

**School of Civil and Mechanical Engineering
Department of Civil Engineering**

**An Integrative Asset-Management Framework to Assist
Post-Disaster Reconstruction in Post-Conflict Situations**

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Abstract

Efficient asset-management of infrastructure is important for countries subject to post-disaster adversity, to reactivate essential services and stimulate civil-engineering industry participation towards 10% of a (recovering) nation's Gross-Domestic-Product. This study aimed to evaluate post man-made-conflict redevelopment phases related to asset-management; specifically, this work determined the implications of managing post 2011 conflict in Libya and Tunisia, to demonstrate how these case-study authorities can respond effectively to adverse conditions, ultimately toward the development of an integrative asset-management framework for infrastructure facilities in conditions of flux. Combining quantitative and qualitative data collection and analytical approaches allowed development of an asset-management framework (AMF) for application in post-conflict development projects. This AMF recommends that management of a project life-cycle in post-conflict settings should be firstly customized to local-settings/users in order to assist stakeholders to prioritize project lists and determine appropriate tools and techniques when planning projects to rebuild communities, and secondly, accommodate life-cycle cost values with flexible change-management strategies in order to make changes with regards to specifications, designs and standards. A fit-for-purpose integrated asset-management framework is presented which necessarily structures-in an affected community's user-needs.

Declaration

I certify that this thesis does not incorporate, without any acknowledgement, any material previously submitted for any units in any institution of higher education; and that to the best of my knowledge and belief, it does not contain any material previously published or written by another person, except where due reference is made in the text.

Signed: ابوزيان Date: 04/05/2016

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In the name of Allah, the most beneficent, the most merciful, all praise and thanks to Allah, lord of the universe and all that exists. Prayers and peace be upon his prophet Mohammed, the last messenger for all humankind. I express my sincere gratitude and thanks to Allah.

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Finally, I would like to present this work to my beloved uncles, Hassan and Hamed Abuzayan, who passed away and may Allah bless them and grant them paradise, Amen.

Relevant Publications

<p>Chapter 2 - Part 1</p> <p>Abuzayan, K. M., Whyte, A., & Bell, J. (2014). Asset-management framework (s) for infrastructure facilities in adverse (post-conflict/disaster-zone/high-alert) conditions. <i>Procedia Economics and Finance</i>, 18, 304-311.</p>	<p>Accepted in 08/2014</p>
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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Natural disasters as well as man-made conflicts have long been part of life and their occurrence is somewhat ever present (McEntire, 2001). The aftermath of disaster affects both developed and newly-developing countries alike resulting in massive destruction and human suffering (Islam & Chik, 2011). The number of reported *natural disasters* which occur globally in a typical year (2008) is 326, with an annual loss of life of 235,736 people (Clive, 2010). *Man-made conflict* is similarly devastating; by way of example, the Libyan Health Ministry monitoring the 10 month civil war recorded 30,000 fatalities and 50,000 serious injuries with severe disruption to major infrastructure and repair expenditure in billions of dollars (RT, 2011).

Natural disaster, conflict and war damage physical infrastructure and public amenities such as hospitals, schools, telecommunication services, airports, ports and harbours, roads and energy supplies (Arabi, 2008). Unfortunately examples are all too available; in post-war Sierra Leone (2000), for instance, around 340,000 homes, 65% of schools and many hospitals were destroyed; approximately 1 million homes needed repairs. Sierra Leone still ranks near the bottom of the United Nations Development Programme (UNDP) Human Development Index (HDI). Other examples abound; the result of the Mozambique civil conflict (1993) is another overwhelming example. Its social infrastructure was ruined, 70% of schools and one third of all rural clinics were shattered as well as roads. Mozambique similarly ranks low on the UNDP HDI. The aftermath of the Nigerian civil war (1970) resulted in the destruction of about 53,732 commercial and private buildings, 750 km of roads, 65 bridges and approximately 854 schools (Ministry of Economic Development, 1975). European instances include the conflict in Kosovo (2000), where 45% of the schools were severely damaged or destroyed, 668 schools needed major repair and approximately 135 schools had to be entirely reconstructed due to severe damage (Jones, 2004).

Between 1989 and 2013, there were around 970 armed conflicts in many locations around the world (Refer to Table 1) (Wallensteen & Sollenberg, 2013). In 2009 alone, there were around 36 recorded conflicts (UNESCO, 2011).

Table 1: Number of armed conflicts by region, 1989-2013

Year	Europe	Middle East	Asia	Africa	Americas
1989	2	4	19	14	8
1994	5	5	15	13	4
1996	1	5	14	14	2
1998	2	3	15	15	2
2000	1	3	14	14	1
2002	1	2	12	15	2
2004	2	3	15	10	3
2006	1	5	16	10	2
2008	2	4	15	13	3
2010	1	5	12	10	3
2011	1	6	13	15	2
2012	2	5	10	13	2
2013	1	4	13	13	2

Source: Wallensteen and Sollenberg (2013)

Severe consequences of conflict, especially man-made conflict have, thus, made post-conflict (asset) management a significant area for attention. Repairing (post-war) damaged physical infrastructure and the rebuilding of homes, roads, bridges, restoring water, securing electricity supply as well as repairing schools and hospitals are critical tasks (Clive, 2010). Competently undertaking these tasks requires concerted efforts of national governments to adopt and apply

effective (asset) management techniques in order to make effective and efficient decisions, within budget constraints. In other words, post-conflict disaster management can be viewed as public project management in which the government is a major stakeholder (Moe & Pathranarakul, 2006), where Government departments and agencies remain accountable for construction decisions (Kelly, 1995).

Post-war or conflict (asset) management requires undertaking vital stages (similar to public project management) encompassing long term planning, organizing, resource mobilizing, training and completing stages (Earnest, 2011). Both Government and non-government-organisations (NGOs) require to be engaged (Dzulkarnaen et al., 2014).

