2nd draft –There are other stages within this, you don't re-consult after that. I would say 2nd draft and subsequent iterations following stakeholder public and regulatory comment."	Change "write and release of 2nd draft" to "2nd draft and subsequent iterations"	Reflects more clearly the to and from process of amending the draft and submitting it to BEIS for review.
"So that can go till 32 weeks. I don't think it is 16 weeks, might be 22 weeks. I don't think it has change over the years, because there are different cases according to if people/contracting parties put in an objection, they can ask."	Change duration for "OSPAR derogation application to approval" activity from 16 weeks to 1 year.	1 year is the average for derogation cases. Larger and more complex facilities can take longer such as Brent facilities.
"Basically, on all platforms, the topsides have to come off, and you have to clean up everything. There is no such thing as a full leave in place. Its only partial leave in-situ, or partial removal. So, it is only this one."	Completely remove "Leave in Place" category. Restructure categories to represent type of facilities instead: "Steel Jacket Platforms, Gravity Concrete Base Platforms, and FPSO"	Serve as a much better representation of the types of facilities available in the North Sea landscape. Decommissioning methods vary by type of facilities. According to OSPAR regulations, 1) concrete-based platforms, 2) Facilities weight above 10,000 tonnes in air, and 3) Facilities beyond repair are the one that can apply to be left in situ.
"You can do a comparative assessment of the topside if you want to inform your own decision making, but it is not required. It is just not required for the Offshore Decommissioning Unit. You don't need to do it for that either because you only need to do a comparative assessment if you feel you	Remove "Comparative Assessment for Topside" activity.	All topsides must be removed according to UK regulations, there is no need for comparative assessment of topsides.

might be leaving something in. Cables normally take out, pipelines only if you want to leave in-situ."	Replace "Comparative Assessment of Pipeline and Cables" to just "Comparative Assessment of Pipelines"	Cables are easy to remove and is most cases must be removed. Thus, take cables out of the equation.
"The permitting slightly different. Well plugging and abandonment is not dependent. Once cessation of production approval from OGA, you can get on with it. And then the race is on then."	Remove dependency of Well Plugging and Abandonment Engineering, Planning, and Execution on decommissioning programme approval. Well plugging Engineering, Planning, and Execution to run in parallel with Decommissioning Planning.	Well Plugging and Abandonment is not approved by ODU/ OPRED. It is a separate operation that is approved by HSE. Therefore, Well Plugging and Abandonment can run in parallel with decommissioning planning.
"Supply chain engagement activities generally takes place after the comparative assessments. Tender and Award of contracts process comes after the engagement."	Change the sequence of activity: Shift supply chain engagement activities to after comparative assessments.	Engage the supply chain only after you know what you want to do.
"Add additional activities to reflect internal discussion within the company before engaging the regulators for consultation."	Add additional activities to reflect internal discussion within the company before engaging the regulators for consultation	Best to have internal approval before going out to talk with the regulators to not keep asking the board of directors to keep approve changes.
"Add in Third party verification and the Write-up and submission of OSPAR closing report at the end of the critical path. These two activities are necessary for derogation cases/ projects."	Add in activity "Third Party Verification" and "Write-up and submission of OSPAR closing report" at the end of the critical path under the post-decommissioning Section.	They are necessary activities during post-decommissioning activities for derogation cases.
"Regulators engagement (with OPRED and OGA and BEIS) should start 6 years prior to cessation of production."	Extend the regulator engagement activity to 6 years before cessation of production.	To align with the guidelines from L2P2 found on the DecomNorthSea website, will make the critical path more accepted by the industry.
"Derogation has a long timeline, it is 120 weeks/ over 2 years for derogation case to get its approval from the date you actually submitted the OSPAR application. 48 weeks' timeline is for a non-derogation case."	Extend the activity for "Submission to Approval of OSPAR" to 2 years.	To reflect the realistic timeline for derogation approval.
"Supply chain engagement to take place 24-18 months before actual operation."	Change duration for supply chain engagement activity to 2 years ending at removal operations.	To reflect realistic schedule of an actual decommissioning project.
"We aim to do is that we will aim to complete well plugging and abandonment operations mostly when this platform is still producing. So, the problem you have got here is because you stopped production and then start well plugging and abandonment operations, if these operations continue on for 2 years or longer, you are spending an awful lot of money to keep that platform there whilst you do well plug and abandonment operations. So, essentially what you have done is you have probably double the cost. The most significant part of your decommissioning cost, you have probably doubled it. That is my immediate observation. Remember that these platforms are designed for simultaneous drilling and production. In fact, that is one of the major lessons learnt about decommissioning form our experiences. Not managing down, the number of idle wells is one	Shift well plugging and abandonment operations to start before cessation of production.	To minimize the risk of time delay between decommissioning approval and beginning removal operation. Thus, minimizing cost for decommissioning and opex, and also being able shorten the total time for the entire decommissioning project. Well plugging and abandonment operations can run in parallel with production operations. It is good business not to have idle wells. Minimize risk of schedule delay due to rig breakdown.

major mistake that people make, they sit with a very large number of well slots."		Minimize risk of not being ready for the contractor to commence well plugging and abandonment operation.
"At this level, we will be thinking about a project like this right now in less than 10 steps. I encourage you to do is think about the project in terms of these major activities first. Your critical path is far far too detail, and you got far too many small tasks in there. The problem with that is you can't see the important stuff because you've got so much. Think about the big stuff at that level. And you don't have enough information to be that precise yet."	Have 2 critical paths. One detailed one to be at the back and 1 shorten version for presentations at conferences etc.	To be easily and quickly understood at first glance. It will take a lot of time for people even project engineers to make sense of a very detail critical path.
"Let's assume that the drill rig has not been operated for 5 years that is not untypical as well. So, it is going to take 1 year or 2 to get the rig ready. So, we will start with "getting the rig ready" as the first activity, which will last till 2020/2021. So, when do you think we should stop production? Around the end of 2021."	Change the duration for "Preparing the Rig/Mobilisation of Rig" to 1 year.	To reflect the accurate duration for preparing the rig/ mobilising the rig in preparation for well plugging and abandonment activity.
"Typically, on a large GBS platform in our experience, well plugging and abandonment will take about 20 to 30 days per well. And typically, these platforms would have between 20 to 40 wells."	Change the duration for well plugging and abandonment operations to reflect the accurate average of 20 to 30 days per well for 20-40 wells on a platform.	Reflect an accurate average estimate for well plugging and abandonment operation.
"So, then cleaning and preparing the platform for removal takes about a year."	Change the duration for "Hydrocarbon cleaning and flushing activities" to 1 year.	Reflect an accurate duration estimate for hydrocarbon cleaning and flushing activities in preparation for removal operation.
"How long will it take me to get regulatory approvals? So, I need to have regulatory approval by the time I going to stop production, end of 2021. For a large GBS, I would say now end of 2018 is about the right time to be starting. Because what you will do is you got a year of environmental studies, stakeholder engagement, and regulatory process. So, you will basically run you decommissioning activity in parallel with the well plugging and abandonment. So, the objective is that you will have your regulatory approval in hand around the same time as you stop production."	Change the duration for decommissioning planning to 4 years and the end date to just before cessation of production. Remove dependency of decommissioning programme submission on approval of cessation of production.	To ensure that the approval of the decommissioning programmes aligns as close as possible to the date of cessation of production. Thus, minimizing the risk of the platform being left unman unnecessarily while waiting for the programme to be approved. Well plugging and abandonment activity runs in parallel with decommissioning planning activities.
"To get through OSPAR will take almost a year, and we know that through experience. The process is 16 weeks, 24 weeks, 32 weeks, it always takes longer because that is just the formal part of the process. Right now, we know that for Brent, it is taking a lot longer because of government intervention and help, and it does take longer."	Confirmed the duration for OSPAR approval to be 1 year. Note that there are exceptional cases for higher profile projects such as Brent.	Note the exceptions to the 1-year period.
"My first observation that jumps up of me is this is all almost standing at the execution phase. Particularly if you are looking at a large gravity base structure, that whole pre-planning and strategy development I would suggest needs to start quite early in the whole process."	Add in a pre-planning and strategy development phase	Very important to have a strategy in place on how you are going to decommission the asset before you actually do it. Currently it is also a requirement by the OGA to

		have a decom strategy in place 4-5 years before COP.
"For early engagement I would suggest you engage the OGA and BEIS prior to meeting the supply chain."	Shift the activities for early regulatory engagement to happen before early supply chain engagement.	Get advice from OGA and BEIS to get a clearer idea of who to approach in the supply chain.
"And what we found was getting a decommissioning programme prepared and approved, particularly if you had a derogation case candidate, it takes about 3 years from the first draft of the decommissioning programme, because it got to have to go through all the signatories of OSPAR. It has to be individually signed by all participants of OSPAR, so it will take some time."	Change the duration for derogation approval from 1 year to 2 years.	To reflect the appropriate timing for derogation application to approval.
"I think that would be something that would be useful building in into your critical path is developing that overall strategy that looks at engagement with other operators, looks at early engagement with the supply chain, and early engagement with the regulator, helps you develop that execution strategy, and ideally that execution strategy, part of it should be determining whether that decommissioning of that asset is best manage as a single asset, or as part of a portfolio."	Add in main activities under decommissioning strategy development as early regulatory engagement and early supply chain engagement.	Main activities required to build the decommissioning execution strategy.
"I think the planning would be together. I think it is best to have the planning as part of the project management. And then the execution will be from the WBS from Oil and Gas UK, because in the planning, you will be looking at the larger picture. So, I think it would make sense to have them (all the planning) together"	Keep all decommissioning planning under one category or group of activities.	Looking and planning decommissioning from a big picture point of view
"Produce a simplified version of that to communicate with other people. So, buried behind it is the detailed version, but here is the bit at the front that you are actually seeing."	Have 2 different critical path. A simplified one and a detailed version.	Easier to communicate with other people using the simplified version of the critical path.
"So, go and get the data, and do a geological assessment. Assess what are the formation that needs abandoning, what needs isolating, and go and confirm that before you are asking well engineers to actually design and abandon, so they will know what they are abandoning. So, that geology bit is very important first. Then you'll do a sort of a base case abandonment" -	Add in "geological studies and assessment" as an activity before "well plugging and abandonment engineering".	To add detail to reflect the actual activities that is done when planning for well plugging and abandonment.
"I mean I have not got involved in platforms well abandonment too much, but certainly with subsea well abandonment. Again, if you have been through that process of the planning piece and you got the permission to abandon, a year I would think. A year to get the engineering ready, getting ready to go. And then the PandA process itself a year, depends on how many platforms is there, how many wells you have got. It just depends, but it is about a year planning, a year execution." -	Change duration of well plugging engineering to be 1 year, and change duration of well plugging operation to be 1 year.	Based on experience from contractor point of view.
"So, if cessation of production is for example here, that is your base case. Thus, you need to do your decom strategy about 4-5 years before COP. And then you need to do area decommissioning plan about 3-4 years before COP."	Change the start date and end date of Decom Strategy activity start 5 years before COP and end 4 years before COP. Add in Area Decommissioning Plan Activity and have it start 4	Current requirement by the OGA to have a decom strategy ready at least 4-5 years before COP. Current requirement by the OGA to have an area decommissioning

	years before COP and end 3 years before COP.	plan submitted to the OGA 3 to 4 years before COP.
"Once you have done that, then you will need to start your well PandA engineering and planning application. That you need to do about similar time, 3 to 4 years before COP."	Change the start date of well PandA engineering and planning activity to start 3 to 4 years before COP.	Aim to start early enough to be ready to commence well PandA activity early enough so as to minimize well PandA activity after COP
"And then when you do well PandA execution, you will do it. It starts after your engineering is done, and it continues after you have ceased production as well. Some of the wells you are plugging it before, and some of the wells you are plugging it after you have ceased production, because they are such an amount. But the key is to reduce this time (the time for well PandA after COP), reduce this phase and shorten it the best as you can. **And this (well PandA execution) you will do it, obviously there is a lag from engineering to application. So, you will do it about 2 years before cessation of production."**	Change the start date of well PandA operation to 2 years before COP.	Aim to minimize time for well PandA activity after COP. Minimizing the time between COP and being ready for removal is key to minimize unnecessary maintenance cost.
"Then once you have done your well PandA, you will only start your decommissioning planning and application, which involves engineering, tendering of the work, engagement with contractors, stakeholder consultation including OPRED, OGA, HSE, all that. That you will start a year before you cease production, and it goes for a period of 2 years, including derogation under OSPAR."	Change the start date of decommissioning planning activity to begin 1 year before COP.	Aim to align the decommissioning approval date so that it will be as close as possible to when the platform is ready to be remove. (With some variance to account for any risk in delay and lag time)
"You'll have got your decommissioning programme and COP approved, now you need to have your safety case change, and hydrocarbon cleaning and flushing activities. That you will do, you will start somewhere here, and it can take up to 2 years, depending on when your decommissioning programme is going to be approve, and depending on which facility you are looking at, how complex the facility is."	Add in safety case change activity. Start date to commence after COP approval. Remove dependency of hydrocarbon cleaning and flushing on the completion of well PandA operations. Start date to commence after COP approval.	Requirement by HSE, safety case changes after you well PandA and move towards decommissioning removal operation. Hydrocarbon cleaning and flushing can be done while well PandA operations is still ongoing. Need not wait for well PandA to be completed. Aim to minimize hydrocarbon cleaning and flushing activity duration after well PandA so that the facility will be ready to be removed around the time the decommissioning programme will be approved.
"And then, decom execution, facilities removal, and disposal. That will start only after your decommissioning programme is approved, maybe there is a lag of about 6 months or so, but it can take 1 to 2 years, depending on how complex your infrastructure is." -	Change the durations of removal activities and disposal to reflect 2 years maximum.	To reflect a realistic timeframe for the decommissioning removal operation of an average facility.
"And 9 is waste management, which starts all the way when you are doing the well PandA, and all the way after the removal, because you will still have some waste to dispose."	Change the start date of waste management activity to start just after well PandA operations.	To consider managing the waste from well PandA operations.
"And the last thing is ongoing monitoring, as per decommissioning programme. And this happen after you have done the decommissioning, and what you have put in your decommissioning programme. Usually 3-4 years, so I will do the monitoring now, wait for 3-4 years, go back and do the survey again, if it is good then I will stop, if not another 3-4 years."	Change the post decommissioning monitoring period to add in 2nd environmental and infrastructure integrity survey.	To reflect the ongoing monitoring period where a survey is repeated 3-4 years after the 1st post decommissioning survey.

"But for the duration, maybe you can just have a synopsis about how things are done. 10 years is maximum for a decommissioning project. Any project that takes more than 10 years becomes a nuclear industry project. **Once you have a technical COP, you can start the work."**	Keep the maximum duration of the whole critical path within 10 years.	Prevent wastage of time and resources.

Appendix P – Robust Stakeholder Oriented Critical Paths

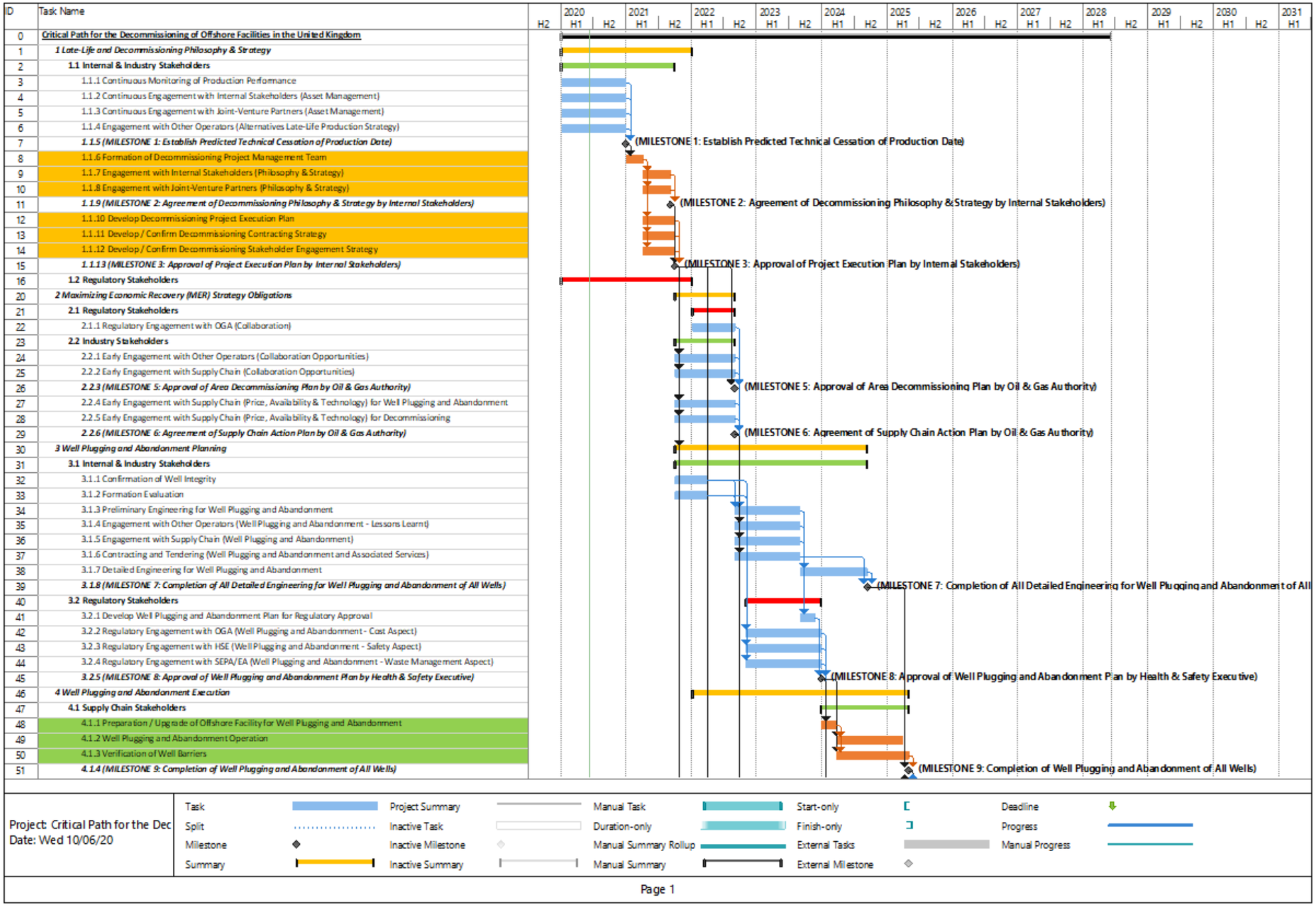


Figure P-1 – The Stakeholder-Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-1)

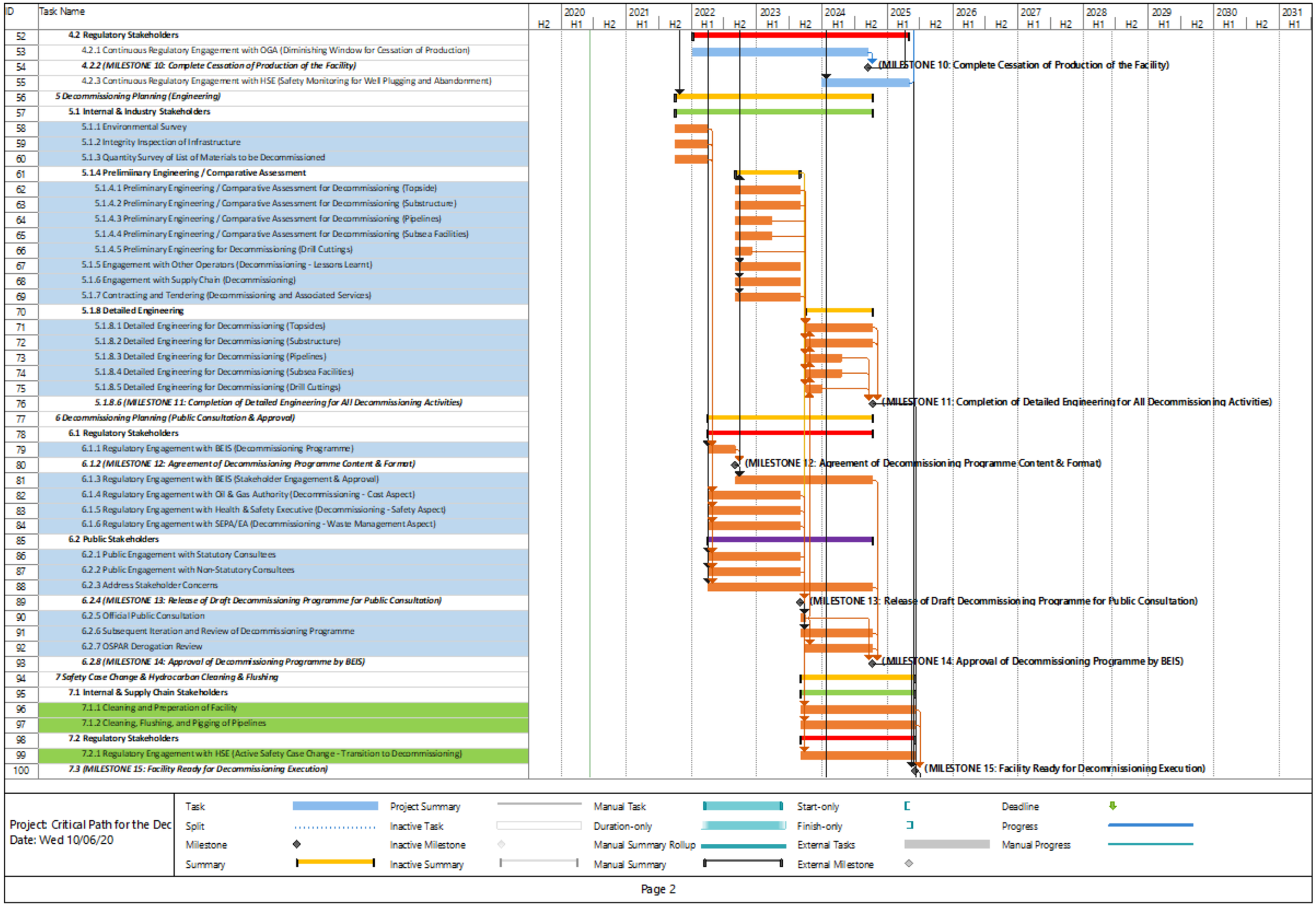


Figure P-2 – The Stakeholder-Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-2)