Government departments ultimately require to take the lead in building redevelopment especially when building is noted as a vital component in (re)establishing economic vitality nationally. The construction industry contributes a significant percentage to the total Gross Domestic Product (GDP) of both developed and developing countries. In the United Kingdom, for example, the construction sector employs over one and half million people and accounts for 10% of gross domestic product (GDP), therefore making it a very important sector for the economy (Corporate Watch UK, 2004). Other than established developed nations, countries that are somewhat less stable or subject to post-conflict or post-disaster adversity, also require the construction industry to continue to contribute to their respective ongoing recovery. In Libya for example, the construction industry contributes 6.3% into GDP and employs about 3.2% of the total workforce (Gherbal et al., 2012). The construction industry is considered to be a pillar of the economy for many countries and is important to national infrastructure(s) (Gherbal et al., 2012). Indeed the contribution of the construction industry to GDP in many countries ranges from 7% to 10% for developed countries and approximately 3% to 6% for developing countries (Lowe, 2003) (refer to Figure 1). Thus, it can be argued that the state of the construction industry will affect most measures of a national economy such as Gross Domestic Product (GDP), the availability of capital, and the employment rate (Wibowo, 2009).

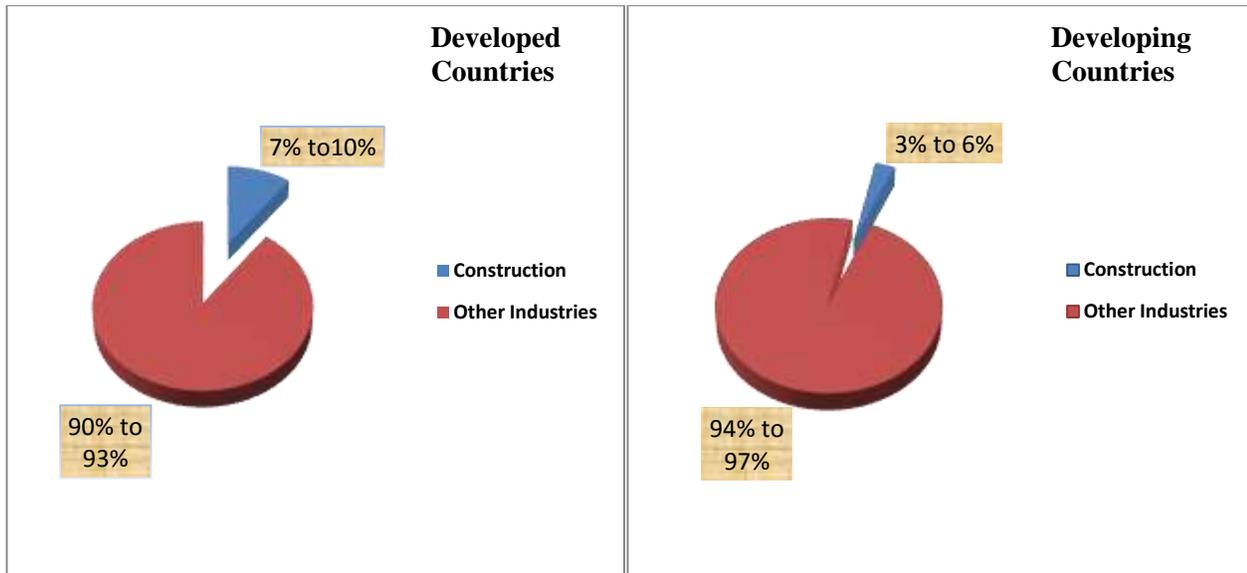


Figure 1: The contribution of the construction Industry into GDP

Source: *adapted from* Lowe (2003)

The construction industry helps build and maintain the necessary public infrastructure and (and in some cases) private physical structures for a range of activities such as mechanical and electrical services, commerce, water and power utilities and other industries (Wibowo, 2009). Normally, it is a nation's specific department of infrastructure or public works departments that has responsibility for regularly managing, operating and maintaining those assets through careful planning and adoption of appropriate (facility) management techniques (Gherbal et al., 2012).

Infrastructure is vital to the economic wellbeing of a nation; notably in the creation and upkeep of public infrastructures such as hospitals, universities, public department buildings, roads, drainage, sewage, metro systems, bridges, sanitary and water systems (Farran, 2006). These infrastructure developments are subject to deterioration as a result of climatic effects, negligence, natural disaster, as well as conflict, war and, perhaps, resultant general mismanagement. Mistreatment and negligence of public infrastructure can occur due to insufficient funding or unsuitable support technologies (Vanier, 2001) and can lead to costly repair or replacement as well

as tragic technical/engineering failure (Wirahadikusumah, 1999). In other words, infrastructure requires proper operational and maintenance control in order to retain respective operational and safety standards as well extending usable infrastructure life within budget constraints (Farran, 2006).

The lack of available funds and a non-alignment of maintenance budgets, for example, make future rehabilitation and necessary refurbishment difficult. The creation and maintenance of infrastructure are subject to many challenges such as elevated labour and material costs (due to the haphazard and somewhat ill-defined nature of the various tasks in retrospective refitting of facilities for the continuing effective usage), continually growing networks of usage, increased accountability, public expectations and, not least, the need for repair outside periodic programmes as a result of unexpected damage from conflict and disaster. Population growth is a key critical factor which can in turn lead to accelerated deterioration of infrastructure and consequently increased concerns over safety, environment and congestion in roads and the like (Soti & Habing, 2009). There is a clear need for an objective (*both proactive and reactive*) decision support system to optimize the usage of available funds through cost effective solutions (Farran, 2006). This is true not only for stable environments but also for national infrastructure in conditions of flux.

Carrying on the theme of the need for infrastructure maintenance as a result of somewhat unforeseen damage from *conflict and disaster*, as mentioned previously, Libya provides an example. Before the revolution, the oil industry in Libya contributed almost 74% to GDP and was considered to be the backbone of the Libyan economy (most of the salaries, investment projects and services' funds came from the oil industry) (Outlook, 2008). However, due to losses of billions of dollars as a result of the 10 months of civil war, (and the knock-on effects of corruption, theft and the continuous rallies for change by a public who wished their demands to be met) refineries and oil fields had to close down. These events have put great pressure on the authorities not to rely on the revenue generated from this (oil) sector and the need to find an alternative means of generating finance to support the country's economy and at least to be able to redistribute effort towards the operation and essential maintenance of the nation's infrastructure. This highlights the

challenges in construction industries in newly-developing countries (and perhaps oil-rich countries subject to change) to adapt to economic environments that are in flux as a result of somewhat external variables such as the fall in the (regional) oil price as a result of unexpected or unaccounted for environmental damage and conflicts (Al-Sedairy, 2001). Moreover, technological innovations required as a result of increased global and local competition and increasing scarce resources have made funds for the maintenance of constructed assets even more difficult to come by and the need to make better use of the money that does exist, through objective and structured asset-management (Al-Sedairy, 2001).