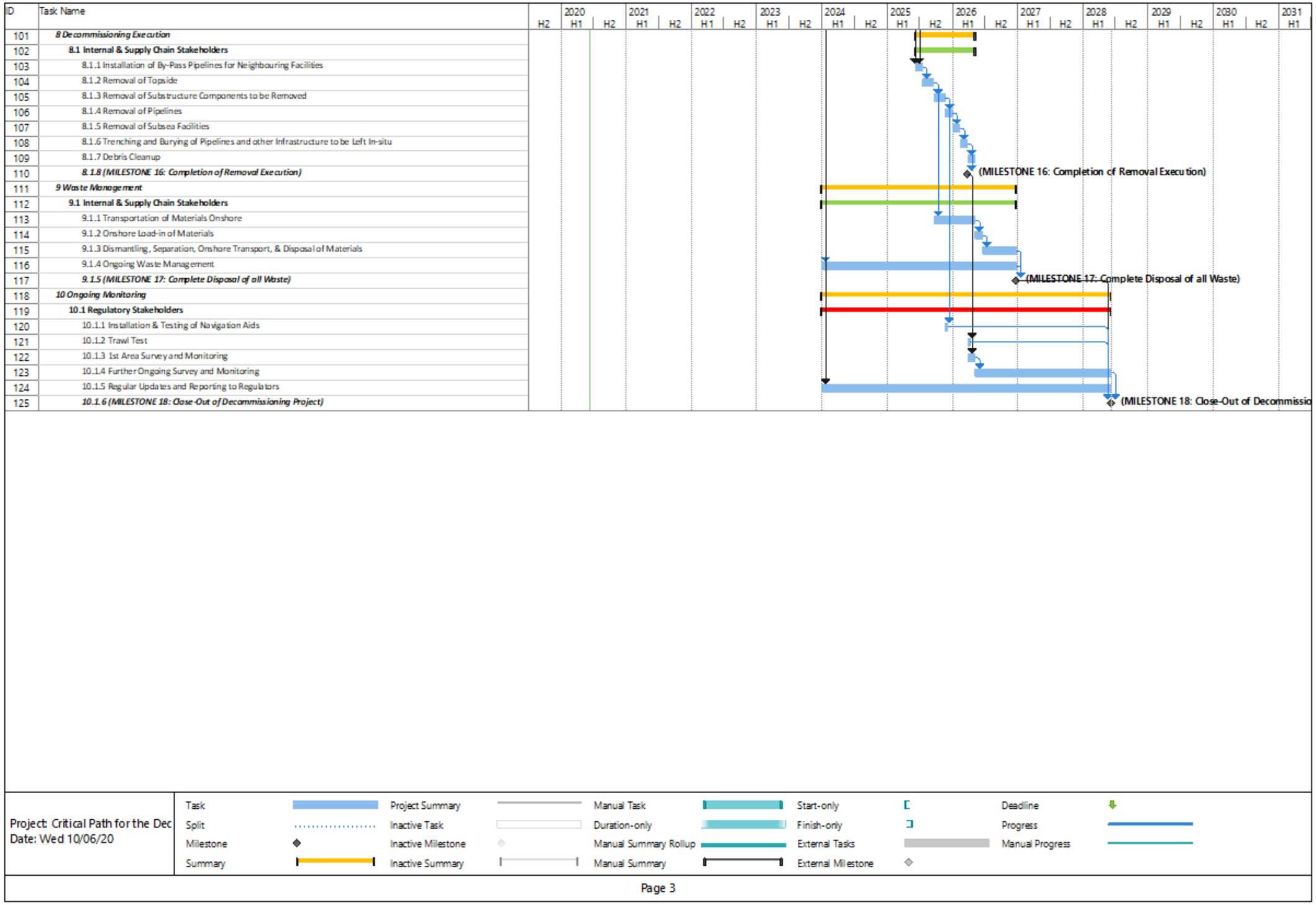


Figure P-3 – The Stakeholder Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-3)

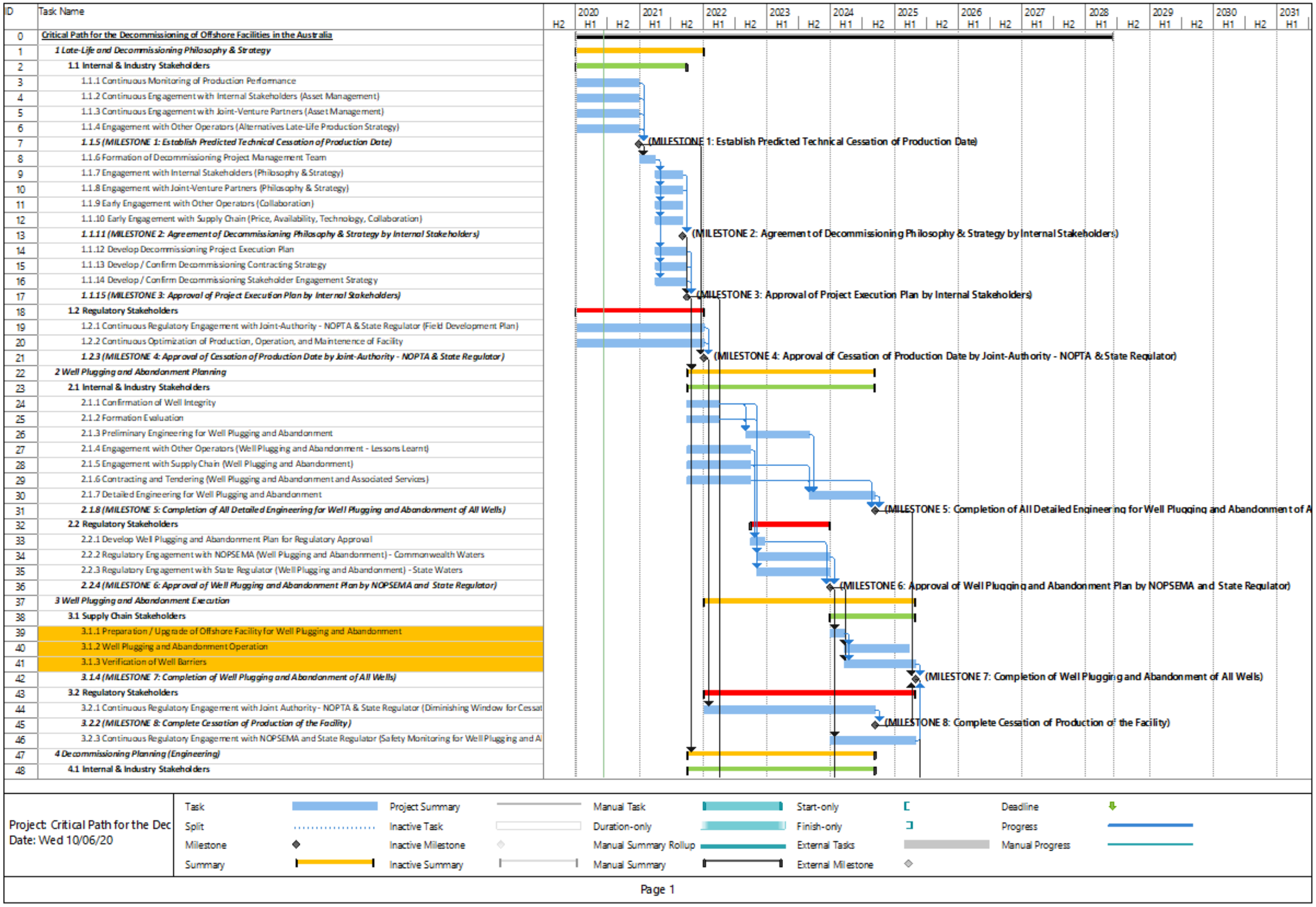


Figure P-4 – The Stakeholder Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-1)

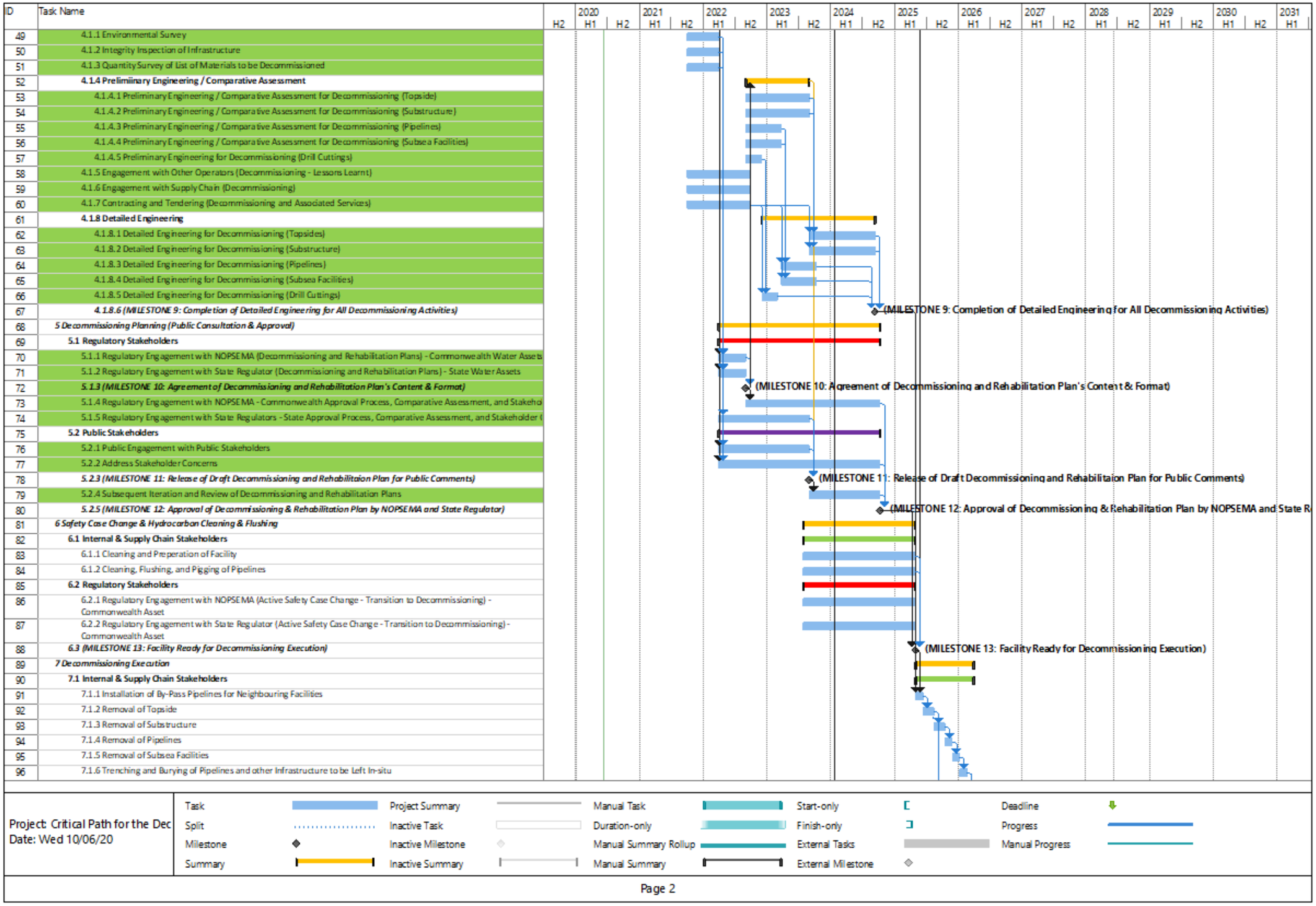


Figure P-5 – The Stakeholder Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-2)

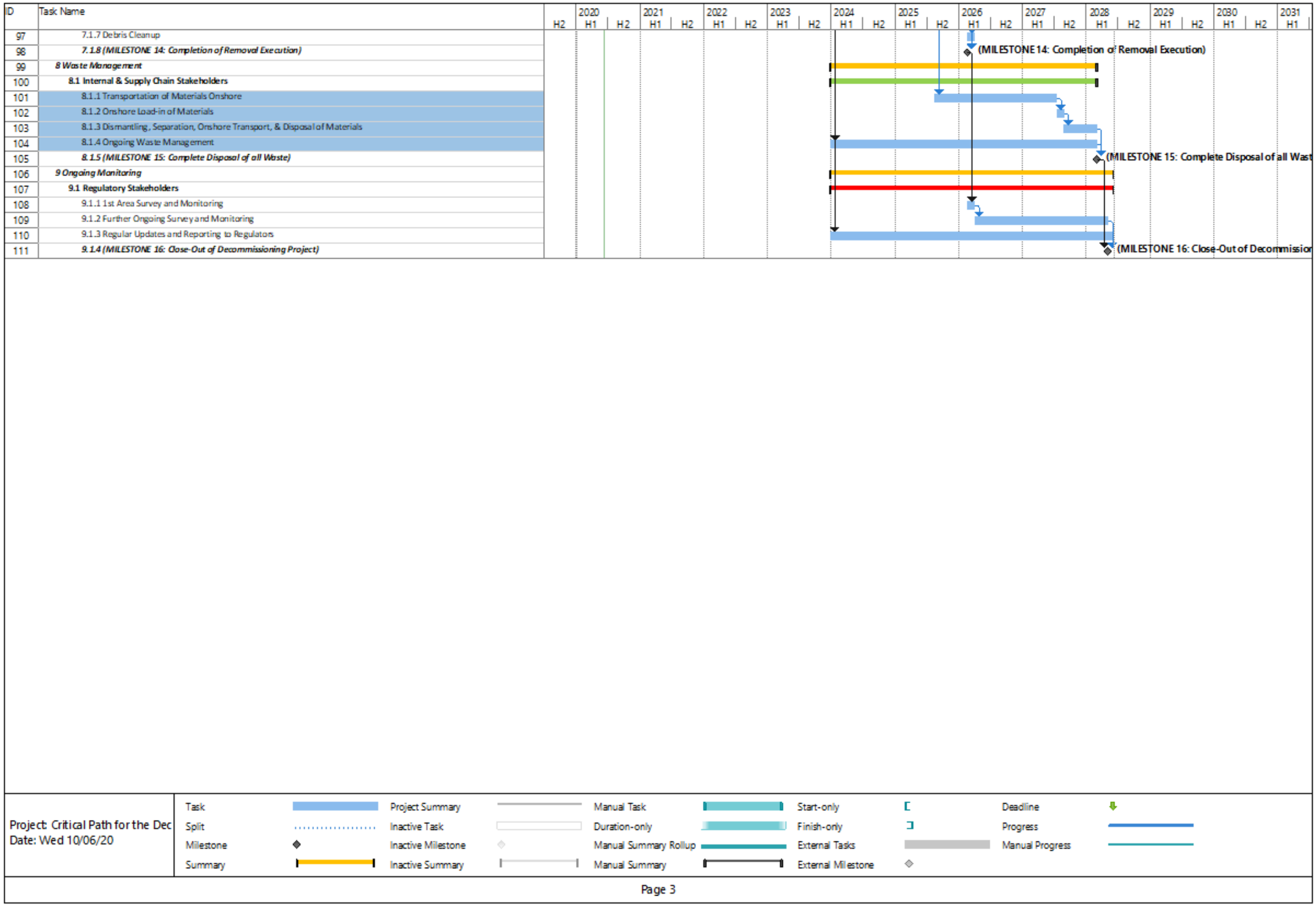


Figure P-6 – The Stakeholder Oriented Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-3)

Appendix Q – Critical Points Determined by Microsoft Project

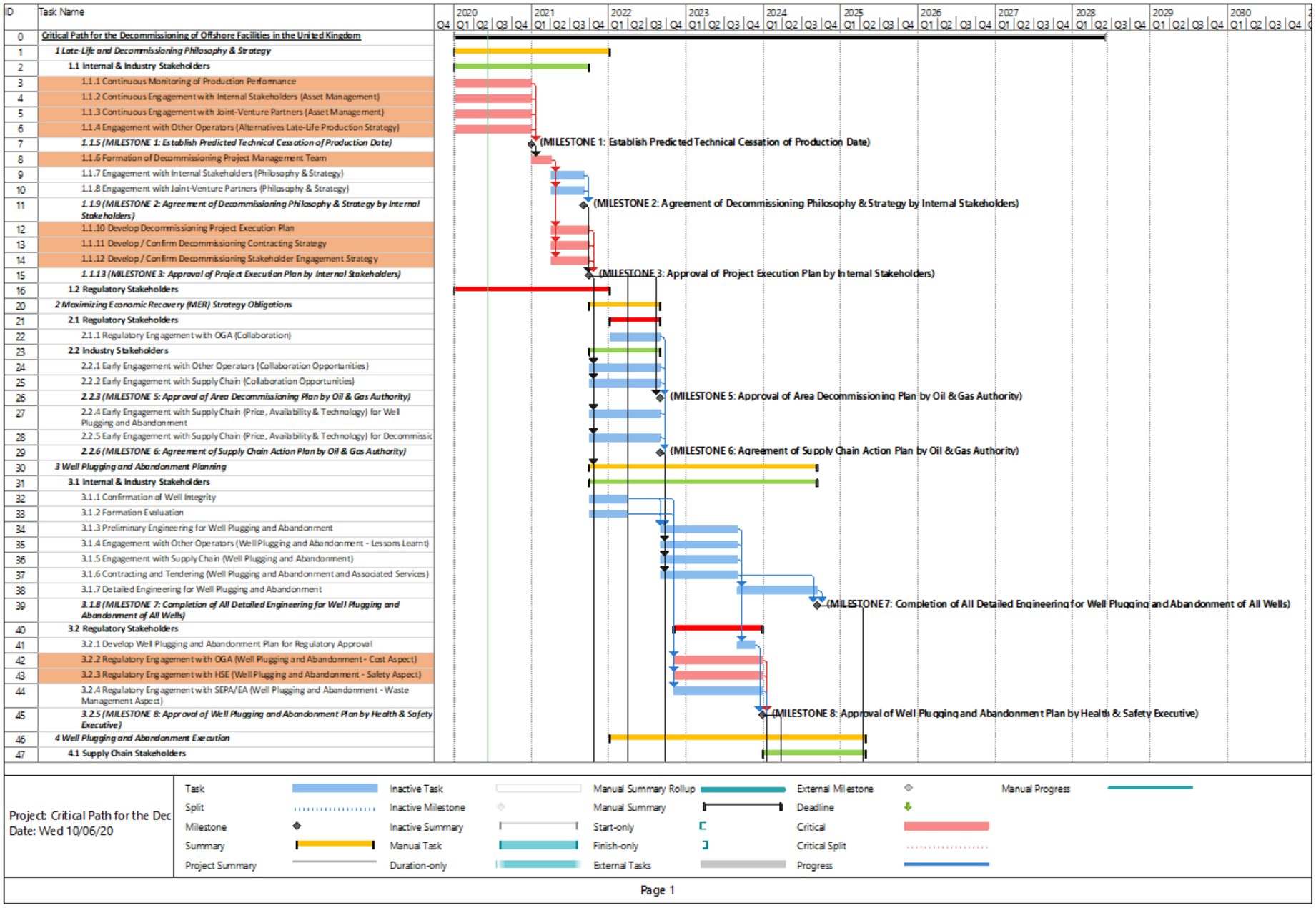


Figure Q-1 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-1)

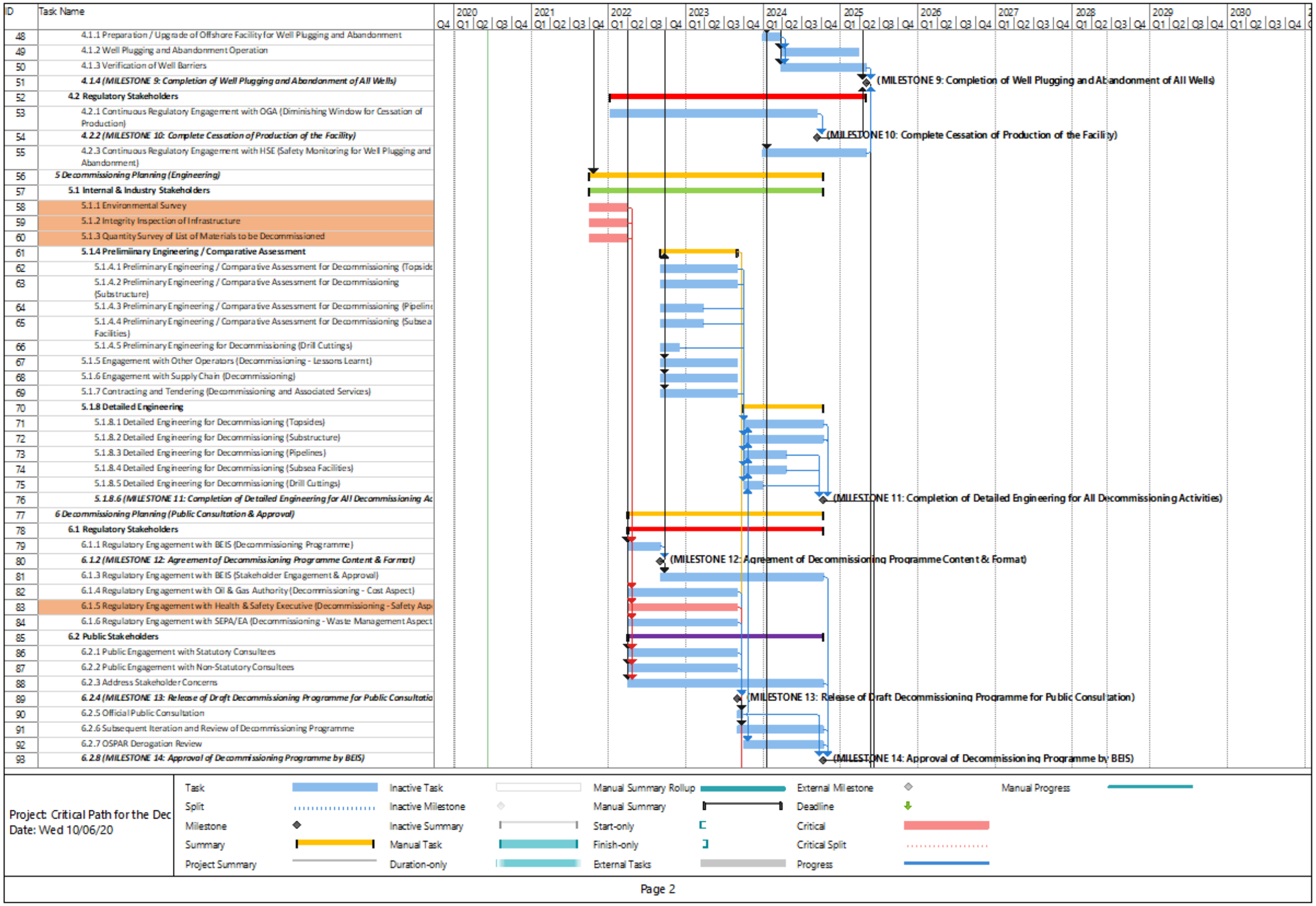


Figure Q-2 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-2)