The construction industry plays a major role, not only in the use of the environment, but also in the development of a society's quality of life. Therefore, providing a structured mechanism to best allocate resources in this area can make a major contribution to the development of society, especially in a post-conflict situation (Al-Sedairy, 2001).

To cope with uncertainty and challenge, there has been a world-wide trend by all industries (including the construction industry) towards a more structured approach to the management of infrastructures and asset-management. While this trend has been demonstrated in most developed countries such as the USA and the UK (Urquhart, 2006), **there seems to be no, or at least very limited, evidence of this trend in developing countries** such as Libya (Hokoma, 2010).

The concept of *asset-management* has gained acceptance in countries such as Australia, the USA, UK, as well as in a minority of post-conflict zones such as the now stable environment of Kuwait. Other countries are progressively adopting and implementing asset-management principles as their countries develop (Kiwelu, 2009). The successful implementation of asset-management requires that, in developing stable countries, the construction industry re-evaluate its methods of doing business; for example, the industry needs to focus on the life-cycle aspect of product/infrastructure rather than on the initial capital cost; this requires also a series of changes in specific management methods, organizational structure, and the overall approach to infrastructure decisions. Furthermore, it requires not only a clear appreciation of all the activities related to asset-management techniques, but also a real commitment to change-management,

investment in human resources (training and rewards), consideration of life-cycle costing perspectives, enhancement of data collection and storage, as well as the adoption of structured asset-management standards (Kiwelu, 2009).

There exist many definitions of the term Asset-management. The American Public Works Association defines the term asset-management as, *'a methodology to efficiently and equitably allocate resources amongst valid and competing goals and objectives'* (Danylo & Lemer, 1998, p. 2). The Federal Highway Administration of the USA (FHWA) defines asset-management as follows: *'Asset-management is 'a systematic approach of maintaining, upgrading, and operating physical assets cost effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision making. Thus, asset-management provides a framework for handling both short- and long-range planning'* (FHWA, 1999, p. 7).

Another definition by Austroads (1997) considers asset-management as *'a comprehensive and structured approach to the long-term management of assets as tools for the efficient and effective delivery of community benefits'* (FHWA, 1999, p. 7). The British Standards Institute (PAS 55) defines asset-management as *'Systematic and coordinated activities and practices through which an organization optimally manages its physical assets and their associated performance, risks and expenditures over their lifecycles for the purpose of achieving its organizational strategic plan'* (BSI, 2008, p. 2).

The Organization for European Cooperation and Development Working Group state that *'Asset-management goes beyond the traditional management practice of examining singular systems within the road networks, i.e. pavements, bridges, etc., and looks at the universal system of a network of roads and all of its components to allow comprehensive management of limited resources. Through proper asset-management, governments can improve program and infrastructure quality, increase information accessibility and use, enhance and sharpen decision-making, make more effective investments and decrease overall costs, including the social and economic impacts of road crashes'* (FHWA, 1999, p. 7).

It can be observed, from these definitions, that asset-management can provide a framework for handling short-and long term operation, maintenance and refurbishment planning. The asset-management framework can be as shown in Figure 2:

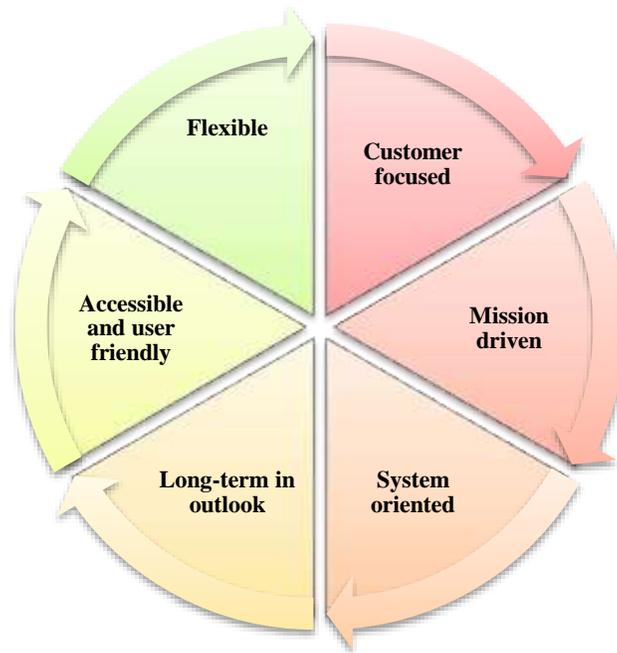


Figure 2: Asset-management Criteria

Source: Adapted from FHWA (1999)

Currently, there are many asset-management models and frameworks which have addressed the technical and economic issues related to managing infrastructure assets (Vanier, 2001; Too et al., 2006; Younis and Knight, 2012; Dornan, 2010; Lemer and Wright, 1997). Unlike the frameworks developed by these researchers, Elhakeem and Hegazy (2012) developed a more comprehensive framework (for schools in North America) with a unique formulation in which all functions from inspection, to deterioration modeling, and life cycle analysis, tracked the dynamics of building deficiencies (from condition assessment to deterioration modeling, repair selection, prioritization, and fund allocation).

With regards to the economic challenge, Dornan's study (2010) intended to develop a remedy for addressing the fiscal challenges facing USA highway infrastructure. He found that asset-management was an effective response to the fiscal challenges as it encouraged the public-private partnership notion, alignment with the Governmental Accounting Standards Board (GASB-34) role for asset-management in order to increase accountability for public owned infrastructure to handle both existing buildings (maintenance for example) and to build new infrastructure assets through covenants aligned with securitization or Shadow tolling. Dornan emphasized that asset-management could be an effective process for helping the expansion, rebuilding or maintenance of any highway infrastructure. No matter the orientation of funding whether traditionally under the wing of the public authority or in the example above an alignment of public and private, asset-management remains an important way forward towards redevelopment.

Existing frameworks, however, seldom account for the social challenge (particularly in post-conflict or high alert conditions), and have very limited reference models documenting all key activities and flexible change strategies for the implementation of asset-management. In addition, the absence of end-users' involvement is another critical factor. This lack is an obstacle to the prompt implementation of an asset-management system in a sector or an organization. According to Kiwelu (2009), a good reference model needs to appreciate end-user's requirements, explain all key activities, outline their flow, communicate and recommend the best practices during the entire implementation process. Furthermore, there are nominal guidelines available that show the key activities of successfully implementing all concept variables, especially in post-conflict and high alert situations.

Asset-management application and benefits have not yet been clearly documented to take account of the full range of factors in *less stable* environments. Thus, flexible standards/specification change strategies, life-cycle costing approach, training and awards (human resource perspective), and end-users' involvement play a major role (with a challenge to not only identify but also factor in) implementation strategies of asset-management (Kiwelu, 2009). Also, due to the relatively long life-cycle of infrastructure assets, the whole life-cycle approach is

becoming increasingly important in investment decisions by any society that seeks long-term usage from its facilities. The life-cycle costs (LCC) approach, according to the NSW Treasury (2004), is central to asset-management as it takes account of the total cost of an asset throughout its entire life; the importance of LCC stems in large part from its linkage and incorporation into many asset-management tools. For instance, conducting benefit cost analysis requires both the total capital cost and present net (*future*) worth of the total cost; thus LCC, as an integrated procedure, requires increasing recognition as an asset-management tool(s). Figure 3 represents this research-project's interpretation of the extent to which LCC analysis is fundamentally linked with asset-management.

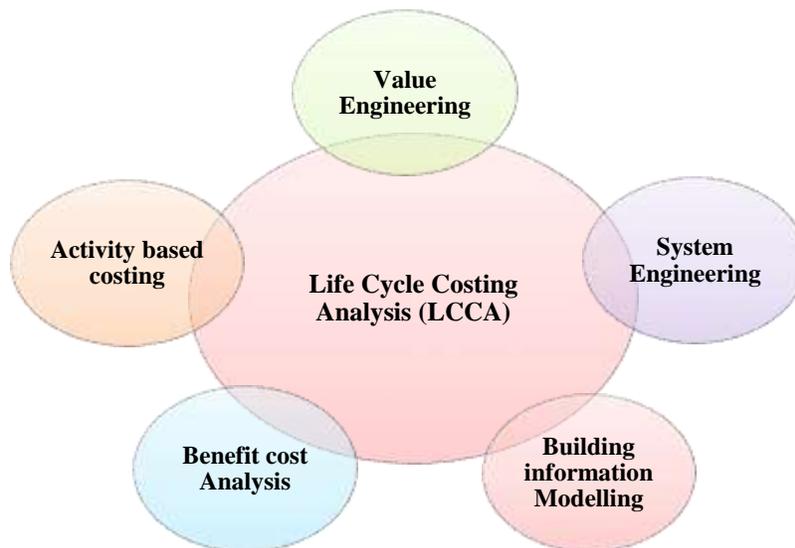


Figure 3: The Incorporation of LCC in many AM tools

Germany and Japan (1945) historically set standards of post-conflict reconstruction for other countries which have undergone a conflict or are susceptible to high-alert conditions, such as Namibia (1989), El Salvador (1991), Cambodia (1993), Somalia (1992), Mozambique (1993), Bosnia (1995), Eastern Slavonia (1996), Sierra Leone (2000), Kosovo (2000), Afghanistan, Iraq (2003), and more recently, Tunisia, Egypt and Libya (2011). However Germany and Japan's post World War II growth experiences are considered to be 'economic *miracles*'. In fact, per capita

GDP in 1950 rose by 8% and 5 % per year in Japan and Germany, respectively, while in the USA, the equivalent figure was 2%. The most critical contributor to such success was the roles played by cultural, institutional and political factors. For instance, the main drives for such significant growth were an immediate post-war reconstruction stage, capital accumulation as well as an early stage of technological catch-up (Gilchrist & Williams, 2004). The latter factor was considered to be the most significant factor.

Kage (2010) also provided more success factors which had contributed to a successful post-war reconstruction in Japan. These were:

- better identification of needs
- more efficient implementation
- more effective monitoring
- and a combination of higher levels of per capita GDP and higher levels of communication among citizens consistently

Most of the studies of the post-world-war-II period have focused on history, peace-rebuilding as well as the *desire* for economic *miracle*. For example, many of the discussions seeking to reflect upon post-conflict reconstruction and development have largely focused on disarmament, demobilization and reintegration of ex-combatants (Jabareen, 2013; Paes, 2005; Muggah, 2005; Hitchcock, 2004; Dzinesa, 2007). Others have focused on the causes as well as the consequences of wars and conflicts (Jones, 2004; Shaw, 2003; Mamdani, 2002; Young, 2002; Leonard and Straus, 2003; Collier and Hoeffler, 2004; LeBillon, 2001; Arabi, 2008; Critchley, 2008; Reno, 1998; Obwona and Guloba, 2009; Zartman, 1995; Busumtwi-Sam, 2004).

There is a clear lack of long-term and comprehensive post-war reconstruction planning. Taking Iraq as a case in point, a report published by Special Inspector General for Iraq Reconstruction SIGIR (2009) mentioned that there was a reconstruction gap between the number of projects promised and planned and the number of projects completed. This was the result of the rise in spending on military and security needs, in addition to project delays and cost overruns. End-users

have been excluded from the asset-management approach as a key element, resulting in multiple re-programming of reconstruction priorities, added maintenance expenses, and higher material costs. In other words, the absence of a long-term comprehensive reconstruction approach has undermined progress in reconstruction in post-war Iraq (Jabareen, 2013a).

Similarly, in Libya and Tunisia, newly developing nations and those emerging from conflict face many challenges including the need to reassess existing building-standards, poor quality-systems measurement, a lack of reliable data, relatively low productivity rates of construction workers in an uncertain environment and resistance to change (Gherbal et al., 2012). Gherbal et al. (2012) revealed that most countries are likely to experience similar obstacles in their construction industry even though their economies are stable. These countries have *not* yet accounted for their respective *end-users' requirements* in the reconstruction decision processes and this lack of attention results in multiple re-programming of reconstruction priorities, creating huge deficits later, as in the case of Iraq. The issue is compounded in post-conflict Libya as, apart from the increasing pressure on the construction industry because of external factors (fall in oil prices) and internal factors (civil war or rallies by the public that have forced the shutdown of oil refineries) (discussed earlier), the construction industry has yet to achieve its potential, and faces problems coping with the competitive challenges previously discussed (especially post-conflict) as well as the ever changing market (Gherbal et al., 2012).