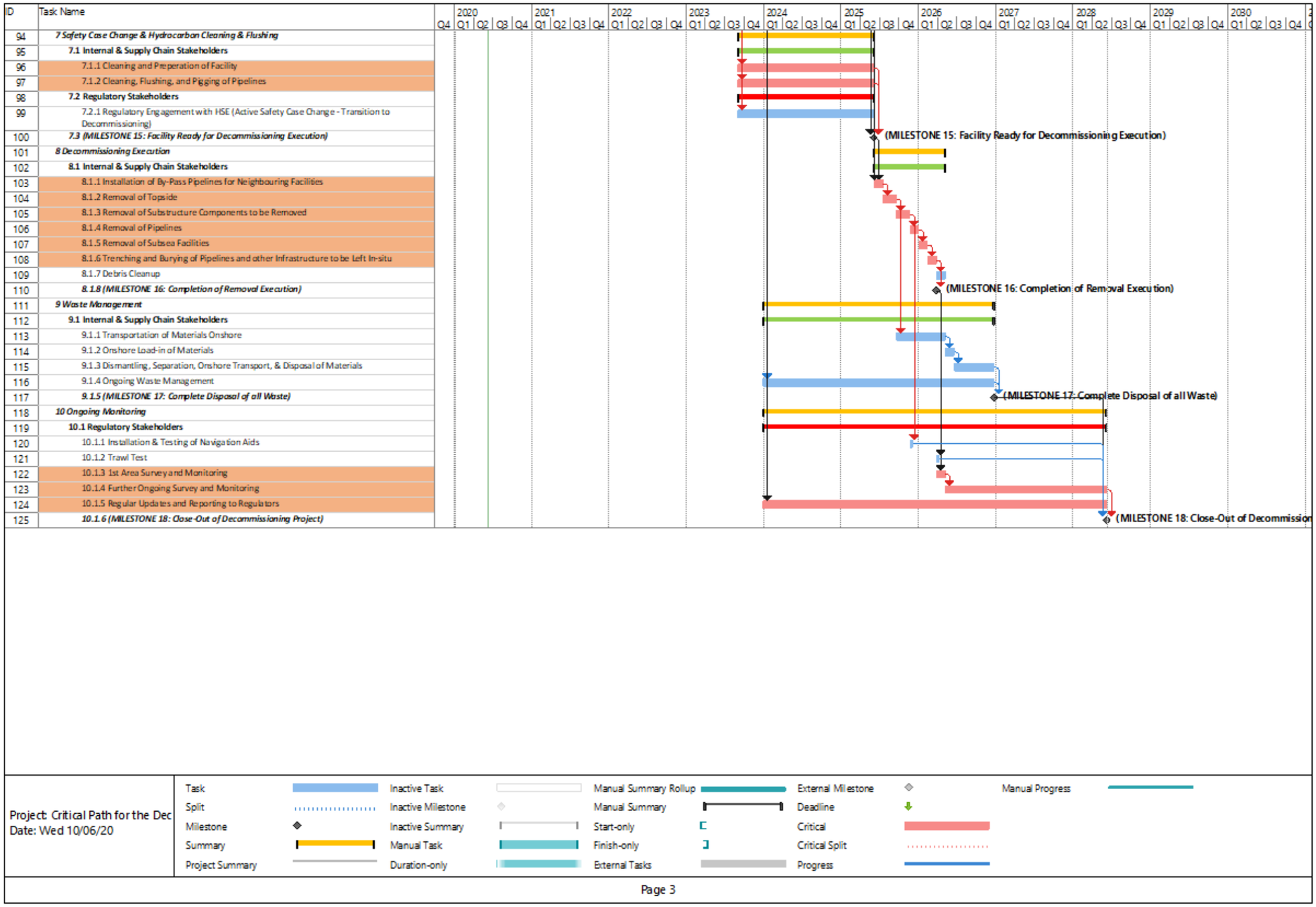


Figure Q-3 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in the United Kingdom (Part-3)

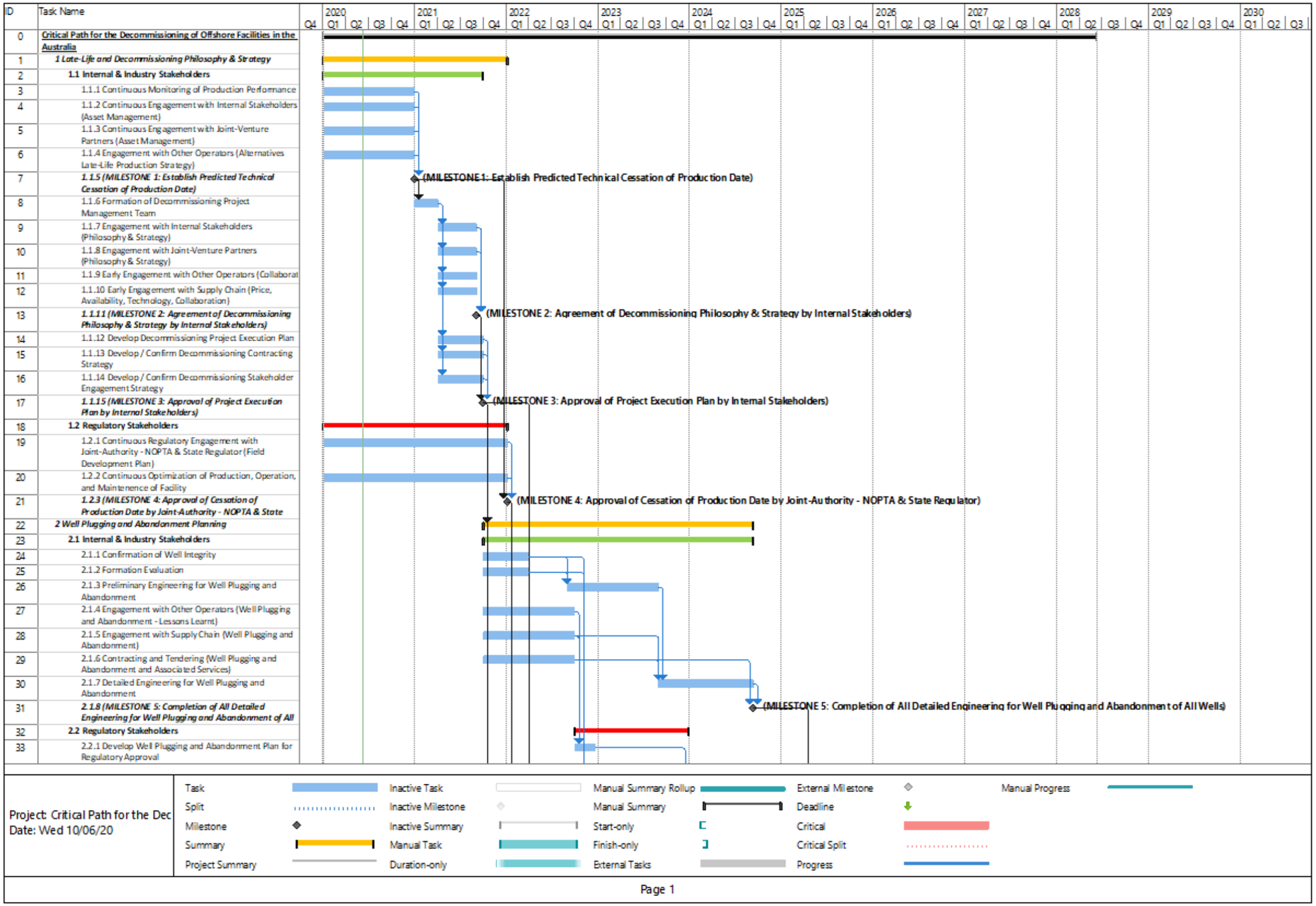


Figure Q-4 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-1)

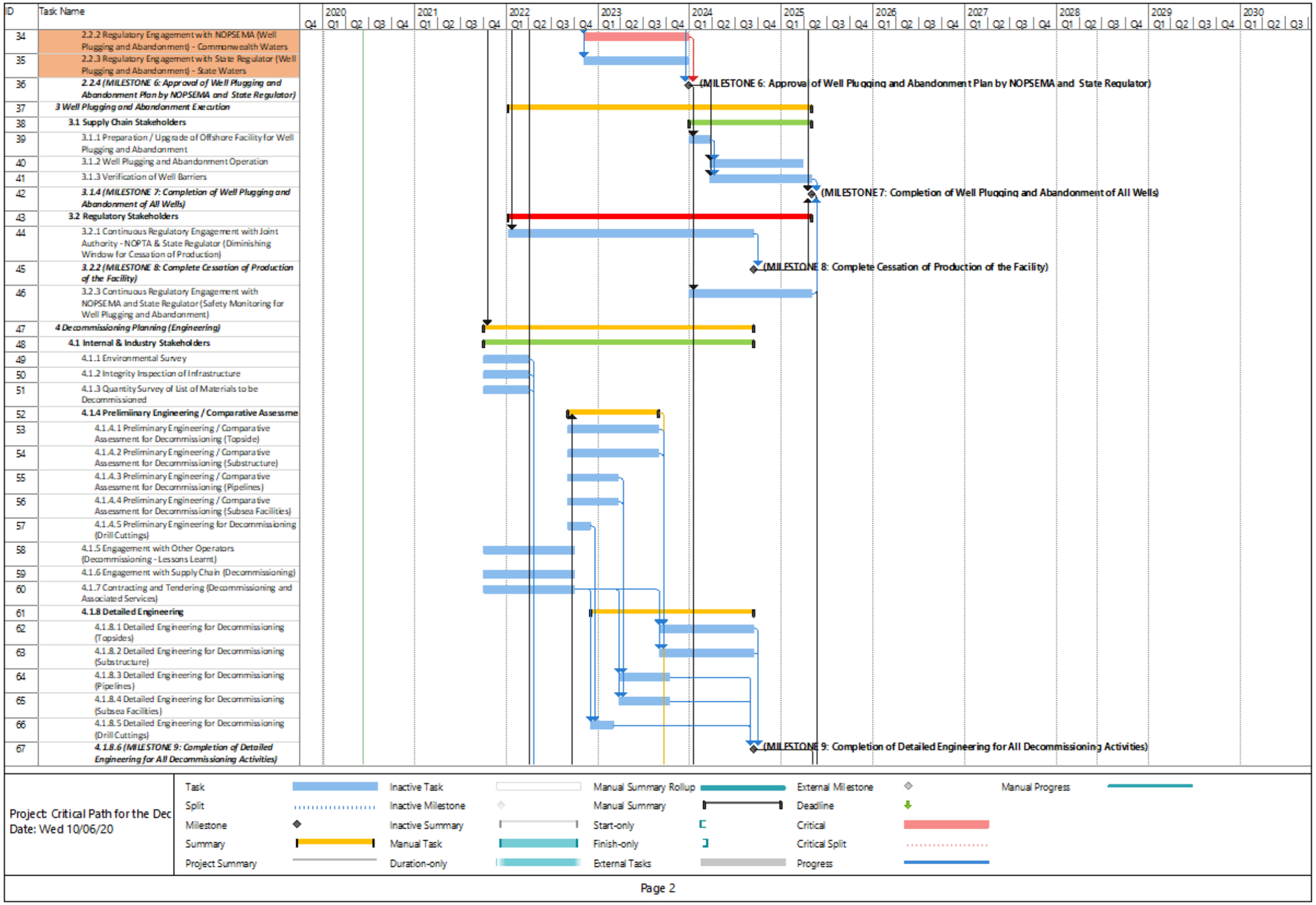


Figure Q-5 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-2)

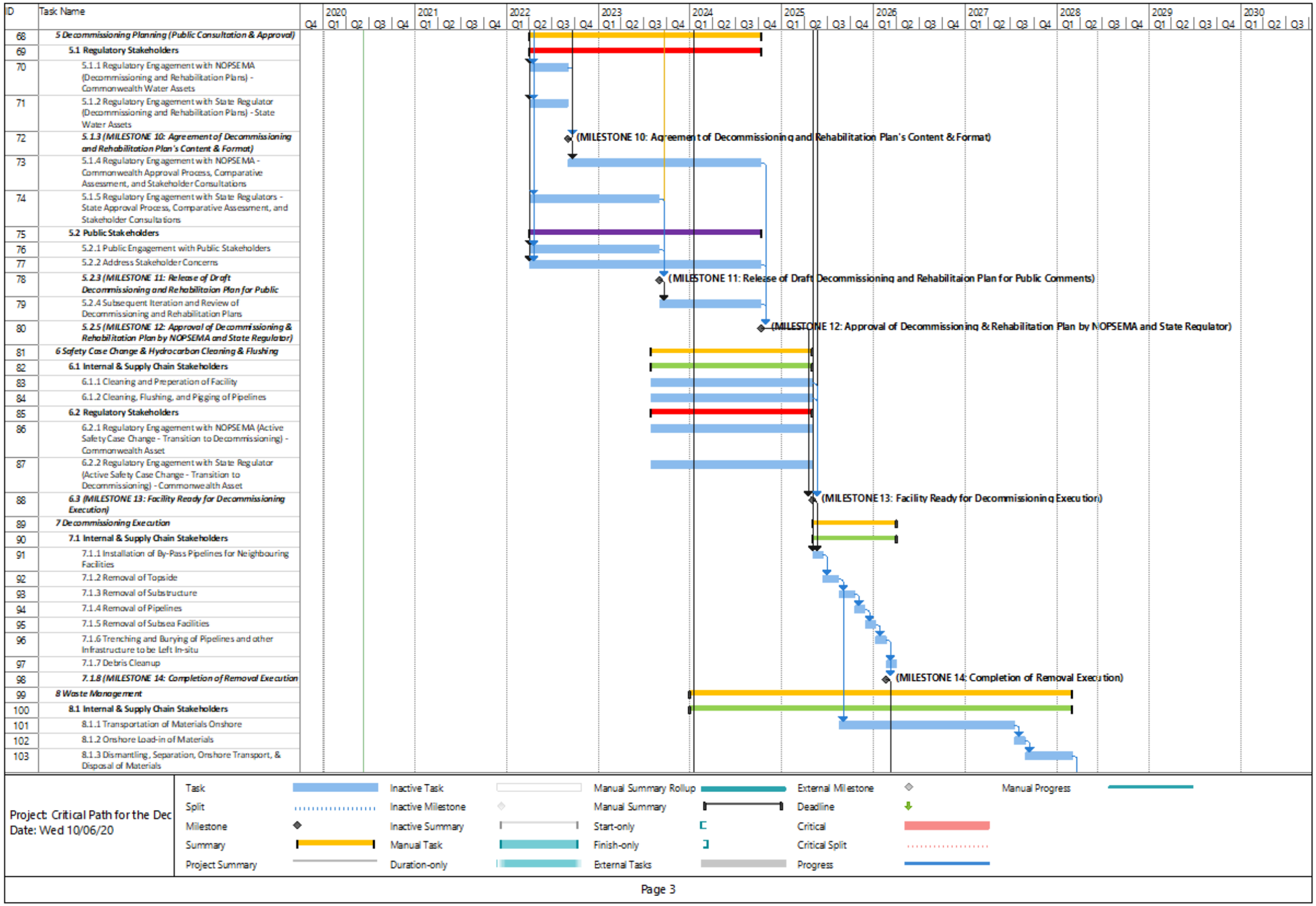


Figure Q-6 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-3)

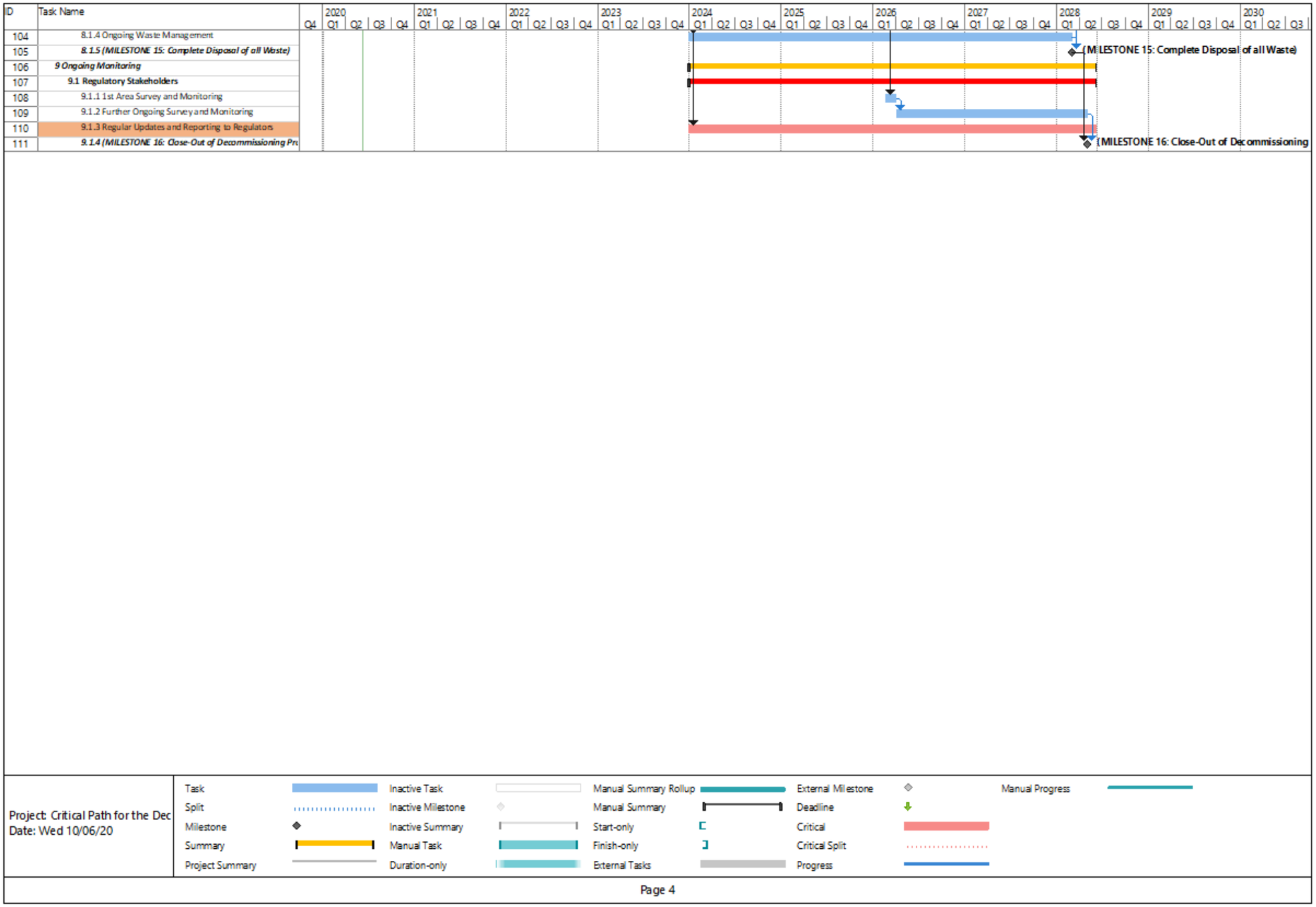


Figure Q-7 – The Critical Path for Oil and Gas Decommissioning Projects or Programmes in Australia (Part-4)

Appendix R – Phased Transition Diagram for the Retirement of Oil and Gas Facilities