Consequently, there is a clear need for an integrative asset-management approach that addresses post-conflict and high alert situations. In fact, Summerell (2005) claims that, by applying asset-management procedures, both private and public sectors may go towards improvements in the efficiency and effectiveness of service delivery. Such improvement could be achieved by reducing operating and maintenance costs, improving delivery timescales and better managing value. In order to apply a successful asset-management framework to public sectors, it is clear there are many challenges to be overcome. Being able to recognize those challenges will help to design value-adding strategies with the development of alternative solutions. This research project

seeks to go towards such an integrated post-conflict asset-management framework, able to plug the current gap of end-user requirement incorporation.

1.2 PROJECT OUTCOME AND SIGNIFICANCE

It is observed that the management of infrastructure is changing as a result of growing difficulties triggered by many factors such as technical, economic, environmental (natural disaster), political (conflict and war is a decisive aspect), human resources and social challenges. It was foreseen that this study would

enable the development of an integrated infrastructure asset-management framework that includes:

- End-users' requirements and needs which lead to the establishment of a priority list;
- a flexible and amendable change structure that can be adapted by the Housing and Utilities Departments (such as those in Libya), appropriate for different conditions, a structure or a procedure that can help in the amendment of specifications, standards, design and legislation to suit specific conditions, in adverse (post-conflict/disaster-zone/high-alert) conditions;
- Life-cycle cost analysis (LCCA);
- Human capital strategies;
- Technology resources; and monitoring and feedback mechanisms.

1.3 CONCLUSION

This chapter provided a background about the consequences of conflict, wars and high alert conditions on societies as well as the critical role which the construction industry plays, through asset-management techniques, in the restoration and reconstruction of such conditions.

The chapter also discussed issues related to post-conflict/high alert conditions globally, and Middle Eastern countries such as Libya in particular. The main issue that was highlighted is the

lack of a long term and comprehensive post-conflict reconstruction approach, as well as the absence of an integrative asset-management framework to deal with post-conflict/high alert situations.

Following on from the background presented above, discussion below shall develop the thesis as a structured discourse in six main chapters, namely where:

- Chapter 1 introduced historical background of post-conflict reconstruction approaches, as well as asset-management definitions and concepts.
- Chapter 2 presents an analysis of research conducted on the application of post-conflict reconstruction approaches as well as the existing asset-management frameworks.
- Chapter 3 addresses the research methodology deemed appropriate for data generation for this research.
- Chapter 4 presents results and analysis
- Chapter 5 provides discussion
- Chapter 6 clarifies the case study applications
- Chapter 7 presents the conclusions from this study and recommendations.

The next chapter presents the literature review of this study.

CHAPTER 2: LITERATURE REVIEW

Many organizations and industry sectors have stressed the importance of the asset-management area as they believe success depends on the most effective and efficient utilization of their infrastructure assets in order to generate revenue. Hence, asset-management is considered a core process in many organizations to achieve fundamental goals such as optimizing utilization of infrastructure assets, increasing output, maximizing availability, and extending asset lifespan, while simultaneously minimizing costs (Koronios et al., 2005).

Asset-management is not a new practice but it is continuously changing. This term, however, has been extensively utilized with primary differences in interpretation and usage. Despite differences, most asset-management techniques involve the process of optimizing return, by scrutinizing performance and creating key strategic decisions during all phases of an asset's life-cycle (Sarfi & Tao, 2004). In order to have a meaningful debate about the concept of asset-management and its procedures, the asset-management studies on history, benefits and frameworks need to be accurately examined.

2.1 HISTORY OF ASSET-MANAGEMENT

The asset-management field is considered to be a relatively new discipline and a contemporary topic compared to other disciplines such as economics, finance and project management. Government organizations and industry specialists are considered to be the main key contributors to the existing asset-management literature. Consequently, these contributions take the form of guidelines, standards and reports on the best asset-management practices. Recently, some of the best practices have been developed as a standard such as the PAS 55 in the UK (BSI, 2008).

There are several leading organizations which have developed asset-management principles. Asset-management was introduced into the Australian public works in 1993 when the Australian Accounting Standard Board issued the Australian Accounting Standard 27 (AAS27). This standard necessitated government organizations to capitalize and depreciate assets rather than set them

against earnings. Such a standard has required organizations and industries to account for whole life cycle costs, useful life and cost effectiveness of asset investment (Too, 2010). The Australian State Treasuries and the Australian National Audit Office were the first organizations to formalize the concepts and principles of asset-management in Australia in which they defined asset-management as a systematic, structured process covering the whole life of an asset (Australian National Audit Office, 1996). As a result, other government organizations and industry sectors have been forced to develop, improve and apply the concept of asset-management in the management of their own infrastructure assets. Therefore, the theory of asset-management evolved as a distinct and accepted management field in Australia in the late 1990s (Too, 2010).

Another leading organization is the New Zealand Asset-management Support Organization which is a non-profit industry organization established to encourage the adoption of the asset-management approach through the development of best practice guidelines and training (van der Velde et al., 2013).

The professional Institute of Asset-management which is based in the United Kingdom in collaboration with the British Standards Institute (BSI) in 2004 is dedicated to developing and promoting best practices for the management of physical assets. The Institute of Asset-management developed the Publicly Available Specification PAS 55 (Part 1 and 2) for the optimized management of physical assets which was considered the first universally recognized specification for an asset-management system (BSI, 2008). The PAS 55 specifications were envisaged to assist all kinds of organizations/utilities to establish a high level of professionalism in the whole life cycle management of their physical assets: to establish an asset-management system to optimally and sustainably manage physical assets; implement, maintain and improve an asset-management system; comply with asset-management policy and strategy; seek certification/registration of their asset-management system by an external organization, and make self-determination and self-declaration of compliance with this PAS (Baird, 2011, p. 36). PAS 55 covers every organization, whether private or public in any sector in the United Kingdom. It is

already being used in utilities and public services and other industries such as manufacturing, mining, oil and gas and defense, pharmaceutical and engineering.

Part 1 of PAS 55 identifies the asset-management system requirements for managing physical assets during their life cycle. Undoubtedly, the management of physical assets is inseparably related to the management of other asset types. In other words, the ideal life cycle management of physical assets is greatly dependent on information and knowledge, human and financial resources (Baird, 2011) . The PAS 55 specification was updated in 2008 and the ground work was laid to move this specification into a standard. In 2010, the International Organization for Standardization (ISO) reviewed it at its preliminary meeting, and proposed new, different items be included in the asset-management specification and then approved the information of planning committee 251 which was charged with developing an ISO standard on asset-management using BSI PAS 55: 2008 as a starting place. The development of this committee stemmed from the current absence of standards on asset-management and so the brief of this committee was to develop a standard that would be more business-centric than asset centric; the new standard would not pertain to physical assets but also to all other organization assets.