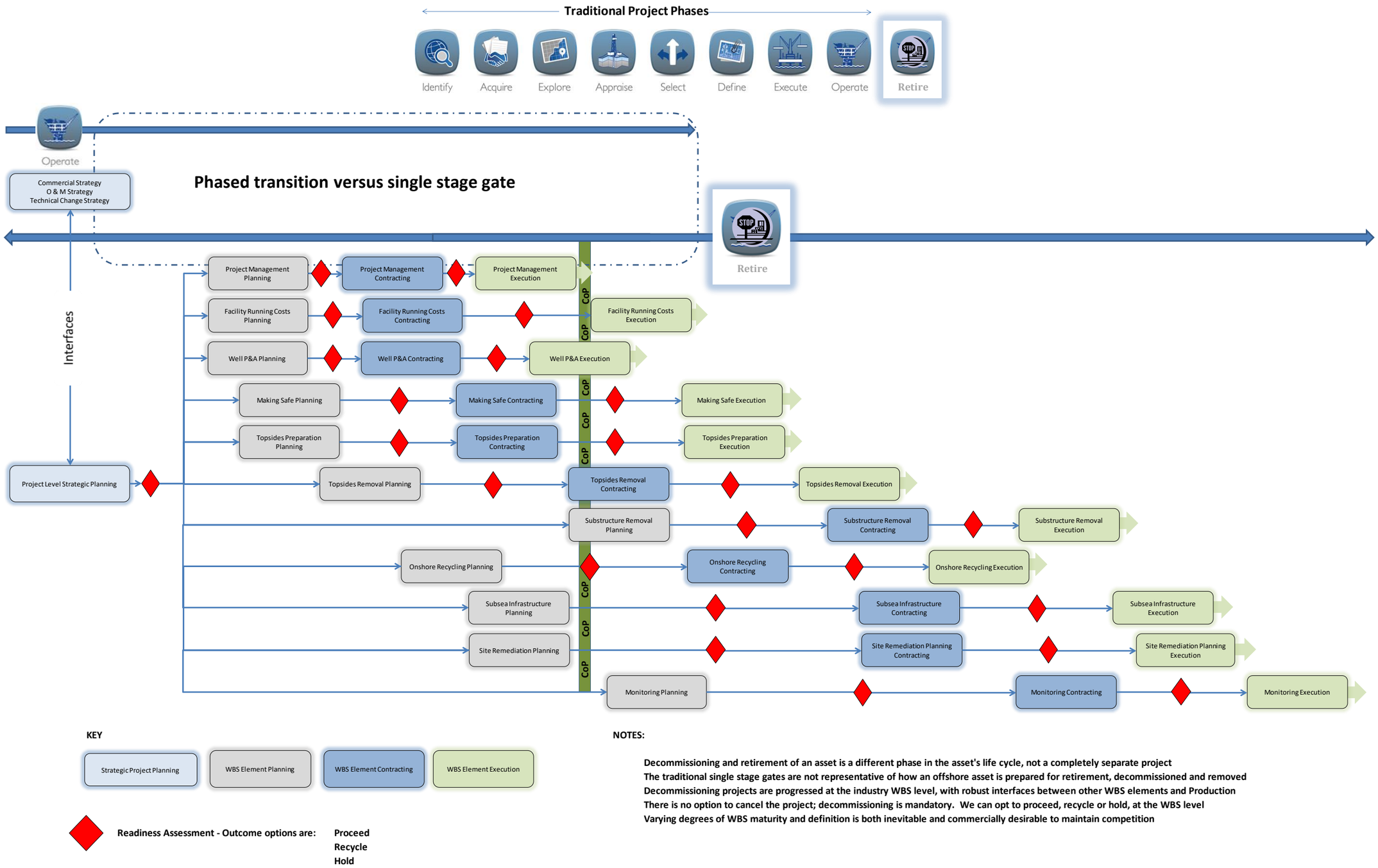


Figure R-1 – Phased Transition Diagram for the Retirement of Oil and Gas Facilities (Marathon Oil 2014)

XX.010 Decision Road Map
XX.012 Governance Model

XX.020 Organizational Strategy
XX.021 Late Life Asset Management Plan
XX.022 Project Charter
XX.023 Information Management Repository

XX.030 WBS

XX.040 Contracting Strategy
XX.042 Contractor Selection Process
XX.043
XX.044 Performance Management System
XX.045 Scope Statement
XX.046 Scope of Work
XX.047 Standards and Specifications
XX.048 Contract Documentation
XX.049 RMA

XX.050 Project Execution Plan
XX.051 Quality Plan
XX.052 Progress Status Report
XX.053 Safety Case Modification Plan
XX.054 Cost Forecast
XX.055 HES Plan
XX.056 Test and Inspection Records
XX.057 Isolated and Cleaned Certificates
XX.058 Preparation Completion Certificate
XX.059 Removal Completion Certificate

XX.060 Stakeholder Engagement Plan
XX.062 Material and Equipment Disposal Recording Plan
XX.064 Material and Equipment Disposal Records

XX.070 Decommissioning Programme
XX.071 Regulatory Compliance Plan

XX.080 Schedule

XX.090 Risk Register

XX.100 Interface Register

XX.110 Cost Estimate

XX.120 Peer Review Report

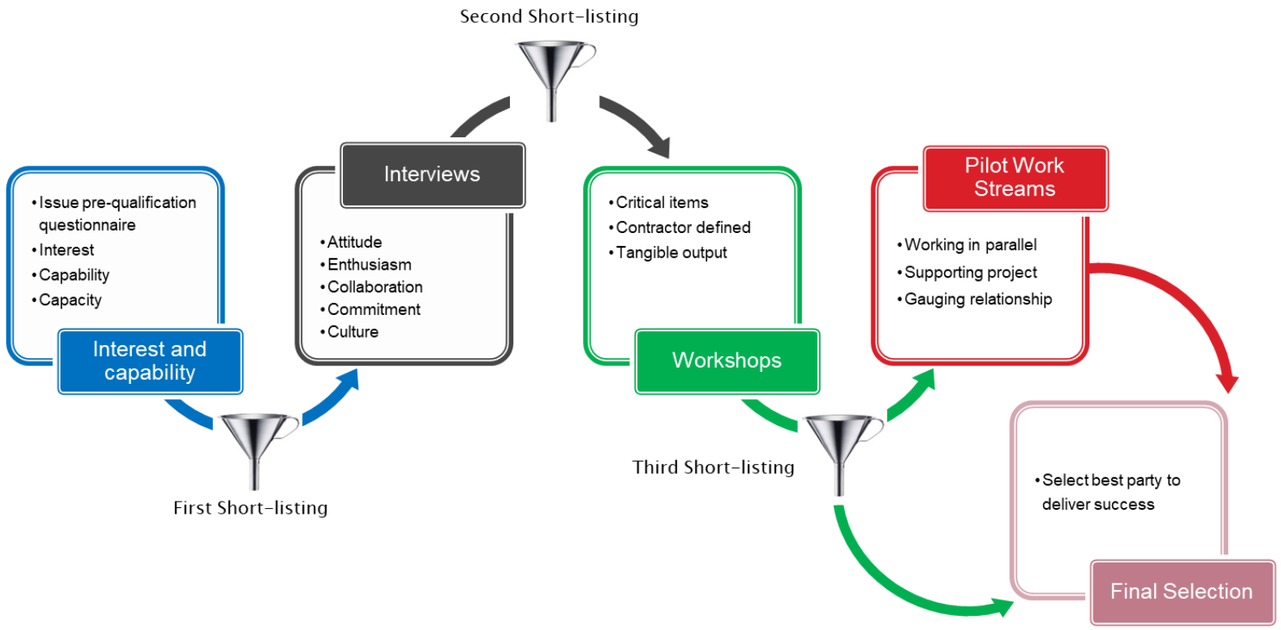
XX.130 Decision Support Package

XX.800 Monitoring Report

XX.900 Close Out Report

Figure R-2 – Deliverables Associated with the Phased Transition Diagram for the Retirement of Oil and Gas Facilities (Marathon Oil 2014)

Appendix S – The Competitive Dialogue Process



Criteria	Scoring				
	1	2	3	4	5
Past Project Performance (relative to project targets)	Unsatisfactory	Fair	Satisfactory	Good	Excellent
Technical Expertise (relative to the industry average)	Unsatisfactory	Fair	Satisfactory	Good	Excellent
Tendered Price (Relative to Average)	>=10%	+10%<.+5%	+5%<>-5%	-5%>-10%	>-10%
PM Experience (relative to the industry average)	Unsatisfactory	Fair	Satisfactory	Good	Excellent
Workload and Capacity	Many projects, limited capacity	Several projects, strained capacity	Several projects, adequate capacity	Few projects, adequate capacity	Few projects, excess capacity
Owner / Contractor Relations (from owner participant survey)	Significant concerns on openness, communication or commitments	Some concerns on openness, communication or commitments	Displays average communication and innovation	Indicates willingness to work together collaboratively	Strong commitment, openness and innovation skills are evident
Method / Technical Solution	Unproven and not yet applied	Adequate but not applied	Established and proven	Robust, proven and applied	Applied successfully several times
Contractor Reputation	Some negative feedback from previous clients	No negative feedback from previous clients	Average feedback from previous clients	Some positive feedback from previous clients	Numerous positive feedbacks from previous clients
Organizational Experience (In similar projects)	< 1 year	1 to <3 years	3 to <5 years	5 to <10 years	>10 years
	1	2	3	4	5

Criteria	Comments
Individual Resumes	In addition to asking for resumes of people who will be working on the project, it can be useful to ask why they are being proposed for the project.
Working Systems	This relates to what the contractor would propose in the way of working processes tools and procedures. This can include the common systems such as quality and environmental management systems, but it can be useful to request information on price transparency and "open-book" pricing methods the contractor would propose.
Individual Reflections	Individual written reflections from individuals within the contractor's organisation and those being proposed for the project team can be very useful in determining consistency of attitude, beliefs and values. Lack of writing skills can be a concern.
Interviews and Presentations	These are very important and assist greatly in assessing the "chemistry" between the companies. It also exposes if the people who are working on the proposal will be the ones working on the project.
Workshops	Holding a workshop to develop and publish a deliverable required for the project can be a very good test for working relationships, commitment, innovation, openness and knowledge. Topics can be decision making, process mapping, interface management, risk identification, or similar subjects.
Grading Information	This is a subjective topic. Providing grading information can encourage contractors to "study for the test" or can be viewed that it will improve the possibility of gaining the correct data

Figure S-1 – The Competitive Dialogue Process (Marathon Oil 2018)

Appendix T – An Example of a List of Stakeholders for an Oil and Gas Decommissioning Project or Programme in the United Kingdom

Aberdeen and Grampian Chamber of Commerce
Aberdeen City and Shire Economic Forum (ACSEF)
Aberdeen City Council
Aberdeen Harbour Board
Aberdeen Renewable Energy Group (AREG)
Aberdeen Science and Energy Centre
Aberdeenshire Council
ACOPS Faculty of Technology
Association of British Offshore Industries (ABOI)
Atlantic Frontier Environment Forum

Bangor University
Bellona
British Geological Survey
BUND (Friends of Earth)
Bundesumwelt Ministerium
Bundnis 90

Carbon Trust
Cardiff University
Centre for Ecology and Hydrology
Centre for Environment, Fisheries and Aquaculture Science (CEFAS)
Cromarty Firth Port Authority

Danmarks Naturfredningsforening
Dansk Ornitologisk Forening
Department of Energy and Climate Change
DG Energy and Transport, European Commission
DG Environment, European Commission

East of England Energy Group (EEEGR)
Energy Foundation
Energy Industries Council
Energy Institute
Environment Agency
Environmental Consultants
Fisheries Research Services Marine Laboratory
Forum for the Future
Friends of the Earth Scotland
Friends of the Earth UK

Gatty Marine Laboratory

GMB (General Trade Union for Britain)
Global Marine Systems
Greenpeace EV
Greenpeace International
Greenpeace UK

Health and Safety Executive
Heriot-Watt University

Independent Review Group
Institute of Marine Engineering, Science and Technology
International Marine Contractors Association (IMCA)
International Maritime Organization
IMechE
International Navigation Association
International Research Institute of Stavanger (IRIS)
International Union for Conservation of Nature (IUCN)
Industry Technology Facilitator

Joint Nature Conservation Committee (JNCC)

KIMO UK Network
King's College, London

Marine Biological Association of the UK
Marine and Fisheries agency (DEFRA)
Marine Conservation Society
Marine Conservation Society Scotland
Maritime and Coastguard Agency
Ministerie van Verkeer en Waterstaat
Ministry of Economic Affairs, Netherlands
Ministry of Petroleum and Energy Norway (MPE)

National Association for Environmental Education
National Federation of Fishermen’s Organisations
National Oceanography Centre Southampton
Natural Environment Research Council (NERC)
Norges Miljovern Forbund (Green Warriors of Norway)
Norges Naturvern Forbund (Friends of the Earth Norway)
NOF Energy
North Sea Directorate (Rijkswaterstaat)
North Sea Foundation
Norwegian Institute for Water Research (NIVA)
Norwegian Petroleum Directorate
Norwegian Pollution Control Authority

Offshore Contractors Association (OCA)
Oil and Gas Producers (OGP)
Oil and Gas UK (OGUK)
Oljeindustriens Landsforening (OLF) Oil Industry Association
Ospar Commission

Peterhead Port Authority
Plymouth Marine Laboratory

Rail and Maritime Transport Union (RMT)
Reading University
Robert Gordon University
Royal Institute of Navigation
RSPB
RSPB Scotland

Scarborough Centre for Coastal Studies
Scotland Office
Scottish Association for Marine Science
Scottish Business in the Community
Scottish Council Development and Industry
Scottish Enterprise
Scottish Enterprise Energy Team
Scottish Environment Link
Scottish Environment Protection Agency (SEPA)
Scottish Government
Scottish Fishermen's Federation (SFF)
Scottish Government - Energy and Telecommunications
Scottish Government -Enterprise, Energy and Tourism
Scottish Government, Environment and Rural Affairs Dept. (formerly SEERAD)

Scottish Natural Heritage
Scottish Wildlife Trust
Sea Mammal Research Institute
Sea Watch Foundation
Seas at Risk
Scottish Environment Protection Agency
Shark Trust
Shetland Islands Council
Shetland Oil Terminal Environmental Advisory Group (SOTEAG)
Society for Underwater Technology
Society of Maritime Industries
Stakeholder Forum for Our Sustainable Future
Sullom Voe Association Ltd.
SustainAbility

The Chamber of Shipping
The Chartered Institution of Waste Management

The Environment Centre(TEC)
The Highland Council
The Mammal Society
The Marine Connection
The Wildlife Trusts
TNO - MEP
T and G

UK CEED (UK Centre for Environmental and Economic Development)
UNITE
University of Aberdeen
University of East Anglia
University of Southampton
University of Strathclyde

Waste Watch
Whale and Dolphin Conservation Society
WWF Denmark
WWF Germany
WWF International
WWF Netherlands
WWF Scotland
WWF UK

ZERO

Appendix U – An Example of a List of Stakeholders for an Oil and Gas Decommissioning Project or Programme in the Australia

AFMW
Australian Customs Service
Australian Hydrographic Office (AHO)
Australian Petroleum Production and Exploration Association (APPEA)
AWSA

BP Developments

Commonwealth Fisheries Association

Department of Agriculture and Water Resources (DAWR)
Department of Biodiversity, Conservation and Attractions (DBCA)
Department of Industry, Innovation and Science (DIIS)
Department of Mines, Industry Regulation and Safety (DMIRS)
Department of Transport
DNP
DPIRD
DoAWE
DoD

King Bay Game Fishing Club (KBGFC)

Marine Aquarium Managed Fishery
Mobil Australia

Nickol Bay Sport Fishing Club (NBSFC)

Onslow Prawn Managed Fishery

Pilbara Demersal Scalefish Fishery
Pearl Oyster Managed Fishery
Pearl Producers Association

RecFishWest

Southern Bluefin Tuna Fishery
South West Coast Salmon Managed Fishery
Specimen Shell Managed Fishery WAFIC

West Australian Abalone Fishery
West Australian Mackerel Managed Fishery
West Coast Deep Sea Crustacean Fishery
Western Skipjack Fishery
Western Tuna and Billfish Fishery

Appendix V – Project Management Tools

Work Breakdown Structure (WBS)

WBS was developed by the US Department of Defense in 1957 to support military development projects. It was not until 1987 when the PMI expanded the use of WBS to non-defense sectors (Haugan 2003). A WBS is defined by PMBoK as "a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables" (PMI 2017). A WBS is commonly used by project managers to define and organise project scopes (Norman, Brotherton & Fried 2008). A WBS is usually presented in a form of a tree structure, dividing the overall objectives into smaller manageable components (Norman, Brotherton & Fried 2008). An example of WBS is illustrated in **Figure V-1** (below, page 70).

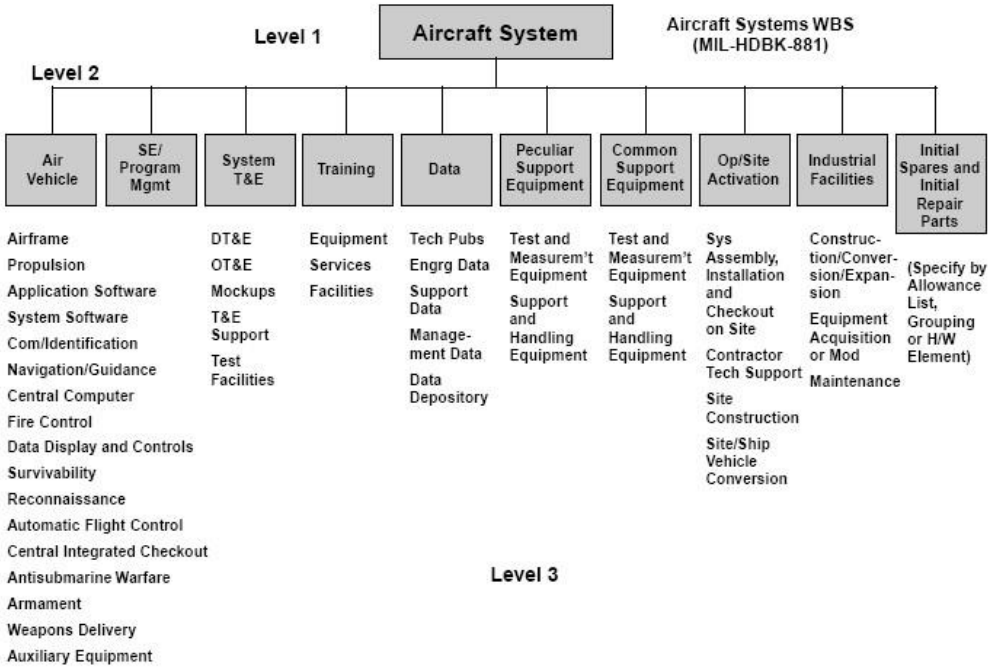


Figure V-1 – An Example of a WBS (Defence Acquisition University Press, 2001)

The literature review showed that there are many projects that have benefited by using the WBS. Norman, Brotherton and Fried (2008) demonstrate that that a WBS can help make project scopes clearer, hence preventing frequent scope change and improving the manageability of projects. Burghate's (2018) study also shows that WBS is an effective tool for ensuring the quality of the

project. However, the benefits of using a WBS can only be realised if the WBS is clearly defined at the beginning of the project (Jung & Woo 2004). This suggests that the users of project management tools are just as important as the design and function of the project management tools themselves.

Stage-Gate Review System

The Stage-Gate Review System is a quality control project management technique developed through the works of (Cooper 1990). The technique involves separating the project into different phases and placing review gates in between the phases (Cooper 1990). An example of a Stage-Gate Review System is illustrated in **Figure V-2** (below).

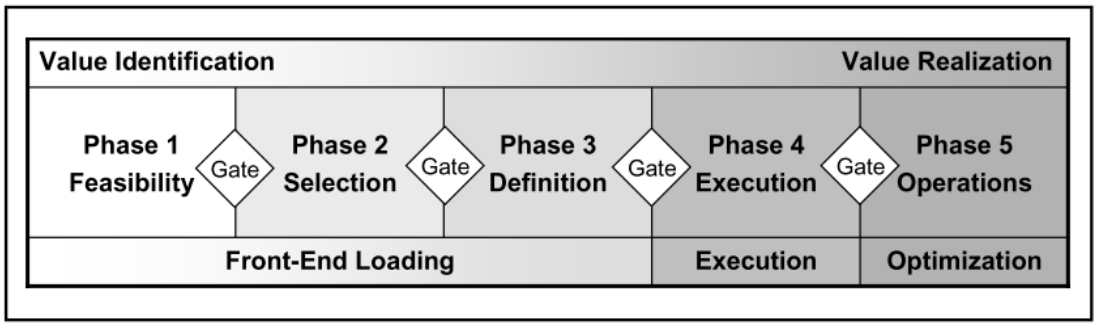


Figure V-2 – Example of a Stage-Gate Review System (Walkup & Ligon 2006)

At each gate, the project progress is reviewed by the project management team to assess the quality of execution up until each gate (Cooper, Edgett & Kleinschmidt 2002). The outcome of the review at each gate can have one of five possible outcomes (Cooper, Edgett & Kleinschmidt 2002):

- Go - Proceed to the Next Phase without Condition
- Kill - Terminate the Project
- Hold - Postpone the Start of the Next Phase
- Recycle - Redo All or Part of the Earlier Phase
- Conditional Go - Proceed to the Next Phase with Condition

The literature review finds that the use of the Stage-Gate Review System has benefited projects across different industries. Goodwin, Muir and Piasentin (2017) suggest that the use of stage gates has improved the management of oil and gas projects in Australia. Stokes (2014) indicates that using the Stage-Gate Review System has reduce the cost of oil and gas decommissioning by

at least 50% in the North Sea fields. Ajamian and Koen (2002) state that implementing stage gates has helped lower the risks for technology development projects. Pietzsch et al.'s (2009) study demonstrates that the use of the stage-gate process has improved the quality of new medical devices developed. Jang, Han and Park (2015) demonstrate that the use of a Stage-Gate Review System can minimise the risk involved for the development of a manufacturing plant. This shows that in general, using the Stage-Gate Review System can help improve the management of projects.

However, some studies indicate that there are some limitations to the Stage-Gate Review System. Szajnfarber and Weigel (2012) suggest that the application of structured processes such as the Stage-Gate Review System reduces innovation and creativity within organisations. Walkup & Ligon (2006) state that project failures continue to occur in the oil and gas sector despite applying state-of-the-art project management processes like the Stage-Gate Review System.