2.2 ASSET-MANAGEMENT BENEFITS

As mentioned earlier, asset-management's growing importance has stemmed from the increasing number of guidelines and reports published by several organizations managing infrastructure assets such as AASHTO, PAS 55, Austroads, FHWA, APCC and others (AASHTO, 2002; APCC, 2001; Austroads, 1997; FHWA, 1999). Furthermore, various professional institutions and councils, such as the Institute of Asset-management in the UK, Asset-management Council in Australia, are being designed to advance the asset-management concept. Holding conferences, creating discussion meetings as well as providing courses, are some of the methods that have been used to spread awareness of the benefits of asset-management.

The asset-management approach stems from organizations' long term goals and objectives, accounts for the whole life assets' value (both physical assets and human resources) and, ideally,

combines economics and engineering fields. It provides an economic evaluation of complete comparative analysis of options for any infrastructure project. Also, asset-management links user expectations for system condition, performance and availability with system management and investment strategies as well as reporting on progress made in achieving goals and the evaluation of the process relative to the goals. Thus, the effect of alternative management and investment strategies on realizing the stated goals may be readily decided and communicated (FHWA, 1999).

According to FHWA (1999), asset-management's main focus is assets (including dollars, people and physical assets) as well as organization performance including return on investment, maximizing economic efficiency, accountability, opportunity costs and future requirements. Such a comprehensive approach is presumed to provide superior value to an organization or sector as well as increase the overall satisfaction for end-users. Another vital advantage of the asset-management concept is its ability to enhance the decision making process through weighting and articulating and communicating the impact of choosing one alternative over another based on ready access to quantitative and qualitative data.

Recently, the asset-management approach has become more vital as it has emerged as a tool that offers a holistic approach to the management of infrastructure assets. APCC (2001) pointed-out several benefits of adopting holistic asset-management:

- Increased opportunities for partnering with private sectors;
- More effective use and maintenance of existing assets;
- Improved processes and accountability for capital and recurrent works;
- Greater use of sustainable development solutions to enhance cultural heritage and environmental outcomes;
- Wider consideration of the use of non-asset solutions to meet service demand;
- Better allocation of limited resources;
- Realization of a return from surplus assets;
- Reduced demand for new assets through better integration of services.

A further assertion to the benefits of asset-management approach was mentioned by BSI (2008) in the Pass 55 (Part 1) as: improved performance, control of service delivery and optimized use of limited finances. It has also been stated to create cost reduction as well as customer service satisfaction. Danylo and Lemer (1998) further indicated that there are mainly three benefits of the adoption of asset-management technique. These are:

1. Emphasis on the economic importance of a region's infrastructure;
2. Identification of the income (and costs) of infrastructure within a framework that is understandable by all stakeholders and;
3. Control and reduction of the costs of public infrastructure assets.

Asset-management is considered as a business method intended to align the management of asset related spending to an organization's goals in order to provide the greatest value from the investment dollars available. Brown and Spare (2004) stated the goals of asset-management as follows:

- Balance cost, performance, and risk;
- Align corporate objectives with spending decisions;
- Create a multi-year asset plan based on rigorous and data-driven processes.

Asset-management is: *'Ambitious in scope, and requires supporting metrics, organizational design, processes, information systems, and corporate culture. Successful implementation can involve extensive business process changes, and requires the involvement and support of top management, sufficient resources, and effective change management skills. Canned approaches are doomed to fail, but thoughtful approaches can help distribution companies reach the next level in business success'* (Brown & Spare, 2004, p. 2).

In fact, The North Sea Oil and Gas Industry was the first to utilize asset-management as a label for a more integrated, whole life, risk-based management of industrial infrastructure assets in the early 1990s (Woodhouse, 2003). More importantly, 'Deregulation and privatization of

infrastructure such as utilities, transport and public services in the late 1980s and early 1990s have resulted in many organizations needing to transform their infrastructure assets from cost centres charged with carrying out budget projects into profit centres charged with contributing to earnings growth' (Too 2010, 33). Consequently, this has put much pressure on public organizations/sectors to adopt a more holistic approach to managing their assets and therefore the adoption of the asset-management approach.

Given discussion above of asset-management opportunities, the following section clarifies the specific problem - that adverse environments require a (more) structured approach to controlling facilities over their whole-life span.

2.3 ASSET-MANAGEMENT PROCEDURES AND IMPLEMENTATION

Currently, several asset-management frameworks exist, but there are no reference-models documenting all key activities and management strategies for the implementation of asset-management. This lack is an obstacle to the prompt implementation (needed in adverse conditions) of an asset-management system in a sector or an organization. A good reference model needs to explain all key activities, outline their flow, communicate and recommend the best practices during the entire implementation process (Kiwelu, 2009); there are limited structured guidelines that show the key activities of successfully implementing/integrating all concept variables timeously, especially for post-conflict conditions.

Asset-management application and benefits have not yet been clearly documented to take account of the full range of factors in less stable environments. Thus, end-users' involvement, life-cycle costing (LCC) approach, training (human resource perspectives) and flexible change strategy regarding standardization must play a major role (with a challenge to not only identify, but also to factor-in implementation strategies of asset-management) (Kiwelu, 2009). Also, due to the relatively long life-cycle of infrastructure assets, the whole/life-cycle approach is becoming increasingly important in related long-term investment decisions by society as it seeks best usage from its facilities. The life-cycle costs approach, according to the NSW Treasury (2004), is central

to asset-management; conducting benefit cost analysis requires both the total capital cost and present net (future) worth, thus LCC as an integrated procedure, requires increasing recognition of asset-management tool(s).

Summerell (2005) claimed that, by applying asset-management procedures, both private and public sectors may go towards improvements in the efficiency and effectiveness of service delivery. Such improvement could be achieved by reducing operating and maintenance costs, improving delivery timescales and better managing value. In order to apply a successful asset-management framework to public sectors, many challenges must be overcome. Being able to recognize those challenges will help to design value-adding strategies with the development of alternative solutions.