Appendix W – Interview Demographics

United Kingdom Interviewee Demographic

Interviewee Group	No. of Interviewees
Operator	9
Contractor / Supply Chain	9
Industry Representative Bodies	4
Regulatory Bodies	6
Public Stakeholders	2
Total:	30

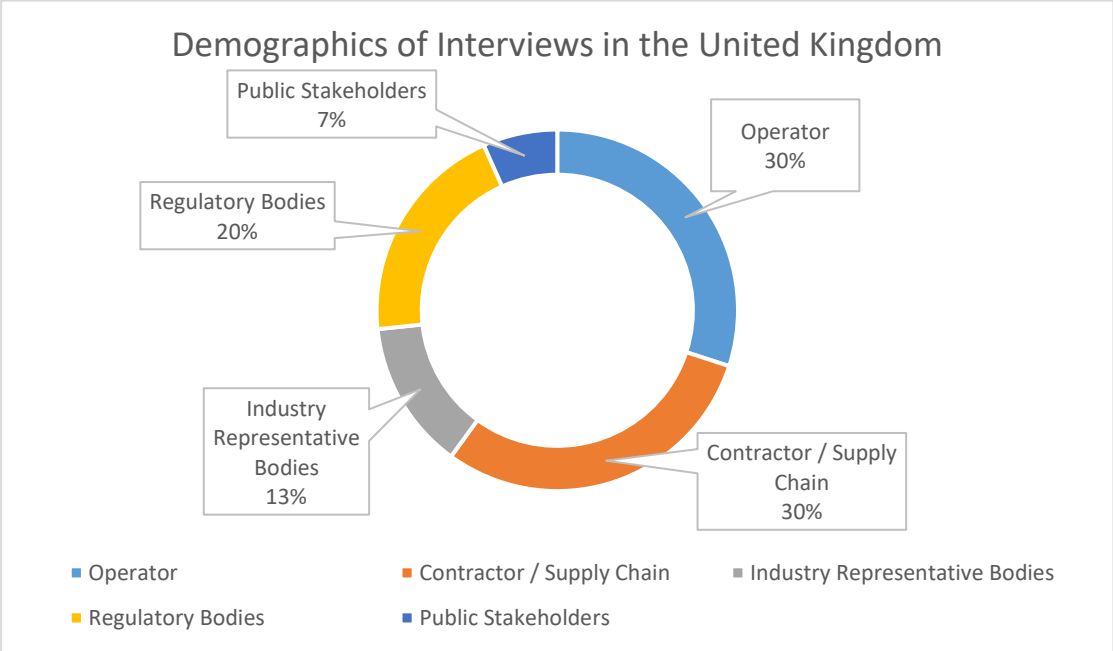


Figure W-1 – United Kingdom Interviewee Demographic

As shown in **Figure W-1** (above), a total of 30 interviewees participated in this research. The full list of interviews can be found in ***Appendix K*** (see page 683). However, as mentioned in ***Chapter 5: Research Methodology*** (see page 180), only interviewees that have experience in the management of oil and gas decommissioning projects and/or stakeholders will be asked to:

- Validate and confirm the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* deduced from the case study data.

- Obtain additional information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in secondary data.
- Obtain recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust stakeholder-oriented critical paths.

This is because interviewees with experience in the management of oil and gas decommissioning projects and/or stakeholders are more likely to be able to provide the information required to improve the initial stakeholder-oriented critical paths. As seen in **Table K-1** (see page 683) of ***Appendix K***, out of the 30 interviewees, only 22 have worked on the stakeholder-oriented critical paths.

An interesting observation from **Table K-1** (see page 683) of ***Appendix K*** is that 13 out of the 30 interviewees have acted in multiple roles within the UK decommissioning industry. For example, as seen in **Table W-1** (below), the interviewee, who is currently in a contracting role at a management consultancy, has more than 35 years' experience in different operating, contracting, and regulating roles in the oil and gas industry.

Table W-1 – An Interviewee with Experience in Multiple Roles

Type of Company	**Current Job Role**	**Date of Interview**	**Interview Duration**	**Experience in Multiple Roles**	**Worked on Critical Paths**
Management Consultancy	Consultant	Friday, 26 October 2018	75 mins	Operator, Contractor, Regulator	Yes

Such interviewees are particularly valuable because of both their cross operator-stakeholder perspectives and their ability to provide more insightful data for the research.

The Longest Interview Session in the United Kingdom

One of the most striking features of **Table K-1** (see page 683) in ***Appendix K*** is that there is an interview session that is significantly longer than the rest, totalling 195 minutes. The particular interview session, as reproduced below in **Table W-2** involves an executive management from a commercial fishing representative body in the United Kingdom.

Table W-2 – The Longest Interview Session in the United Kingdom

Type of Company	Current Job Role	Date of Interview	Interview Duration	Experience in Multiple Roles	Worked on Critical Paths
Commercial Fishing Representative Body	Executive Management	Friday, 26 October 2018	195 mins	-	No

The executive manager from the commercial fishing representative body brought the author to his office during the interview session and shared with the author the long history of cooperation between the organisation and the UK oil and gas industry. There were also several mementos in the office given to the organisation by oil and gas companies commemorating their years of cooperation. Furthermore, according to the executive manager, the commercial fishing representative body is also involved in oil and gas activities:

> *We have been heavily involved with oil and gas since the 1970s. We have a fleet of vessels that provide various services to the oil and gas operators. For example, as you can see here, our vessels can be deployed as guard vessels, for ROV [remote operated vehicle] deployment, and also to conduct environmental surveys…we are actually looking to do some debris clean-up in the future…as we have special nets that are capable or removing debris.*
>
> *– An executive manager of a commercial fishing representative body in the United Kingdom*

Overall, the finding indicates that there is stakeholder participation in oil and gas activities in the United Kingdom. It also suggests that there is some form of alliance between oil and gas companies and commercial fishing representative bodies in the United Kingdom.

Australia Interviewee Demographic

Interviewee Group	No. of Interviewees
Operator	3
Contractor / Supply Chain	4
Industry Representative Bodies	1
Regulatory Bodies	1
Public Stakeholders	1
Total:	10

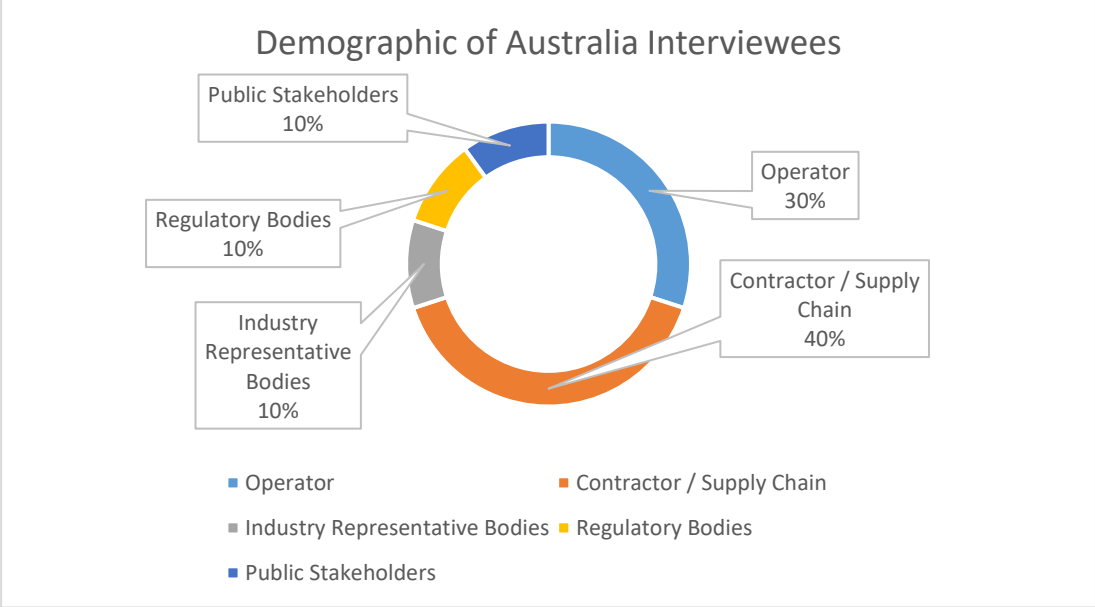


Figure W-2 – Australia Interviewee Demographic

As shown in **Figure W-2** (above), a total of 10 interviewees participated in this research. The full list of interviews can be found in ***Appendix K*** (see page 686). However, as mentioned in ***Chapter 5: Research Methodology*** (see page 180), only interviewees that have experience in the management of oil and gas decommissioning projects and/or stakeholders were asked to:

- Validate and confirm the information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* deduced from the case study data.
- Obtain additional information *(List of all project activities, duration of each activity, dependencies between activities, milestones and deliverables, stakeholder interactions, and emerging findings)* that is not recorded in secondary data.

- Obtain recommendations and ideas to improve the initial stakeholder-oriented critical paths design in order to form the robust stakeholder-oriented critical paths.

This is because interviewees with experience in the management of oil and gas decommissioning projects and/or stakeholders are more likely to be able to provide the information required to improve the initial stakeholder-oriented critical paths. As seen in **Table K-2** (see page 686) of ***Appendix K***, out of the 10 interviewees, only four have worked on the stakeholder-oriented critical paths.

In contrast to the United Kingdom, all interviewees from the operator are relatively new to their oil and gas decommissioning roles. For example, there is one interviewee who was only appointed decommissioning manager for the Asia-Pacific region in mid-2019. This suggests that Australia's oil and gas operators, in general, have less experience in oil and gas decommissioning than those in the United Kingdom.

However, the supply chain representatives appear to have an abundance of oil and gas decommissioning experiences, although most of their experiences were obtained outside Australia. For example, there is one interviewee from a lifting vessel company that has 10 years of decommissioning experiences in Malaysia, Thailand and China. There is another interviewee, who is currently working at an engineering consultancy, with more than 40 years' experience in the oil and gas industry, with decommissioning experiences in the United Kingdom and Mauritania. This suggests that there is much more oil and gas decommissioning expertise and experience in the supply chain. It could then perhaps be more advantageous for oil and gas operators to engage with the supply chain and tap into their expertise and experience when planning for oil and gas decommissioning.

The Longest Interview Session in Australia

The most striking feature from **Table K-2** (see page 686) in ***Appendix K*** is that there is an interview session significantly longer than the rest, totalling 240 minutes. The particular interview session, as reproduced below in **Table 7-12** involves a semi-retired engineering consultant with more than 40 years' experience in the oil and gas industry globally.

Table W-3 – The Longest Interview Session in Australia

Type of Company	Current Job Role	Date of Interview	Interview Duration	Experience in Multiple Roles	Worked on Critical Paths
Engineering Consultancy	Consultant	Tuesday, 15 October 2019	240 mins	Operator, Contractor	Yes

The engineering consultant was extremely keen to work on the stakeholder-oriented critical paths, provide valuable insight into current affairs in the oil and gas industry, and even provide recommendations for structuring and formatting of the thesis itself. It must be noted that saturation on the Australian stakeholder-oriented critical path was achieved after this particularly interview session. The author is therefore extremely grateful for the valuable assistance provided by this engineering consultant.

Appendix X – Detailed Analysis of the Stakeholder-Oriented Critical Paths

United Kingdom - Cluster No. 1 – Late-Life and Decommissioning Philosophy and Strategy

The critical points in this cluster relates to the process of developing late-life and decommissioning philosophy and strategy for the oil and gas facility. The key stakeholders involved in this cluster of critical points include:

- The Project Management Team
- The Top Management Team
- Joint Venture Partners
- The Oil and Gas Authority
- Other Oil and Gas Operators
- The Supply Chain

Figure X-1 (below) illustrates the stakeholder interactions that occur related to the development of a late-life and decommissioning philosophy and strategy.

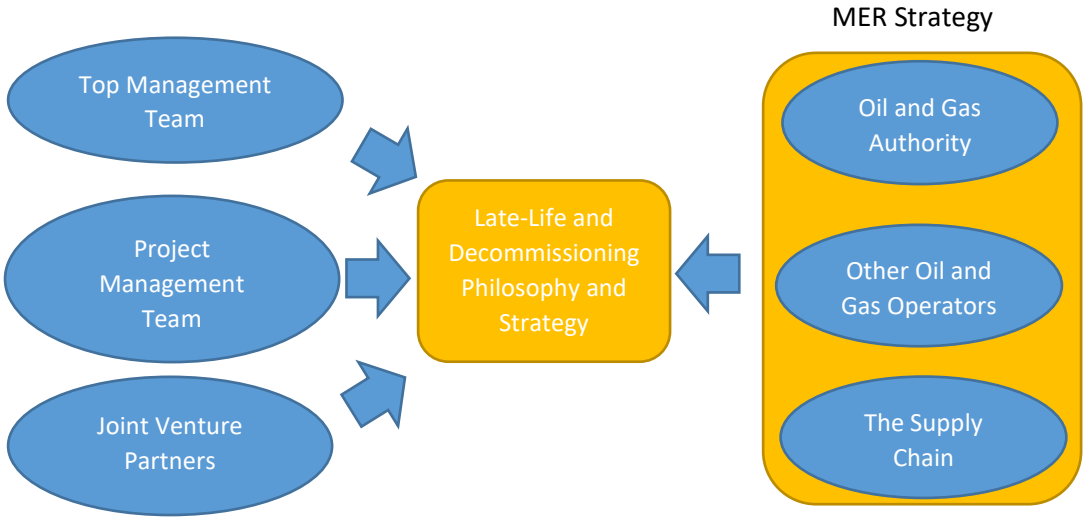


Figure X-1 – Stakeholder Interactions relating to the Development of a Late-Life and Decommissioning Philosophy and Strategy

As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 120), the MER Strategy places additional regulatory obligations on the oil and gas operators (Gordon, Paterson & Usenmez 2018a). From **Figure 8-4** (above), it can be seen that these additional MER Strategy obligations introduce additional stakeholder interactions when it comes to the development of a late-life and decommissioning philosophy and strategy.

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 85), projects and organisations with a higher number of different stakeholder groups can be difficult to manage (Ackermann & Eden 2011; Eskerod & Jepsen 2013). This suggests that policy makers should consider the challenges of stakeholder management when designing and implementing policies.

Misinterpretation of Decommissioning Strategy

One of the most intense interactions during an oil and gas decommissioning project or programme is the interaction between project management teams and top management teams when developing and the late-life and decommissioning philosophy and strategy for the oil and gas facility. While this interaction was only mentioned by 56% of interviewees representing the UK oil and gas decommissioning landscape, the interactions were mentioned to be intense and sometimes heated.

One reason for the intensity of this interaction, according to a former compliance manager with more than 40 years' experience in the oil and gas industry, is due to the misinterpretation of the decommissioning strategy by the project management team when executing the strategy. According to the former compliance manager with more than 40 years of experience in the oil and gas industry:

> *Developing a strategy is very easy. Executing that strategy in a proper way you need to be sensible. It is not difficult.*
>
> *When I initially consulted with the regulators. My initial intent was to divide the Brent decommissioning programme into 1) What we know – which included both topsides, the sub-structures, pipelines, and 2) What we don't know – which is purely the cell contents, because Shell have a very poor record of what went into the storage cells on the Brents.*
>
> *What happened is that someone in Shell misinterpreted the strategy that I wrote and in subsequent negotiation with the regulators, it was eventually split it into topsides, and sub-structure instead.*
>
> *– A former compliance manager with more than 40 years' experience in the oil and gas industry*

According to Shell (2017d), the rationale for the decision to split the Brent decommissioning programme into topside and substructure was to provide flexibility to the project schedule, allowing the topsides of the Brent platforms to be removed while the substructures go through the derogation application process with OSPAR. This means that the main reason for the decision to split the Brent decommissioning programme into topside and substructure, was to improve the management of the project schedule.

However, according to a former decommissioning manager with 40 years of experience in the oil and gas industry, decisions made by the project management team during the execution of the decommissioning strategy can have an impact on future stakeholder interactions further down the stakeholder-oriented critical path:

> *If the topsides were still kept in place, they [Shell] would have kept more options on how to clean up the gravity base cells. It was a cynical move to remove some of the options for cleaning up the cells.*
>
> *– A former decommissioning manager with 40 years' experience in the oil and gas industry*

This suggests that the interactions between Shell and Germany, the Netherlands, and Greenpeace in late 2019 regarding the gravity-based cells (Thomas 2019), was primarily due to the misinterpretation of the decommissioning strategy by the project management team when executing the strategy.

A way to mitigate misinterpretation of the decommissioning strategy by the project management team, according to three interviewees from the United Kingdom is to have a smaller decommissioning team. According to a former decommissioning manager with 40 years' experience in the oil and gas industry:

> *Large mammoth organisations just don't work for decommissioning…they are not efficient…it is better to have a small team, with each of them responsible for a big patch, than a large team, but each of them responsible for a small patch.*
>
> *– A former decommissioning manager with 40 years' experience in the oil and gas industry*

The idea of having a small decommissioning team was also supported by three interviewees representing the UK supply chain. According to an engineering contractor with 30 years' experience in the UK oil and gas industry:

> *Operators are having too big a team for decommissioning…Their policies and procedures are all geared towards the exploration and production phase, where you have big teams working the projects…For decommissioning, you don't need a big team, you only need four people maximum in the operator to run a decommissioning project.*
>
> *– An engineering contractor with 30 years' experience in the UK oil and gas industry*

The findings suggest that current best practice to prevent misinterpretation of the decommissioning strategy is to have smaller decommissioning teams. According to Hoegl (2005), smaller project teams result in better teamwork. It is possible, then, that having a smaller decommissioning team can improve the management of the oil and gas decommissioning project or programme.

An alternative solution is to host decommissioning strategy workshops with the decommissioning team prior to execution. Such workshops can foster more communication among the team members, and create opportunities for the clarification of doubts. Decommissioning strategy workshops can hence be useful to ensure that team members are absolutely clear about the decommissioning strategy prior to execution. These approaches to the prevention of misinterpretation of decommissioning strategy are illustrated in **Figure X-2** (below).

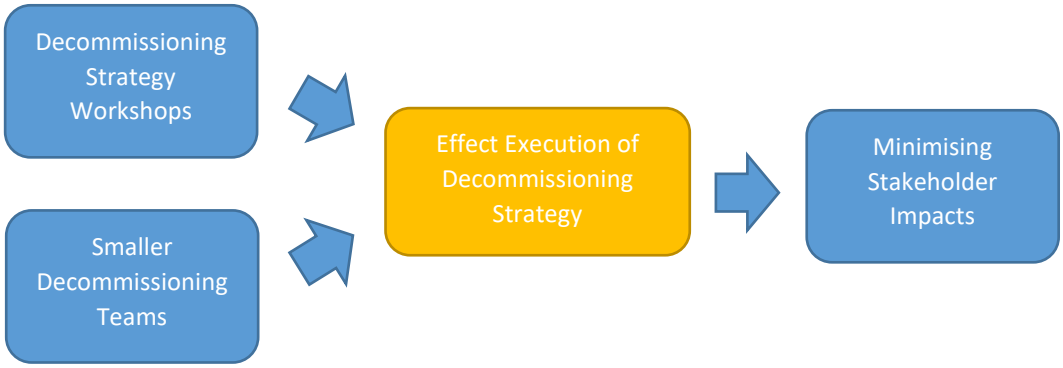


Figure X-2 – Minimising Stakeholder Impacts by Preventing Misinterpretation of Decommissioning Strategy

Philosophical Differences regarding Stakeholder Engagement

Another reason for the intense interactions between project management teams and top management teams when developing the late-life and decommissioning philosophy and strategy for an oil and gas facility is, according to five interviewees representing the UK oil and gas decommissioning landscape, the philosophical differences between the stakeholder manager and the top management team with regard to stakeholder engagement. According to a former decommissioning manager with 40 years' experience in the oil and gas industry:

> *To them, external relations, stakeholder engagement was about investor relations. It was about keeping financial organisation sweet. So the thought of us roaming around Europe talking with all sorts of people, stirring up a hornet's nest about decommissioning was just greeted with such alarm. And our CEO, was on the top of that list.*
>
> *– A former decommissioning manager with 40 years' experience in the oil and gas industry*

This finding suggests that top management teams in oil and gas organisations tend to prioritise investors (i.e. shareholders) over stakeholders. As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 80), there is a debate between the stakeholder theory, developed by Freeman (1984), and the shareholder theory, developed by Friedman (1962). This finding suggests that the debate between stakeholder theory and shareholder theory is perhaps still ongoing today.

When questioned further on the reason for the phenomenon of top management teams prioritising shareholders over stakeholders, all five interviewees stated that it is because of corporate culture and processes. According to a stakeholder manager with 10 years' experience in the oil and gas industry:

Unfortunately, it is not the typical culture of the oil and gas industry to reach out and engage, they generally keep their heads below the parapet, and so it is quite a difficult experience for many operators to go through to go out and tell people what they are doing and invite their responses.

– A stakeholder manager with 10 years' experience in the oil and gas industry

One possible action that can be taken in an attempt to resolve the interaction between the stakeholder manager and top management team, according to two interviewees representing oil and gas operators in the United Kingdom, is to:

Keep these managements informed throughout the project.

That is one of our stakeholders we identified – Management in Bartlesville. "How do we manage them? What do we keep them informed with? When do we tell them?" And we have a stakeholder relations guy in place just to liaise with our senior management.

– A former decommissioning manager with 40 years' experience in the oil and gas industry

This suggests that constantly keeping the top management team informed throughout the progress of the stakeholder engagement process is current best practice to manage top management teams.

An interesting finding in this research is that oil and gas decommissioning projects or programmes, with stakeholder managers that stick with their own stakeholder engagement philosophies instead of conforming to corporate culture and processes, tend to be the ones that are more successful when it comes to stakeholder engagement. The Maureen and Murchison decommissioning cases are the two prime examples. Maureen was awarded the Institute of Petroleum and IChemE award for Excellence in Project Communications in 2003, while Murchison is now regarded as the textbook case for stakeholder engagement in the UK oil and gas decommissioning landscape, according to a stakeholder manager with 10 years' experience in the oil and gas industry.

Overall, this suggests that a philosophical change by members of top management teams towards embracing stakeholder engagement could

perhaps be beneficial for the success of the organisation, as illustrated in **Figure X-3** (below).