This section reviews studies which have sought to examine asset-management procedures and implementation. Much of the literature on asset-management has shown that there are major challenges to public sectors in adopting and implementing public asset-management. A study by Vanier (2001) examined the need for decision support tools for municipal-type organizations, and determined the challenges for maintenance, repair and renewal planning faced by asset owners and managers. He found that the needs were: unified data integration, improvement and standardization of currently obtainable tools, information exchange and technology transfer, and a need to address the lack of willingness to adopt asset-management principles by both the employees and senior management. Also, this researcher discovered that the integration with newly computerized systems such as maintenance management, geographic information corporate legacy systems was perceived as the major challenge for developing and using decision-support approaches in the area of asset-management. He recommended additional research in areas such as life-cycle analysis and service-life prediction.

A study was also undertaken by Hanis (2011) aimed at identifying the main challenges faced by a local government in a newly-developing region when adopting a public asset-management framework. The findings indicated there were significant challenges that the (Indonesian case-

study) government had to manage when adopting a public asset-management framework: the absence of an institutional and legal framework to support the asset-management application; the non-profit principle of public assets; multiple jurisdictions involved in the public asset-management processes; the complexity of local government objectives; the non-availability of data for managing public property and limited human resources. Hanis recommended that the (case-study) government address these challenges before accepting and applying a developed asset-management framework. The findings of this study are in line with another study undertaken by Hokoma (2010). Hokoma's study aimed to investigate the present status of the implementation levels of quality and manufacturing management techniques and philosophies within the Libyan iron and steel industry. The study revealed that the overall implementation status of total-quality management TQM, Just-In-Time (JIT) and manufacturing-resource-planning MRPII (building upon materials requirement-planning) was, at that time, at a most basic level of application even when it was indicated that these techniques and philosophies had been formally implemented. His study also showed that there was a lack of knowledge of key management techniques and their benefits across the surveyed industry. Of concern was the lack of senior management support indicated by *all* the respondents as an obstacle for non-implementation of the TQM practices.

A recent study undertaken by Gondo (2012) reviewed the practices, challenges and policy options used in municipal-asset water and sanitation sector(s) in newly-developing countries. The results indicated that the water sector had gone through a number of reforms but had *not* resulted in any knock-on cascade into improved infrastructure asset-management. Lack of financial resources, human resource expertise and appropriate organizational strategy had constrained the adoption and application of systems-software for effective asset-management. The researcher recommended that, in order to improve asset-management in the water and sanitation sector (of this developing region), there is a need to address: the absence of an asset-management plan; the limited financial capability by the local authorities; the shortage of experienced personnel; the absence of a supportive organizational strategy and the lack of stakeholder commitment.

Asset-management systems then, require a full appreciation of the variables concerned and a commitment to implement the factors in a structured way and not least an appreciation of the challenges to be overcome. The range of variables to improve structured approaches is discussed in more detail through the following relevant studies.

A study by Lemer (1992) identified the need for (new) national infrastructure policies requiring public infrastructure managers to acquire explicit *revenue* from public assets, thus moving from the old perception that public infrastructure are ‘free goods’. That revenue, he reported, must be allocated to the department of infrastructure for future maintenance of public infrastructure assets. Such policies, he added, should address and seek to avoid being syphoned-off, as various levels of maintenance-management can result in (politicians) making decisions based on their own personal gains or political agenda. An example of this is (politicians) deferring necessary maintenance and using funds for a political agenda towards creating ‘jobs’ or show-casing projects towards placating the electorate. Lemer states there is a vital need for non-aligned specialized expert groups (*such as the American Association of State Highway and Transportation Officials AASHTO*) to be responsible for technical leadership in the national development of infrastructure policies, publication of specifications and examination of protocols and guidelines, as well as to be a point of contact for any issues related to national or international infrastructure needs and impacts. Lemer concluded by emphasizing the need for public education as well as exploring partnership with private companies, to go towards better management of public assets in the long-run.

Another major challenge for public sector management of infrastructure assets is the availability of funds. Dornan’s study (2010) aimed to develop a remedy for addressing the fiscal challenges facing highway infrastructure. This research explored asset-management in light of recent developments in the funding, conditions, documentation and management of the USA’s highway infrastructure. Dornan found that asset-management was an effective response to the fiscal challenges confronting the US highway infrastructure as it encouraged the public private partnership notion that would necessitate state and local transportation agencies to seek efficient ways in which the highway infrastructure is managed. He suggested a Governmental Accounting

Standards Board (GASB-34) role for asset-management in order to increase accountability for public owned infrastructure and promote improved management of long- lasting capital assets as well as enabling public agencies to finance implementation of asset-management techniques and renewal of infrastructure assets through ‘covenants’ aligned with securitization or ‘shadow-tolling’. Shadow tolling, he stated, offers a helpful mechanism for generating a positive revenue stream to support securitized highway bonds. His study concluded that asset-management could be an effective process for helping the expansion, rebuilding or maintenance of any highway infrastructure.

Earlier research by Lemer and Wright (1997) demonstrated that improved infrastructure performance is achievable in spite of various obstacles (mentioned before) facing asset managers. The researchers undertook an integrated program, namely, the infrastructure innovation (I2) partnership, aimed at transferring research, education and technology to design, produce and publish new knowledge (knowledge management) that would enable and encourage enhanced infrastructure performance, and a management and decision-support system. They found that a management system would provide responsible managers with significant information on the status and performance of their current infrastructure system and would provide a means for discovering how future demands and management policies may impact performance. Lemer and Wright argued improvement can be attained by: increasing the overall returns of the public assets and changing the old belief that the public assets are ‘free goods’ (albeit without suggesting how this might be done); improving the scope, efficiency and reliability of infrastructure technology; improving the effectiveness of human resource involved in the design, construction, operation, maintenance of an infrastructure; acquiring more knowledge of infrastructure behaviour and then using that knowledge to improve design/ management; and improving efficiency/reliability of infrastructure services delivery.

The researchers proposed an intelligent-infrastructure-management-system (IIMS) framework as a computer-based management tool that would apply advanced information collection and management technologies to provide more efficient, accurate, and effective bases for making

decisions about infrastructure. The IIMS would combine a balance sheet (management report for accurate assessment of the value of infrastructure), an income statement, condition assessment, predictive modelling such as LCC, scenario development, and user-friendly information-access capabilities. This suggested that an integrated procedure has yet to be practically applied.