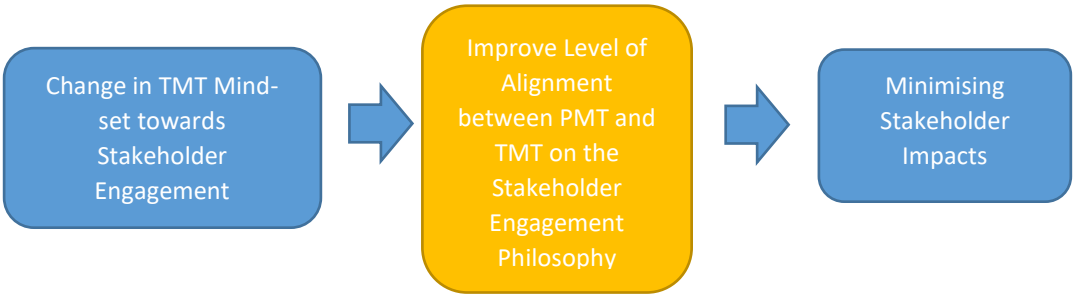


Figure X-3 – Minimising Stakeholder Impacts by Improving the Level of Alignment between PMT (Project Management Team) and TMT (Top Management Team) on the Stakeholder Engagement Philosophy

Competent Joint-Venture Partners

Another one of the most intense interactions, as mentioned by three interviewees, is the interaction between joint-venture partners regarding the decommissioning plan. The existence of interactions among joint-venture partners on the decommissioning plan, is also evident in the recent English high court case: *TAQA Bratani Ltd and Others v RockRose UKCS8 LLC [2020] EWHC 58 (Commercial)*, where joint-venture partners *TAQA Bratani Ltd and Others* refused to accept the proposed decommissioning plan which gave *RockRose UKCS8 LLC* the status of main operator for the decommissioning of the Brae field. According to a project manager with 40 years' experience in the UK and Norwegian oil and gas industries:

> *The owners are the most impactful, and that is not necessarily the operator. In my experience the owners are the most impactful. And why is that? Because they got competence of knowledge, and they got an interest in it… An example that I would give you is that Shell and ExxonMobil did not agree on how Brent should be decommissioned.*
>
> *– A project manager with 40 years' experience in the UK and Norwegian oil and gas industry*

This suggests that the higher the level of knowledge of the stakeholder, the more influential and impactful the stakeholder will be on the project or programme. When questioned on best practices to resolve the interactions, all three interviewees stated that it is very difficult, which suggests that current

best practice may not be effective. According to a project manager with 40 years' experience in the UK and Norwegian oil and gas industries:

> *It is difficult…ExxonMobil and Shell worked pretty hard within the joint-venture to consider the alternatives, make changes, optimise, and try to align with each other. If Shell had been on their own, Brent would have been decommissioned in a completely different way to how it is being done today. Operating partners are the most influential, if they do their job well.*
>
> *– A project manager with 40 years' experience in UK and Norwegian oil and gas industries*

It is interesting that the project manager with 40 years' experience in the UK and Norwegian oil and gas industries added the additional sentence at the end of the response to the question, which suggests that there are instances where things did not work out even when working hard to improve the extent of alignment among joint-venture partners on the decommissioning plan, as illustrated in **Figure X-4** (below).

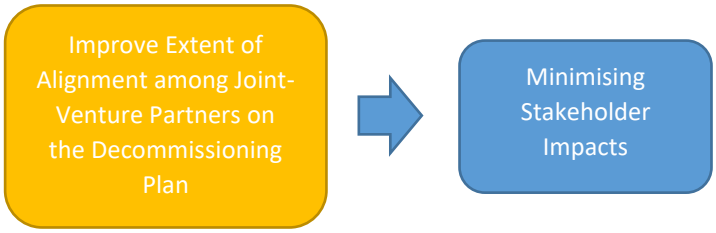


Figure X-4 – Minimising Stakeholder Impacts by Improving Extent of Alignment among Joint-Venture Partners on the Decommissioning Plan

Engaging the OGA for Agreement on Cessation of Production

Of interviewees representing the United Kingdom oil and gas decommissioning landscape, 93% of them mentioned that there are interactions between the oil and gas operator and the OGA (Oil and Gas Authority) to discuss and agree on a CoP (cessation of production) date. This suggests that the interaction between oil and gas operators and the OGA is perhaps one of the most talked-about interaction among the oil and gas decommissioning community. According to the former project manager with 36 years' experience in managing oil and gas decommissioning projects and programmes globally:

> *You will need OGA on your side. They [OGA] don't approve the decommissioning programme, but they [OGA] will make life very difficult for you if they [OGA] don't agree with what you are doing when it comes to cessation of production and MER…….It is BEIS that approves the decommissioning programme itself, but the permission to stop production must come from the OGA.*
>
> *– A former project manager with 36 years' experience in managing oil and gas decommissioning projects and programmes globally*

As mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths*** (see page 332), the right time to start well plugging and abandonment (i.e. the schedule of the project or programme) is determined by the CoP date. Also, as mentioned in ***Chapter 7: Development of Stakeholder-Oriented Critical Paths*** (see page 329), the CoP date is used as a reference point for identifying potential synergies between different oil and gas decommissioning projects or programmes. As the OGA has the power to influence the CoP date, this suggests that OGA can potentially have a significant impact on the overall cost, schedule, and scope of the oil and gas decommissioning project or programme.

Current best practice to prevent negative impact and influence of the OGA on the cost, schedule, and scope of an oil and gas decommissioning project or programme, as mentioned by eight interviewees, is to plan ahead and start the regulatory engagement with the OGA early, ideally six years prior to CoP. According to a representative from the OGA with 34 years' experience in the oil and gas industry:

If you want to be a good operator, you start thinking well ahead. We want you to think about your field well before you decommission, so that you will be able to identify based on the current information, this field is going to CoP in six years' time, and then you start to put things in place, including coming to us with your forecast, and your proposal, sooner rather than later, and then we will grant you a not before date.

– A representative from the OGA with 34 years' experience in the oil and gas industry

Early engagement with regulators has been mentioned in the literature to be a best practice for oil and gas exploration projects and programmes (Cahuzac 2014; Genter 2019). This suggests that current best practices for regulatory engagement for oil and gas decommissioning took guidance from past regulatory engagement experiences for oil and gas exploration.

An interesting finding from the regulator is that the OGA appears to be flexible rather than a "regulator with teeth". According to a representative from the OGA with 34 years' experience in the oil and gas industry:

If it is not economic, it is not economic. The regulator would not tell an operator to continue production if they are losing money….And of course the expectation of six years, but it is not a rule…If the world oil price drops from 100 to 10 dollars a barrel, economics will change you would just have to come back to the OGA to reassess it.

And in the fields sometimes things change pretty quick and fields get close in, for example the production performance, all of a can sudden be very different, or a well with an ESP[25] has failed, and to replace an ESP in a subsea well is so expensive, I doesn't make sense to do it anymore, and then the field is close in without a CoP, but the OGA won't tell them not to do it.

– A representative from the OGA with 34 years' experience in the oil and gas industry

[25] Electric Submersible Pump (ESP) is an item of downhole equipment used to facilitate the production of hydrocarbon from the subsurface to the surface environment.

This finding suggests that there is perhaps some alignment between the oil and gas operators and the OGA when it comes to the rationale for ceasing production of the oil and gas facility. From a regulatory perspective, this finding suggests that a prescriptive regulation on the timing of engagements is not practical. It could perhaps be worthwhile to consider having a new regulator (OGA) that is staffed as much by ex-industry people as by former civil servants in order to improve the extent of alignment between the OGA and oil and gas operators.

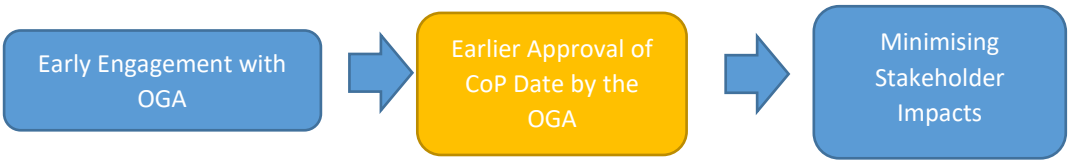


Figure X-5 – Minimising Stakeholder Impacts by Earlier Approval of Cessation of Production Date by the Oil and Gas Authority

Fulfilling MER Obligations by Seeking Collaboration with Industry

Of the interviewees representing the UK oil and gas decommissioning landscape, 83% of them mentioned that there are interactions between oil and gas operators and the wider oil and gas decommissioning industry (i.e. other oil and gas operators and the supply chain), in order to identify opportunities for collaboration. This suggests that the interaction among oil and gas operators and the supply chain is perhaps one of the most talked-about interactions in the oil and gas decommissioning community. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

> *In the UK at least, there is an obligation placed on operators to minimise the cost and to look for opportunities to collaborate with other operators and contractors.*
>
> *– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

This suggests that the primary reason for the interactions among oil and gas operators and contractors in the oil and gas decommissioning landscape is the presence of the MER Strategy, which means that regulations and guidelines do indeed have an influence on how stakeholders are being managed by oil and gas operators.

Current best practice for managing other oil and gas operators and the supply chain regarding meeting MER obligations, as indicated by 14 interviewees representing oil and gas operators and the supply chain in the United Kingdom, is early engagement. According to a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

> *To me the trick is early engagement…early engagement with collaborative operators…and early engagement with supply chain members that have actually managed large multi-year infrastructure projects rather than oil and gas projects.*
>
> *– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally*

The main rationale for the decision to engage other oil and gas operators and the supply chain early, as mentioned by 10 interviewees, is to increase the chance of co-creating more effective decommissioning solutions with other oil and gas operators and contractors. For example, a current well contractor noted that early engagement can result in a more cost-effective decommissioning solution:

> *If I am thinking of needing a heavy lifter three years' time. Well let's go and talk to Heerema or Allseas and all the heavy lifters and say:*
>
> *"What's your availability like three years' time?"*
>
> *"Oh, we are looking busy"*
>
> *'Okay, so do I need to book a slot? Do I need to book a vessel now or I'll miss out?"…*
>
> *Or maybe they will say: "Nobody has committed to anything, we do not have any work"*
>
> *"Okay, would you do me a deal?"*
>
> *"Tell you what, if you sign me up now, I will do you a great deal for half the cost."*
>
> *"Oh, that might be worth doing."*
>
> *And now have a better deal to remove your platform.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

Another interesting finding when analysing the interview data, is that the word "collaboration" appears to have different meanings. For some interviewees, "collaboration" appears to mean aggregation of project scope. For other interviewees, "collaboration" appears to mean sharing of information. As discussed by a former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally:

Collaboration…with other operators might not be in work execution, it might be in knowledge sharing…collaboration still takes place even if you aren't aggregating the scope.

– A former project manager with 36 years' experience of managing oil and gas decommissioning projects and programmes globally

As the main rationale is to co-create decommissioning solutions with stakeholders, it could perhaps be better for future industry literature to use the phrase "co-creation of effective decommissioning solutions" rather than the word "collaboration", in order to be more specific regarding the rationale for engaging other oil and gas operators and contractors when developing a late-life and decommissioning philosophy and strategy.

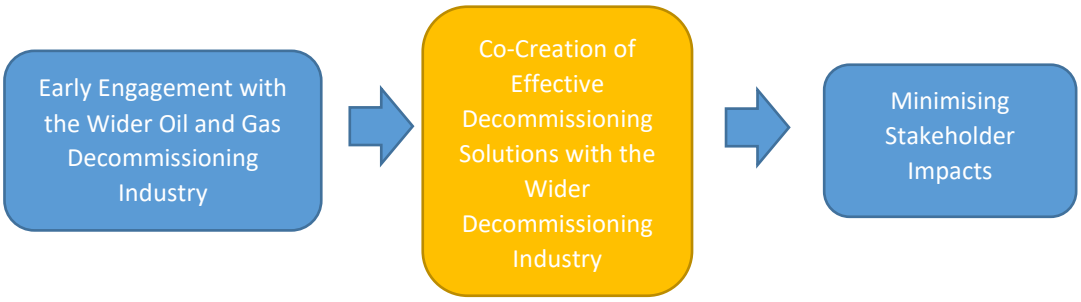


Figure X-6 – Minimising Stakeholder Impacts by Co-Creating Effective Decommissioning Solutions with the Wider Decommissioning Industry

United Kingdom - Cluster No. 2 – Comparative Assessment Period

The critical points in this cluster relate to the process of conducting the CA (Comparative Assessment) to determine the precise decommissioning option to decommission the facility. The key stakeholders involved in this cluster of critical points include:

- BEIS (The Department of Business, Energy and Industrial Strategy)
- The Supply Chain
- Commercial Fishing Stakeholders
- Environmental Stakeholders
- Academia and Other Research Institutions

Figure X-7 (below) illustrates the stakeholder interactions related to the CA process:

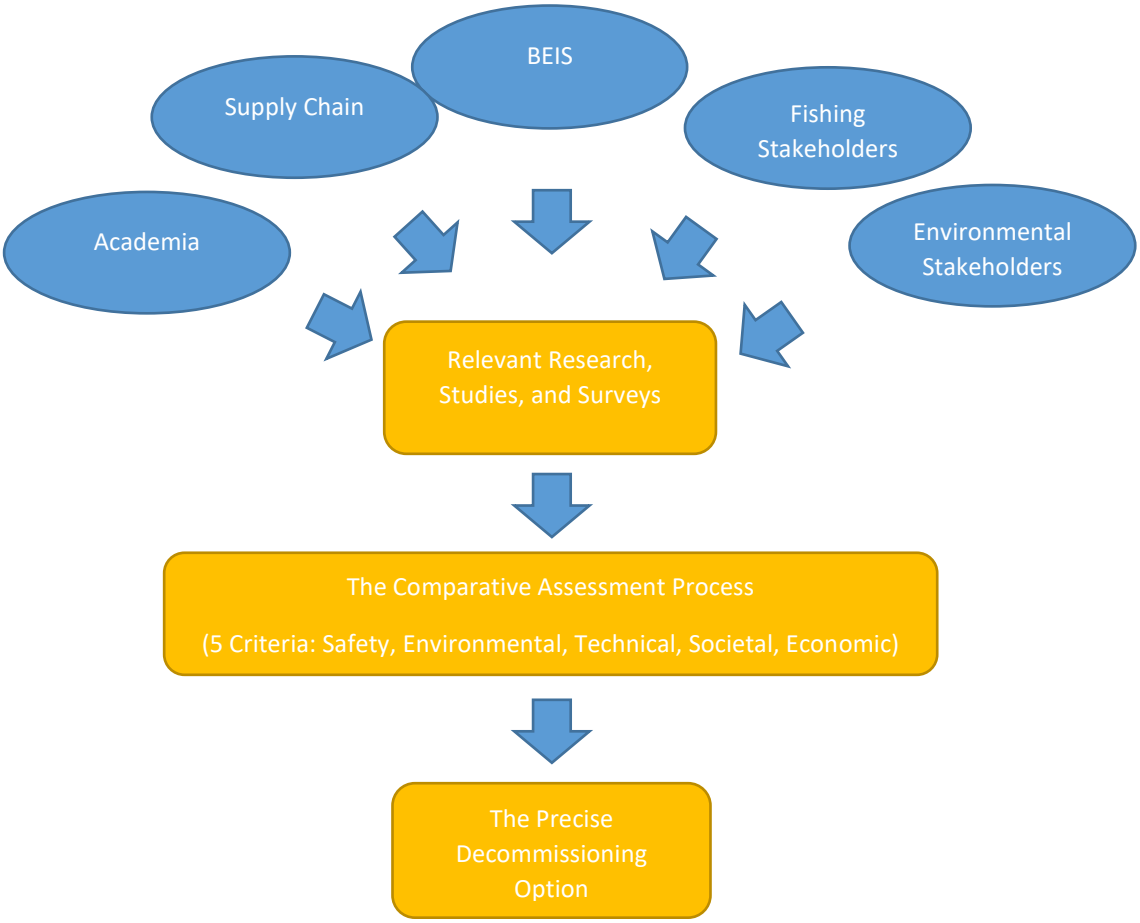


Figure X-7 – Stakeholder Interactions relating to the Comparative Assessment Process

Uncertainties with the Expectation of BEIS

Of the interviewees from the UK oil and gas decommissioning landscape, 50% of them mentioned the existence of interactions between the oil and gas operator and BEIS during the planning and production of the decommissioning proposal. As mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 123), specifically in Stage 2 of the Decommissioning Programme Process, the CA is part of the decommissioning proposal. According to a regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom:

> *Basically, how it works is that they don't just come in and submit the decommissioning programme (i.e. decommissioning proposal). We work with them from when they actually cease production, to agree on the decommissioning programme [i.e. decommissioning proposal] from the start. We go through a couple of drafts generally… If they have a pipeline, they have to do a Comparative Assessment…or if it needed a high level of monitoring, then that part of the Comparative Assessment process.*
>
> *– A regulator with 15 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

This suggests that BEIS is influential on decisions made by oil and gas operators regarding the planning and production of the decommissioning proposal, including the CA process. As mentioned in ***Chapter 6: Case Studies of Past Oil and Gas Decommissioning Projects*** (see page 246), a change in the sub-criteria or weightings in the CA can have an influence on the outcome of the comparative process. This means BEIS should be careful about how their actions impact oil and gas operator's decisions when it comes to the CA process.

According to nine interviewees representing oil and gas operators and contractors in the United Kingdom, the main reason for the interactions between oil and gas operators and BEIS regarding the planning and production of the decommissioning proposal, is that oil and gas operators themselves are unsure about the expectations of BEIS when it comes to the decommissioning proposal contents. According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

It is to understand what I need to do. What is the regulators expectation? What do they want to see? What kind of studies do they want to see to underpin my justification for doing something?

Otherwise I will turn up with my draft programme and say: "Here you go, I've got my draft programme here, this is a great idea."

And then they will say, "Where is the studies and justification? Well off you go, come back in a year's time."

Well that is 50 million for you. It is not 50 million to go for the study, it is 50 million for the asset to sit out there while I go and do my study.

– A current well contractor with more than 30 years' experience in multiple operating and contracting roles

This finding suggests that the level of stakeholder interactions increases when there is less certainty regarding the expectations of stakeholders.

With regard to best practice, 10 interviewees representing oil and gas operators, contractors, and regulators in the United Kingdom mentioned early engagement. Viewing this finding in the light of best practice in engaging the OGA, it can be said that best practice for engaging regulator stakeholders, in general, is to engage them early.

From a regulatory perspective, this finding supports the work of Beckstead (2018), which suggests that a clear regulatory framework is more beneficial. A clear regulatory framework can improve oil and gas operators' understanding of the expectations of regulators, hence enabling them to better plan and manage their portfolios in accordance with the regulator's expectation (Beckstead 2018). A possible solution to improve oil and gas operators' understanding of regulatory expectations, as suggested by a decommissioning engineering manager with 20 years' experience in the UK oil and gas industry, is to:

Standardise the Comparative Assessment process…All the data should be requested in the same format to allow the approval process and to be quicker. And this will also enable the stakeholders to be able to see how similar the area is with another area for example.

– A decommissioning engineering manager with 20 years' experience in the UK oil and gas industry

The idea of a standardised CA process is also supported by two interviewees representing the UK supply chain. According to a current well contractor with more than 30 years' experience multiple operating and contracting roles:

You could use that to ensure some form of good practice or best practice is being used by everybody. It would make it easier for the regulator to be able to monitor what people are doing and demonstrate that they are doing the right thing as the representative of the people.

– A current well contractor with more than 30 years' experience in multiple operating and contracting roles

This suggests that regulators could perhaps consider standardising the data format for each of the criteria and sub-criteria of the CA process. For example, when assessing the impact of decommissioning on commercial fishing stakeholders, one possible data format for the criteria that can be fixed is fishing hours per year. Similarly, when assessing the impact of decommissioning on transport and shipping companies, one possible data format that can be fixed is vessels per year.

One possible avenue that can be explored in the future is to input all the CA data can be input into a machine learning algorithm. The machine learning algorithm can then use the dataset to predict the outcome of the individual studies and surveys. This may eliminate the need for unnecessary studies and surveys to be commissioned in order to inform the CA process, hence reducing the overall cost of decommissioning. However, according to Lantz (2013) there is a need for the inputted data to be in the same format for machine learning to work. This suggests that having a fixed data format can be beneficial for oil and gas decommissioning if the oil and gas industry wants to explore this avenue in the future.

Figure X-8 – Minimising Stakeholder Impacts by Improving the Understanding of the Expectation of BEIS on the Decommissioning Proposal Contents

Missing Out due to Late Engagement with the Supply Chain

Another interaction that was mentioned is the interaction between the oil and gas operator and the supply chain when it comes to the assessment of decommissioning options. This interaction was mentioned by 14 interviewees representing oil and gas operators and contractors from the UK oil and gas decommissioning landscape.

The main reason for the interaction, as mentioned by all 14 interviewees, is that the supply chain was engaged too late during the CA process. According to a vice-president of decommissioning with 25 years' experience in the UK oil and gas industry:

> *In the most general terms, a little too late, to be honest…*
>
> *I'll give you an example on a subsea satellite decommissioning project that I was involved in. The operator, not to be named, wanted to use divers to connect the injection pipelines to 30 subsea wells.*
>
> *But we actually found a much better way of doing it, which is to have a single water injection pipeline from the platform, and by doing it that way, the divers are not actually needed.*
>
> *What happened was because the operators were too scared to talk to their board again, and they stick to their diver method. And eventually spend an additional 10 million pounds to do the diver method.*
>
> *- A vice-president of decommissioning with 25 years' experience in the UK oil and gas industry*

This suggests that the supply chain can have the potential to positively influence and impact an oil and gas decommissioning project or programme. Therefore, it would actually be beneficial for oil and gas operators to engage the supply chain early, in order to maximise the positive influence and impact of the supply chain on the oil and gas decommissioning project or programme.

Current best practice to minimise interactions between the oil and gas operators and the supply chain during the Comparative Assessment Period, according to 14 interviewees representing oil and gas operators and the supply chain in the United Kingdom, is to engage the supply chain early on in the oil and gas decommissioning lifecycle, specifically when seeking opportunities for collaboration. This suggests that interactions between the oil and gas operators and the supply chain earlier on in the oil and gas decommissioning lifecycle, specifically when seeking opportunities for collaboration, can have an impact on the interactions between oil and gas operators and the supply chain during the assessment of decommissioning options.

Interactions regarding Maximising Local Content

Another reason for the interaction between oil and gas operators and the supply chain, as mentioned by six interviewees representing oil and gas operators and the supply chain in the UK landscape, is related to the issue of maximising local content. According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

> *One of the big issues in the UK is how little profits that is made from the work that is done here is actually UK companies. So, the rigs are half the cost of the wells. The heavy lift vessels are more than half the cost of removal. Half of the cost of the subsea removal is the vessels. Who owns the rigs? Who owns the heavy lift vessels? Who owns the ships? Not British companies. So, all the profit that is associated with that [decommissioning] are leaving the country.*
>
> *– A current well contractor with more than 30 years' experience in multiple operating and contracting roles*

Three interviewees representing oil and gas operators in the United Kingdom stated that there is no incentive to maximise local content if it is cheaper to decommission the oil and gas facilities using foreign-based contractors. This suggests that current best practice is to treat the views of the supply chain as "noise" when it comes to maximising local content.

However, governments might want to consider implementing measures to retain profits from oil and gas within their own country. From an economics point of view, maximising local content can be favourable as it minimises spending on imported goods and services, hence promoting a healthier economic growth, *ceteris paribus* (Rode & Coll 2012; Blanchard & Fischer 1989). According to a current well contractor with more than 30 years' experience in multiple operating and contracting roles:

In Malaysia for example, there is a preference for Malaysian contractors. Why not? It is your country, it is your assets, yeah. I have no problem with that at all.

Norway does it a little bit differently, but it ends up with the same result. Norwegian contractors do an awful lot of work in Norway. What a surprise. Why doesn't Britain do that? It is politics. But there is a case to say that that should be considered.

I think while we are currently in the EU[26], it is illegal for us to differentiate between British companies and European companies. So, it is a bit difficult. But if we leave the EU, actually that will be a possibility.

– A current well contractor with more than 30 years' experience in multiple operating and contracting roles

This finding suggests that political changes can also have an impact on oil and gas decommissioning decisions, highlighting an opportunity for future academic research to explore the impact of political changes on oil and gas decommissioning decisions. The impact of Brexit[27] on oil and gas decommissioning activities is a possible starting point considering the increase in the amount of literature on this topic (Cairney et al. 2019; Gehring & Phillips 2019; LaMaster & Hammerson 2016).

[26] Note that this interview was conducted in 2018, prior to the departure of the United Kingdom from the European Union at 11pm GMT 31 January 2020.
[27] Brexit is the withdrawal of the United Kingdom from the European Union. Following a UK-wide referendum in June 2016 (Cairney et al. 2019; Gehring & Phillips 2019)

Engaging Commercial Fishing Stakeholders

Of the interviewees representing the UK oil and gas decommissioning landscape, 83% of them mentioned that there are interactions between oil and gas operators and commercial fishing stakeholders during the CA (Comparative Assessment) Period, primarily to discuss the impact on the safety of fishermen, so that the information can be included in the CA. This finding suggests that the primary concern of commercial fishing stakeholders in the United Kingdom is more for the safety of the fishermen than for the fish stock.

This finding also appears to be in contrast to the behaviour of commercial fishing stakeholders in the Gulf of Mexico, where commercial fishermen are welcoming to the idea of Rigs-to-Reefs because of the commercial benefits from the increase in fish stock (Kaiser, Shively & Shipley 2020; Ajemian et al. 2015). This suggests that the same stakeholder group can have different priorities in different locations.

With regard to best practice, seven interviewees representing oil and gas operators in the United Kingdom, stated that best practice is to be honest with the fishermen regarding the cost involved in decommissioning the oil and gas facility. This finding supports the findings from works such as McManus et al. (2006) and Bandsuch, Pate and Thies (2008), which suggest that transparency is an important factor in influencing the extent of trust, and thus the effectiveness of stakeholder management.

Perhaps one of the most interesting findings, based on the interview with a representative of commercial fishing stakeholders, is that commercial fishermen’s organisations are commercially involved in the oil and gas industry. According to a representative from one of the fishermen’s organisations:

We have very good relations with the oil and gas operators. We have been heavily involved with oil and gas since the 1970s. Guard watch, ROV [remotely operated vehicle] deployment, and environmental surveys are some oil and gas duties that are currently being done by us. There is also a possibility of doing some debris clean-up for decommissioning in the future because we have nets that are capable of removing debris

– A representative from a commercial fishermen's organisation in the United Kingdom

A revisit to industry literature finds that the SFF (Scottish Fishermen Federation), for example, has a subsidiary company called Marine Environmental Solutions Limited[28], which provides seabed clearance services for oil and gas decommissioning (SFF 2019). This suggests that perhaps there is some form of alliance between the oil and gas industry and commercial fishing stakeholders in the United Kingdom.

Figure X-9 – Minimising Stakeholder Impacts by Improving Extent of Trust between the Oil and Gas Operators and Commercial Fishing Stakeholders

[28] Marine Environmental Solutions Limited (MES) is a subsidiary of SFF Services Limited which has been delivering environmental services to the offshore industries for +30 years. http://www.mar-env-sol.com/

Engaging Environmental NGOs

It is of note that, given the significant impact eNGOs (environmental non-governmental organisations) had on the Brent Spar decommissioning project, the eNGOs were not mentioned as much as the fishermen as being an impactful and influential stakeholder (Elkington & Trisoglio 1996; Zyglidopoulos 2002). Only a total of three interviewees, 10% of all interviewees in the UK oil and gas decommissioning landscape, mentioned interactions with eNGOs. For the three interviewees, the projects they were involved in all had gravity-based structures, which suggests that stakeholder interactions differ depending on the type of oil and gas facility.

The primary reason given by the three interviewees for the interaction was dissatisfaction by the eNGOs regarding the scientific evidence used to assess the environmental aspect of the CA. According to a decommissioning engineer with 17 years' experience in the UK oil and gas industry:

> *I would say the largest stakeholder is the NGOs, they have one of the biggest impacts on decommissioning projects.*
>
> *There was one instant where we needed to put the gravity-based cells in place, because it is technically not safe and difficult to access the cells under 100-130 metres of water.*
>
> *We know that there are hydrocarbons inside the cells but we have little evidence on what is actually inside the cells. The regulatory says okay, we understand the difficulty in removing the cells, we are okay that it will be left in place.*
>
> *But the NGOs however, demanded more evidence to prove what will be left in place.*
>
> *So, we just finished the first survey, and sure enough the result was not as what we were expected to be inside the cells, and there are 75 cells.*
>
> *– A decommissioning engineer with 17 years' experience in the UK oil and gas industry*

With regard to best practice in managing eNGOs, all three interviewees agreed that the scientific evidence is the most important factor. However, scientific evidence can sometimes be difficult to obtain, as evident by the difficulties faced by Shell in obtaining samples from the concrete gravity-based storage cells of the Brent platforms (Shepherd et al. 2017).

In the event where scientific evidence is difficult to obtain, a former decommissioning manager with 40 years' experience in the oil and gas industry suggested that co-creation of knowledge with eNGOs is an effective solution, as evident by the Maureen decommissioning case:

> *Our most contentious thing was that we need to cut to remove the template, which is a large steel structure, which fishermen didn't like, or want to be able to trawl over. We had to remove it, and to do that, we have to disturb the drill cuttings.*
>
> *At first, Greenpeace said: "You will not disturb the drill cuttings, you will not do this, because you will be putting into the water column pollutants that you cannot at this stage identify as satisfactory, because the technology was not there to do deep coring, to get into the middle of the pile, it will only do surface coring. But the surface of the drill cuttings have already been remediated naturally by a certain extent." So, it went on and on…*
>
> *So we said, "You agree that we have to the template out yes?"…"But we still have a problem, what happens to these drill cuttings?"*
>
> *So we [Phillips and Greenpeace] agreed on a limited basis, because it is a limited area, well it is a size of a football pitch, it is still a limited area in terms of the North Sea, what we will do is we would deploy non-toxic dyes, and we would use ROVs [remotely operated vehicles], and spectrometers, and analyse what happened to the drill cuttings when we did the work. And all the scientific results, and all the recorded videos, and everything, we would share with Greenpeace, to give them information that they would use in future projects.*
>
> *And they (Greenpeace) said "Well alright, on the basis of furthering scientific knowledge, and we reckon that the actual pollution level would be minimal, because hydrocarbons occur naturally anyway, and we don't think that they are too many toxin or too many PVCs, due to the nature of the drilling programme."*
>
> *So it was agreed that as a mutual scientific project, we would cut up the template and remove it in eight large sections.*

The divers will blow away the drill cuttings as we were removing the template. And while that is ongoing, we would monitor "Where they were going?" and "How high up the water column they went?" and all that sort of stuff. And it ended up as a scientific report, shared jointly by Greenpeace and an oil company. I don't think there are any other oil companies that have worked with Greenpeace.

– A former decommissioning manager with 40 years' experience in the oil and gas industry

This finding supports the findings from works such as Aarikka-Stenroos and Jaakkola (2012), Kazadi, Lievens and Mahr (2016), and Jull, Giles and Graham (2017), which suggest that co-creation of knowledge involving stakeholders is an effective way of managing them.

As mentioned in ***Chapter 2: Exploring Oil and Gas Decommissioning*** (see page 51), the body of knowledge in oil and gas decommissioning is still evolving. Clearly, involving stakeholders in the knowledge creation process could be beneficial, and in recent years, the oil and gas industry appears to have taken steps towards co-creation of knowledge with eNGOs. The 20th North Sea Decommissioning Conference, held in Stavanger in March 2020, was probably the first oil and gas conference where an eNGO was invited to present and share their knowledge with the wider oil and gas industry (Santillo 2020).

In the light of this finding, it might be beneficial for Shell to actively collaborate with Greenpeace to further extend the body of knowledge regarding the concrete gravity-based storage cells of the Brent platforms. Co-creation of knowledge between Shell and Greenpeace could also improve their mutual relationship. Furthermore, involving Greenpeace closely in the knowledge creation process can also convince other stakeholders that the environmental aspect has been thoroughly explored before arriving at the final decision.

Figure X-10 – Minimising Stakeholder Impacts by improving eNGOs' Level of Acceptance of Evidenced used in the Comparative Assessment

Academia as a Stakeholder

It is of note that academia was not originally identified as a stakeholder in the literature review. However, two former project managers identified academia as a stakeholder in an oil and gas decommissioning project or programme. According to a former decommissioning manager with 40 years' experience in the oil and gas industry:

> *We have contacted initially about 150 stakeholders. We identified them through internet research, conferences, and seminars. And that included academics, Professor Alex Kemp from the University of Aberdeen was on our list.*
>
> *– A former decommissioning manager with 40 years' experience in the oil and gas industry*

As mentioned in ***Chapter 3: Managing Oil and Gas Decommissioning*** (see page 84), PMBoK (the Project Management Body of Knowledge) defined stakeholders as "an individual, group, or organisation, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project" (PMI 2017). Academic research may be used as references by oil and gas operators, influencing their decisions making in oil and gas decommissioning. Hence, it may not be wrong to consider academia as a stakeholder in an oil and gas decommissioning project or programme.

Furthermore, academia can also be affected by an oil and gas decommissioning project or programme. Issues encountered during an oil and gas decommissioning project or programme, can be a gap in academic knowledge, which dictates the direction in which the body of knowledge expands in oil and gas decommissioning. Oil and gas decommissioning research in Chulalongkorn University, for example, are heavily influenced by the issues faced by the national oil company of Thailand, PTTEP

(Sirirattanachatchawan et al. 2019). Similarly, in Malaysia, Petronas has a large influence on oil and gas decommissioning research at Universiti Teknologi PETRONAS (Zawawi, Liew & Na 2012; Na et al. 2017; Zawawi, Liew, Shawn, et al. 2019).

As research activities continue to increase in the field of oil and gas decommissioning (NERA 2019; UKNDC 2019), it can be argued that academia could potentially become a more influential and impactful stakeholder in oil and gas decommissioning in the future.

United Kingdom - Cluster No. 3 – Simultaneous Operations (SimOps)

The critical points in this cluster relate to the period between CoP (cessation of production) and the physical removal of the oil and gas facility. As shown in **Figure 8-4** (above, page 394), multiple operations are being executed in parallel during this period, including well plugging and abandonment, making safe the oil and gas facility, and preparing the topside for removal. Hence, the term simultaneous operations or SimOps. The key stakeholders involved in this cluster of critical points include:

- The Health and Safety Executive (HSE)
- Contractors and Sub-Contractors

Figure X-11 (below) illustrates the stakeholder interactions that occur related to Simultaneous Operations (SimOps):

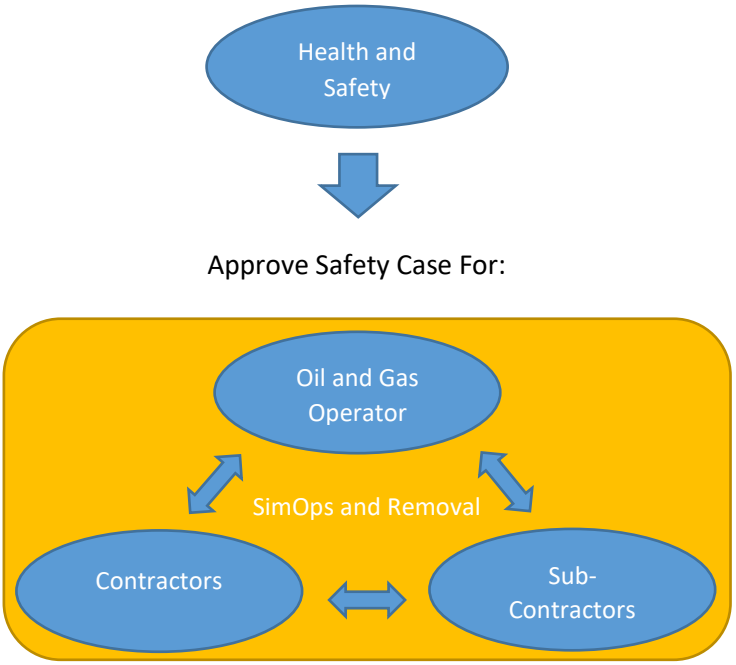


Figure X-11 – Stakeholder Interactions relating to Simultaneous Operations (SimOps)

HSE under Time Constraint

Three interviewees representing the oil and gas operators and regulators in the United Kingdom stated that there are interactions between the oil and gas operators and the HSE during the period between CoP and the physical removal of the oil and gas facility, where a safety case change is to be approved by the HSE.

The primary reason for the interactions is the debate between oil and gas operators and the HSE regarding the right time for engagement with the safety case change. A decommissioning engineer with 22 years' experience in the oil and gas industry, representing the perspective of the oil and gas operator, stated that:

> *The safety case is very detailed because we have to risk assess the actual operations. So, how we are going to perform the operation? So, essentially, we need to have our Comparative Assessment locked down and approved before we work on our safety case. We could assume, but if we didn't get the assumptions, we would need to recycle. We will be going back to ask ourselves whether we have the right contractor, whether we need to do more engineering, whether we need to do new detail activity descriptions and rehash the safety case, and then get that all approved and go into execution.*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

A representative from the HSE, with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom, also shared their side of the story, stating that:

Operators placed the contracts for that work back here [before they engage HSE]. So, they have chosen the crew, they have chosen the methodology, they have chosen their vessel.

The HSE can actually come along and say: "actually that vessels is not good, that vessel is too big, it is a vessel impact problem for us, or if you are trying to do an evacuation, that is going to be your primary place of safety, we are not happy with that, because the vessels is not equipped properly."

A three month time frame is far too short. So, what we are trying to do is say to industry now is that, involve the HSE at the very minimum here, at the Comparative Assessment stage. So, that we know, so that we can influence what goes into the decommissioning programme, and we can make sure that you can place the right contracts, pick the right vessels, etc. So that you don't have any problems at this very late stage.

– A regulator with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom

This suggests that current best practice in the United Kingdom is to engage the HSE approximately three months prior to the physical removal of the oil and gas facility. However, as stated by the regulator with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom, current best practice has a high risk of schedule delays due to potential impact by the HSE on the approval of the safety case change.

From a project management perspective, this finding suggests that it would be more beneficial to engage the HSE earlier on in the project or programme lifecycle, preferably during the CA period, in order to minimise the risks of schedule delays. This also suggests that earlier interactions between the oil and gas operator and the HSE, during the CA period, can have an influence on the interactions between the oil and gas operator and the HSE, during the period between CoP and the physical removal of the oil and gas facility.

The representative from the HSE, with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom, further added:

> *I don't think that it is the operator's fault. I think the way that the UK legislation is set up, operators don't actually legally have to engage us on these points until fairly late in the process.*
>
> *– A regulator with 20 years' experience of regulating oil and gas decommissioning activities in the United Kingdom*

As engaging the HSE approximately three months prior to the physical removal of the oil and gas facility is current best practice in the United Kingdom, this finding suggests that regulations and guidelines have an influence on the way oil and gas operators manage their regulatory stakeholders.

From a regulatory perspective, this finding suggests there is a limitation regarding the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015. A revisit to the United Kingdom legislation finds that in Section 9(2) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015, it is stated that:

> *The operator of a fixed installation in external waters must ensure that it is not dismantled unless—*
>
> *(b)the operator has sent a version of the current safety case which incorporates the proposed revisions, showing clearly where they are to be made, to the competent authority at least three months (or such shorter period as the competent authority may specify) before the commencement of the dismantling; and*
>
> *(c) the competent authority has accepted those revisions to the current safety case.*
>
> *– Section 20(1), the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015*

The HSE is being placed under significant time constraint under the current legislation, when it comes to the approval of the revision of the safety case when moving from a live platform to a cold platform ready for removal. Any schedule delays due to the late approval from the HSE, may also result in an increase in the overall cost of decommissioning, which goes against the MER Strategy. Hence, it could perhaps be beneficial to amend Section 20(1) of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015, by removing the word "shorter", and introducing an obligation for continuous engagement between the duty holder (which is usually the oil and gas operator), and the HSE, when it comes to the safety case revision for oil and gas decommissioning activities.

Figure X-12 – Minimising Stakeholder Impacts by alleviating the Time Constraint of the HSE for Approval of Safety Case Change

Managing Multiple Contractors and Subcontractors

As mentioned in ***Chapter 7 – Development of Stakeholder Oriented Critical Paths*** (see page 338), managing the various interfaces between the oil and gas operator, contractors and sub-contractors during the period between CoP and the physical removal of the oil and gas facility (i.e. SimOps), is one of the most challenging tasks in an oil and gas decommissioning project or programme.

Of interviewees from the UK oil and gas decommissioning landscape, 33% of them stated that there are intense interactions between the oil and gas operator, contractors, and sub-contractors throughout this SimOps period, due to scope creep and schedule delays.

Regarding best practice to mitigate the interactions, seven interviewees offered that it is necessary to ensure a good working relationship between the oil and gas operator, and the contractors and sub-contractors. One way of ensuring a good working relationship between the parties involved during SimOps, according to a project manager with 20 years' experience in the oil and gas industry, is to spend additional time fostering the good working relationship between the parties:

> *Before the start of the project, we spend about six to twelve months gathering the contractors in the same room to talk about the procedures of how things will operate on the platform. So, although there is no formal contractual agreement between Petrofac and Saipem, there is a consensus that all contractors will operate under the procedure of the duty holder, which is Petrofac… And I believe that fosters a good working relationship between the contractors as well.*
>
> *– An industrial representative who worked on the Miller decommissioning project*[29]

[29] The reason for not including the position and years of experience is because the interviewee can be easily identified if the details are given. There were not many people on the project management team for the Miller Decommissioning Project.

This finding suggests that an effective engagement with the contractors and sub-contractors earlier in the stakeholder-oriented critical path, can prevent stakeholder interactions between the oil and gas operator, contractors, and sub-contractors during SimOps. This finding supports the work of Aagaard, Eskerod and Madsen (2015) which suggests that better coordination among contractors and sub-contractors can lead to a more successfully executed project.

Another way to ensure a good working relationship between the oil and gas operator, contractors and sub-contractors during SimOps, according to a former project manager with 36 years of experience managing oil and gas decommissioning projects globally, is to modify the tendering criteria. For example, Marathon Oil used a competitive dialogue process, introducing additional tendering criteria, in order to measure the ability of contractors to foster a good working relationship with Marathon Oil. The competitive dialogue process and the list of criteria used by Marathon Oil for the Brae decommissioning project or programme can be found in ***Appendix S*** (see page 717).

Figure X-13 – Minimising Stakeholder Impacts by ensuring a Good Working Relationship between Oil and Gas Operator, Contractors, and Subcontractors

Australia - Cluster No. 1 – Well Plugging and Abandonment Operations

The critical points in this cluster relate to well plugging and abandonment operations. As observed in **Figure 8-4** (above, page 404), this include the planning, contracting, and execution of well plugging and abandonment. The key stakeholders involved in this cluster of critical points include:

- Public Stakeholders
- Joint-Venture Partners

Figure X-14 (below) illustrates the stakeholder interactions that occur related to well plugging and abandonment operations:

Figure X-14 – Stakeholder Interactions relating to Well Plugging and Abandonment Operations

Consulting Public Stakeholders

Perhaps one of the most interesting findings during the Australian part of the research is that 30% of the interviewees from the Australian decommissioning landscape mentioned interactions with public stakeholders during the planning for well plugging and abandonment. According to a decommissioning engineer with 22 years' experience in the oil and gas industry:

> *We have seen the port authorities as well, two ports actually in the Thevenard Island decommissioning project in order to plug and abandon the wells.*
>
> *– A decommissioning engineer with 22 years of experience in the oil and gas industry*

This finding is a contrast to the UK landscape, where there was no mention of any interactions between the oil and gas operators and public stakeholders when it comes to the planning of well plugging and abandonment.

A revisit to the UK and Australian oil and gas decommissioning regulations and guidance find that there is a difference in the well plugging and abandonment regulatory approval process, as illustrated in **Figure X-15** and **Figure X-16** (below):

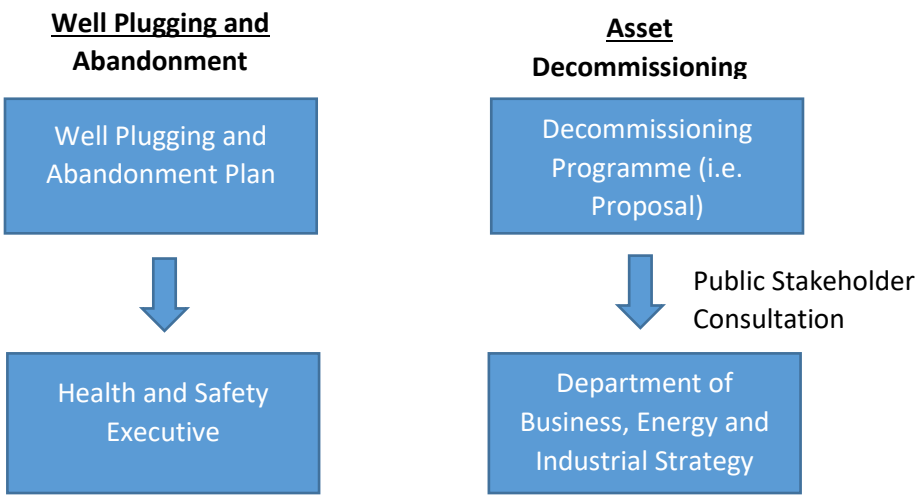


Figure X-15 – Separate Regulator Approach in the United Kingdom for the Approval of Well Plugging and Abandonment and Asset Decommissioning (OGA 2016a; OPRED 2019)

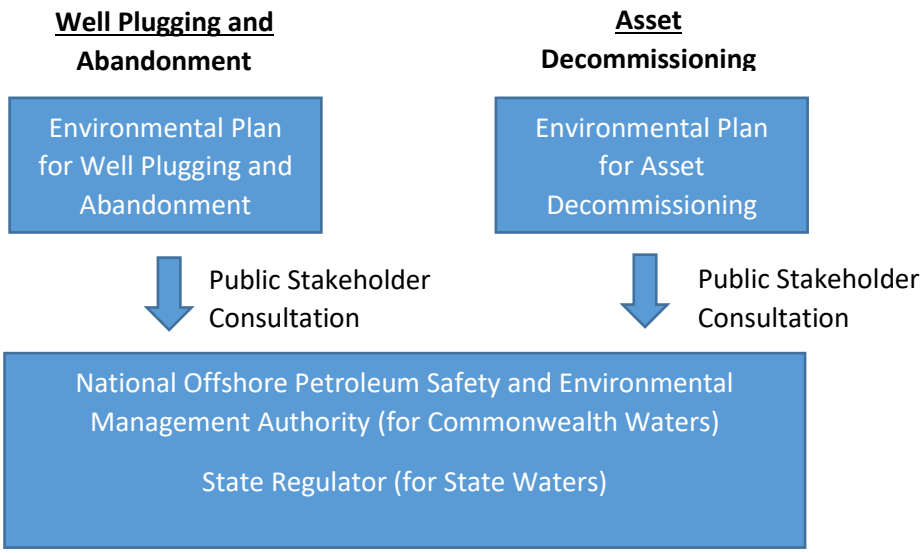


Figure X-16 – Single Regulator Approach[30] in Australia for the approval of Well Plugging and Abandonment and Asset Decommissioning (DMIRS 2016; NOPSEMA 2019)

This finding suggests that the difference in levels of public stakeholder interactions between the UK and Australian landscapes, when it comes to well plugging and abandonment planning, is due to the difference in regulatory arrangements. This also means that regulatory arrangements can have an influence on the level of stakeholder interactions throughout an oil and gas decommissioning project or programme.

[30] Single regulator approach means that both well plugging and abandonment and asset decommissioning plans are being assessed and approved by the same regulator. In Commonwealth Waters, both plans are being assessed and approved by NOPSEMA. In State Waters, both plans are being assessed and approved by the respective state regulator.

Well Plugging and Abandonment Issues

Of the interviewees from the Australian decommissioning landscape, 40% of them mentioned interactions with joint-venture partners during the execution of well plugging and abandonment, largely due to unexpected issues encountered during well plugging and abandonment execution, and changes in the decommissioning plan. According to a decommissioning engineer with 22 years' experience in the oil and gas industry:

> *We had some technical issues at the upper levels. Not the reservoir, the reservoir was fine, but on the upper levels. So, we didn't complete it…Part of the debate with our joint-venture partners was to abandon the offshore plug and abandonment, and move on to onshore plug and abandonment, changing the sequence…*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

This suggests that joint-venture partners are influential when it comes to decisions made with regard to the decommissioning plan. This finding suggests that joint-venture partners are influential when it comes to decisions made regarding the decommissioning plan. It is possible that the interests and concerns of joint-venture partners are the same regardless of location.

Best practice to minimise stakeholder interactions due to unexpected issues in well plugging and abandonment and changes in the decommissioning plan, according to a decommissioning engineer with 22 years' experience in the oil and gas industry, is to:

> *Space the packages out, so that we are able to delay another package[31] and reshuffle our packages around when there are issues. If we had it together in a shorter timeline, we would have…more difficulties…because we would have had contractors already signed up for the next packages."*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

As mentioned in ***Chapter 7: Development of Stakeholder Oriented Critical Paths*** (see page 338), not being ready for the contractors for the following

[31] Chevron's term for each project scope. E.g. Well Plugging and Abandonment Package, Pipelines Package, Platform Infrastructure Package.

decommissioning activity may result in an increase in project cost. This finding suggests that stakeholder impacts can be minimised by considering the risks of stakeholder impacts (e.g. the contractors already signed up for the next activity) and spacing oil and gas decommissioning activities further apart. This finding also supports findings from stakeholder management literature, such as Butt, Naaranoja and Savolainen (2016) and Eskerod and Jepsen (2013), which suggest that considering stakeholders when scheduling project activities can minimise stakeholder impacts.

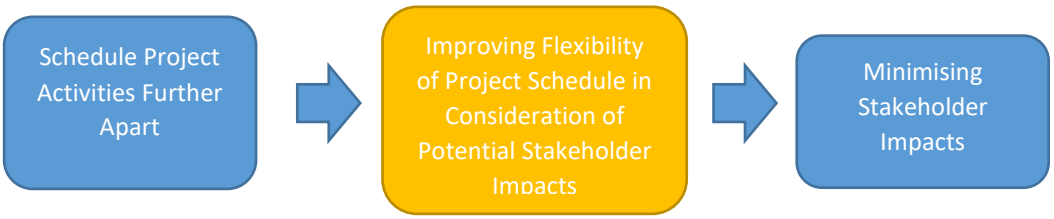


Figure X-17 – Minimising Stakeholder Impacts by Improving Flexibility of Project Schedule in Consideration of Potential Stakeholder Impacts

Australia - Cluster No. 2 – Planning for Removal

The critical points in this cluster relate to the planning for removal. As shown in **Figure 8-4** (above, page 394), this cluster is essentially the same as Cluster No. 2 of the robust UK stakeholder oriented critical path. This suggests that stakeholder interactions that take place during the planning from removal are similar across different landscapes. The reason for not using the term "Comparative Assessment" is that there is no requirement for the use of the CA in the Australian landscape (NOPSEMA 2019), as mentioned in ***Chapter 4: Regulating Oil and Gas Decommissioning*** (see page 132). The key stakeholders involved in this cluster of critical points include:

- National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) / State Regulators
- The Supply Chain
- Public Stakeholders

Figure X-18 (below) illustrates the stakeholder interactions that occur related to the planning for removal:

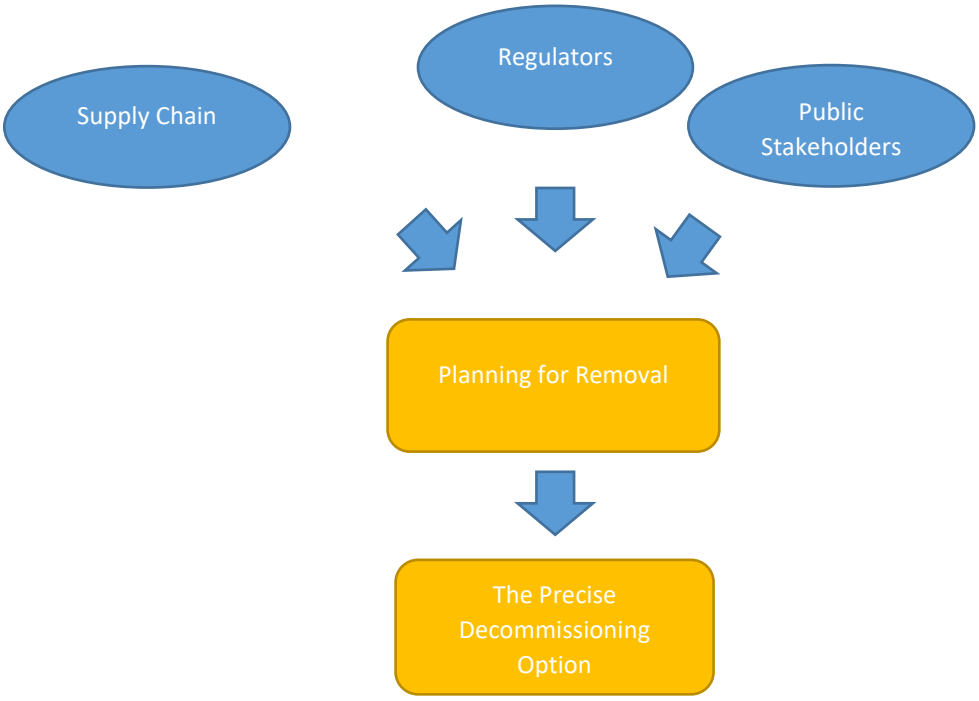


Figure X-18 – Stakeholder Interactions relating to Planning for Removal

Forging the Decommissioning Path with Regulators

Of interviewees from the Australian decommissioning landscape, 60% of them mentioned interaction between the oil and gas operator and the regulators in order to forge the decommissioning path. According to a decommissioning engineer with 22 years' experience in the oil and gas industry:

> *We haven't seen a lot of it [decommissioning], it is still unfamiliar territory to a large extent…We are forging out the paths a little bit on the regulatory engagement…side of things.*
>
> *– A decommissioning engineer with 22 years of experience in the oil and gas industry*

One possible reason for the interaction, is the difference in opinion between oil and gas operators and regulators in the Australian oil and gas decommissioning landscape regarding the CA. According to a decommissioning manager with 17 years' experience in the Australian oil and gas industry:

> *The operators are quite keen on the Comparative Assessment. APPEA [Australian Petroleum Production and Exploration Association has drafted a Comparative Assessment guidelines for Australia, which should be released sometime in 2020.*
>
> *– A decommissioning engineer with 17 years' experience in the oil and gas industry*

However, a representative from an Australian regulator explicitly stated that:

> *I know the industry is quite keen on doing Comparative Assessments. But for us, we see it as only one of the methods of demonstrating how you can meet the acceptance criteria of the environmental regulator.*
>
> *I know that in the UK the Comparative Assessment can be used to come up with the preferred decommissioning option. That will come into play more so in the environmental plan, where a titleholder is making a case on what solution they are planning to adopt – partly removing, Complete Removal, augmentation, re-purposing.*
>
> *The Comparative Assessment on its own, is not enough for us to make a decision on decommissioning…*

For example, you can't use the Comparative Assessment to tell me that the consultation is up to standard by telling me the technical, safety, economics, and you know, all the five factors in the OGUK guidelines. The comparative assessment may tell me you have considered these factors, but it doesn't really tell me how the stakeholders were consulted.

Comparing the five factors of Comparative Assessment alone may not be enough. That is what we are trying to tell our industry here. Because I think the Australian industry would like to just have a simple Comparative Assessment and produce some results, and say that is what we are going to adopt.

– A current regulator in Australia with 30 years' experience in multiple roles in the oil and gas industry

This finding suggests that there is some degree of misalignment between oil and gas operators and the regulators in the Australian oil and gas decommissioning landscape, regarding the environmental plan contents. As mentioned earlier, early engagement appears to be considered best practice in the UK landscape to manage regulatory stakeholders. Hence, it could perhaps be beneficial for oil and gas operators in the Australian decommissioning landscape to adopt the UK best practice, and engage the regulators earlier in order to improve the extent of alignment between oil and gas operators and regulators.

Figure X-19 – Minimising Stakeholder Impacts by Improving Improve Extent of Alignment on the Environmental Plan Contents

Consulting the Supply Chain

Of interviewees from the Australian oil and gas decommissioning landscape, 40% of them mentioned interactions between oil and gas operators and the supply chain during planning for removal. According to a lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries:

> *A good example of that would be the upcoming project. It is the Bayu Undan Field by ConocoPhillips. It will be decommissioned in the next five years but it is a complex facility. So, there is a limited number of contractors in the world that have the capability to decommission the Bayu Undan facility.*
>
> *What ConocoPhillips have done in the last year is that they have come out to the industry, to the contractors and given them various case studies to develop the methods. So, when they come out, these contractors will produce reports on how to remove and dispose of the Bayu Undan field. And then operator would then compare the pricing and also finding out the best way of doing the decommissioning. Probably that is the way the contractors would influence the operators, which is through those case studies.*
>
> *I would say contractors have zero say on what comes out, but they definitely have a say on what goes in.*
>
> *– A lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries*

This finding suggest that the supply chain can bring positive influences to an oil and gas decommissioning project or programme. It is possible that the potential positive impact supply chain stakeholders can have on an oil and gas decommissioning project or programme is independent of location.

An interesting insight provided by three interviewees representing the Australian oil and gas decommissioning supply chain, is that the Australian oil and gas decommissioning supply chain appears to lack a voice. According to a decommissioning manager with 33 years' experience in the UK and Australian oil and gas industries:

We don't have OGUK and Decom North Sea where there is an integrated community. Supply chain companies are members of OGUK and Decom North Sea.

If you look at APPEA, APPEA is an industry body for operators. There is no supply chain in APPEA. APPEA listens to the operators and are always campaigning for the operating community to the government…So, by not integrating, the Australia decommissioning industry might not grow rapidly enough.

– A decommissioning manager with 33 years' experience in the UK and Australian oil and gas industries

This suggests that the growth of an oil and gas decommissioning industry may be limited by the lack of input from the supply chain. Thus, it may be beneficial to establish an industry representative body that involves both oil and gas operators and stakeholders, similar to the United Kingdom's Oil and Gas UK and Decom North Sea, in Australia.

Engaging Public Stakeholders

Of the interviewees, 80% mentioned interactions between oil and gas operators and public stakeholders during the planning for removal. This finding suggests that the engagement between oil and gas operators and public stakeholders is one of the most talked-about interaction in the Australian oil and gas decommissioning landscape.

The primary reason for the interaction, according to six interviewees representing oil and gas operators, regulators, and public stakeholders in Australia, is that it is a regulatory requirement to engage the stakeholders and include evidence of the engagement in the environmental plan (i.e. decommissioning proposal). According to a current regulator in Australia with 30 years' experience in multiple roles in the oil and gas industry:

> *For any EP [Environment Plan], you have to do some level of stakeholder engagement…...we have a very clear criteria, on the evaluation of the environment. For example……stakeholder, consultation must be to a certain standard…… you must demonstrate how all these criteria have been met.*
>
> *– A current regulator in Australia with 30 years' experience in multiple roles in the oil and gas industry*

This finding suggests that regulations and regulatory guidelines have an influence on the level of interactions between oil and gas operators and stakeholders.

An interesting insight from three interviewees representing oil and gas operators in Australia is that in Australia, stakeholders are feeling the fatigue of engaging oil and gas operators for oil and gas decommissioning activities, despite the oil and gas decommissioning industry in Australia still being in its infancy. According to a decommissioning engineer with 17 years' experience in the oil and gas industry:

We found that stakeholders are getting what we called stakeholder fatigue. Stakeholder engagement fatigue. This is because, any Environment Plan, factsheets, we have to send them, according to legislation. And they said like:

"You know, if you expect us to respond to everything, then we won't be able to do our fishing jobs".

So that is what we found. So, even though we haven't done much stakeholder engagement, there is fatigue. When we started, there is a bit of hype and interest that came along. And then you know what, it just became too much for the stakeholders. And that is quite an interesting nuance.

– A current regulator in Australia with 17 years' experience in multiple roles in the oil and gas industry

However, a revisit to the Australian legislation finds that in Section 11A(2) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, it is stated that:

For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.

– Section 11A(2), Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009

This finding suggests it is actually not a legislative requirement to submit the environment plan and all factsheets to stakeholders, but rather there is a perception by oil and gas operators that stakeholders require the environment plan and all factsheets in order to make an informed assessment of possible consequences to the proposed oil and gas activity.

As mentioned in ***Chapter 7: Development of Stakeholder Oriented Critical Paths*** (see page 294), stakeholders may only be interested in specific elements of the oil and gas facility rather than the entire oil and gas decommissioning project or programme. For example, according to a decommissioning engineer with 22 years' experience in the oil and gas industry:

> *We haven't seen a lot of it (decommissioning), it is still unfamiliar territory to a large extent… We are forging out the paths a little bit on the regulatory engagement…side of things"*
>
> *– A decommissioning engineer with 22 years' experience in the oil and gas industry*

Thus, it could perhaps be beneficial for oil and gas operators in the Australian landscape to have an initial consultation with potential stakeholders to confirm their interests, and the information they require to make an informed assessment, before following up by sending them the relevant information they require. Such an approach may minimise unnecessary stakeholder interactions and prevent stakeholders from developing fatigue from engaging with oil and gas operators.

Figure X-20 – Minimising Stakeholder Interactions by Verifying Stakeholder Interests, Needs, and Concerns

Australia - Cluster No. 3 – Transportation and Disposal of NORMs and Mercury

The critical points in this cluster relate to the transportation and disposal of naturally occurring radioactive materials (NORMs[32]) and mercury[33]. The key stakeholders involved in this cluster of critical points include:

- Disposal Contractor
- Port Authorities

Figure X-21 (below) illustrates the stakeholder interactions that occur related to the transportation and disposal of NORMs and mercury:

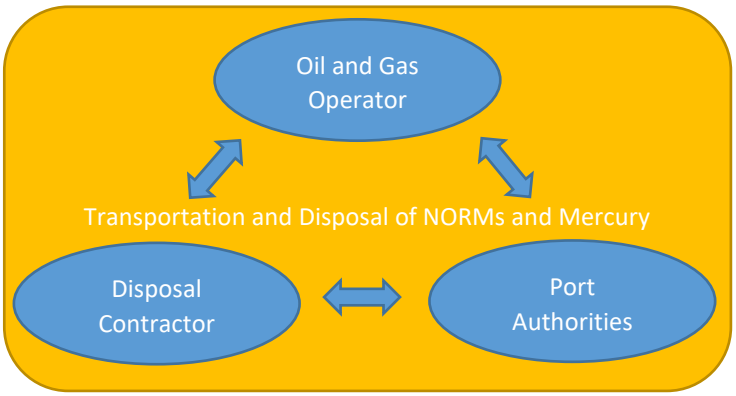


Figure X-21 – Stakeholder Interactions relating to Transportation and Disposal of NORMs

Unexpected Changes to Project Scope, Schedule, and Cost

Of interviewees from the Australian oil and gas decommissioning landscape, 30% of them indicated that there are intense interactions between the oil and gas operator, contractors and sub-contractors, when it comes to the transportation and disposal of NORMs, primarily due to unexpected changes in project scope, schedule and cost. According to a lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries:

> *Australia has one NORM disposal site. But it currently costs $2 million just to open the gates, and it is costly. So, essentially*

[32] Naturally Occurring Radioactive Material (NORM) are naturally existing materials that can be found in hydrocarbons produced during oil and gas operations. Residual NORM may remain on the surfaces of oil and gas facilities used to produce, process, store, or transport hydrocarbon fluids, even after cleaning.

[33] Mercury is not radioactive, hence it is not considered a NORM. However, Mercury is still toxic and must be disposed of properly.

Australia does not have a way of disposing of NORMs or other radioactive materials within Australia…

For Australia, we essentially only have France and the United States when it comes to disposal of NORMs.

We were originally going to ship our flow lines to Singapore to get it on a ship…The ship would then have to go by two Chinese ports and then across to the west coast of America.

Now, just before we are about to do that. Singapore say you are not bringing any radioactive materials into my country. So, we spent about four to five months negotiating to get permission to bring it into Singapore just for six hours to wait for a ship that has been booked. So, there is a huge amount work to do with that which you will never have to do for an installation job.

Then just 3 minutes before the flow lines are supposed to go onto the ship in Singapore, those two Chinese ports that the ship was going to go past change the rules and we were no longer allowed to have ships with radioactive materials going through there. Which means we couldn't take that ship anymore.

We were lucky that we found a ship that is going through the Suez Canal to the East Coast of the United States. And that was the last ship that the shipping company was going to do that. And the ship wasn't making stops at any other ports which makes it more efficient. So, we were lucky.

The options you have to transport NORMs and other radioactive materials are very few, and very expensive. So, that is one of biggest issues that we have to deal with when disposing of these stuffs for Australia.

– *A lifting contractor with 27 years' experience in the Australian, South-East Asian, and Chinese oil and gas industries*

This finding suggests that stakeholder impacts increase when there is a limited capacity in the supply chain. So, it may be beneficial for governments in emerging oil and gas decommissioning regions to invest more in developing supply chain capacity. The Scottish government, for example, has been heavily investing to strengthen oil and gas decommissioning capabilities and capacities (Scottish Government 2019).

Figure X-22 – Minimising Stakeholder Impacts by Increasing the Capacity in the Supply Chain

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