Another study examining asset-management tools for municipal infrastructure planning in the construction industry was carried out by Vanier (2001). Based on a literature review, the study aimed to recognize the extent of the asset-management market in North America; the study found that there was a need for decision-support tools for municipal-type organizations, and identified the challenges for life-cycle (maintenance/repair/renewal) costs planning faced by asset owners and managers. His study categorized various stages for asset-management using the six 'What' questions: What do you own? What is it worth? What is its condition? What is the remaining service life? What is the deferred maintenance? The responses to these questions provided information on the currently available tools and techniques for asset-management. From this data, Vanier developed an asset-management framework with each 'what' establishing a growing framework for asset-management plan implementation. This study, however, did not discover any comprehensive solution that addresses the current and future needs for investment planning for municipal engineers and managers unlike the study by Lemer and Wright which was able to identify more criteria for an effective asset-management framework. However, Vanier considered integration with existing systems such as computerized maintenance management, geographic information, and corporate legacy systems to be the most significant challenge for developing and using decision-support tools in the area of asset-management.

A further study, which reviewed the goals of infrastructure asset-management, identified the core processes of infrastructure asset-management as well as developing an AM framework, was carried out by Too (2009). A multiple case design that allowed replication logic and interviews was used to gather data. His results showed that cost efficiency, capacity matching, meeting customer needs and market leadership were the main goals of AM. Two main barriers to the adoption of AM were observed: a 'step-child' status that is often bestowed upon asset-management

groups within organizations; a lack of any strategic approach; and contentious statements of what constitutes asset-management. Asset planning (capacity-management/options-evaluation), asset creation (procurement/delivery) and asset operation (maintenance management) were the core processes of Integrated AM. Too indicated information management as central to the effective performance of all the other processes. Somewhat excluded from Too's illustration, it is argued here, is an explicit inclusion of any Life-Cycle Costing Analyses.

Too (2010) undertook another study in order to develop approaches that could be adopted in order to overcome challenges and improve the performance of the assets of Brisbane Airport (BAC). Through a case study approach data were collected from various interviews with senior managers responsible for the management of infrastructure assets as well as from a literature review. The challenges and approaches that were identified were categorized as broad strategic core processes required to contribute to the achievement of asset-management goals. However, a need remains for future research to develop improved management processes to achieve optimal solutions. In order to develop a descriptive framework for strategic-infrastructure asset-management that can be applied to various types of infrastructure assets such as roads, rails, utilities, airports, seaports, a study was prepared by Too et al. (2006) reviewing the research on current asset-management practices in-use. The framework which he developed, based on previous frameworks examined in his study, consists of three core components: strategic analysis, strategic choice and strategic implementation. Too, Betts, and Arun stated that an integrative strategic infrastructure asset-management framework is important as it is presented as a process model, is generic and can be applied to various types of infrastructure assets. His developed framework, presented as a process model, is generic and seeks to be applicable to various types of infrastructure assets.

Other studies have examined asset-management methods. Brighu (2008), for example, investigated the viability of asset-management methods and their prospective contribution towards enhancing water service utility. A case study was chosen for this study, namely, a water utility serving Jaipur in India. A generic asset-management framework was developed and applied to this

case study. The research indicated that it is possible to take a ‘low-cost’ first step towards asset-management, but it requires a change in the management approach. However, the study found that a lack of relevant data was a crucial factor influencing an effective and comprehensive application of a generic asset-management framework.

Another study, carried out more recently, by Younis and Knight (2012) in Ontario Canada aimed at developing an integrated asset-management framework for wastewater collection systems. A case study based on real data presented the use of business intelligence tools to implement, monitor and report various components of the developed framework. The researchers developed a new integrated asset-management framework for wastewater collection systems using a modified balanced scorecard model. The elements of the proposed management framework and modified balanced scorecard were developed based on multiple collaborative working sessions held in 2009 during the first Canadian National Asset-management Workshop (CNAM, 2009). The framework took into account social/political, financial, operational/technical and regulatory perspectives. This framework, the researchers stated, would only be suitable for waste water utilities and waste water collection. Some asset-management frameworks, then, it might be argued are discipline specific; this presents a challenge for authorities seeking to adopt a generic system to manage facilities.

Another comprehensive building asset-management framework was developed by Elhakeem and Hegazy (2012). The proposed framework based on a two-phase optimization procedure was evaluated in a large school environment in the USA. The framework had a unique formulation in which all functions from inspection, to deterioration modelling, and life-cycle analysis, tracked the dynamics of building deficiencies, arguing that frameworks could assist, they stated, organizations with large building assets to enhance the overall condition of their inventory with the highest return on the limited repair budget. This framework developed and integrated versions of other frameworks mentioned earlier. It might be argued here that a Pareto’s law (20:80 weighting) of input/output variables might enhance applications above for limited budgets to have most benefit, across a wide range.

It can be concluded from this review on asset-management application that this concept would be a very beneficial technique for addressing the fiscal and technical drawbacks facing infrastructure departments world-wide. Management of infrastructure, however, is changing as a result of growing difficulties triggered by many factors such as technical, economic, environmental (natural disaster is an example), political (war and both internal and cross-border conflict are significant factors), human resources and social challenges. These factors have not yet been addressed in totality and this represents a gap in the current knowledge. In other words crises as a result of natural or man-made disaster have not been incorporated as criteria of concern in asset-management frameworks.

Crises are inevitable challenges for projects (Mallak et al., 1997). Traditional engineering management techniques for managing such infrastructure require review, not only to meet the need of all key players when developing an infrastructure management framework such as regulators, policy makers, infrastructure managers, users and operational staff, but also to address the vital need of an integrative approach that allows infrastructure decision-makers to deal with adverse (post-conflict/disaster-zone/high-alert) conditions.

This need also arises from the past failure of post-conflict reconstruction experiences in many countries such as in Iraq. This is mainly due to the short term vision, absence of end-users' involvement as well as the absence of a long-term comprehensive reconstruction approach. There have been several studies examining post-conflict reconstruction techniques and approaches, highlighting key success factors as well as vital obstacles for post-conflict situations.

2.4 AN EXAMINATION OF POST-CONFLICT RECONSTRUCTION

Kage (2010) conducted a study in order to determine the factors influencing the variations in the rate of post-war recovery as well as to develop and test a framework for post-war reconstruction. Based on quantitative data Kage developed a general framework for post-conflict reconstruction which contained three basic elements: *identifying needs*, *implementation* and

finally **monitoring**. The study also identified the success factors which had led to faster reconstruction in Japan in terms of employment, rebuilding of hospitals or schools:

- effective identification of needs;
- efficient implementation;
- private sector involvement;
- effective monitoring;
- a combination of high levels of per capita GDP as well as high levels of consistent knowledge sharing among citizens.

Arguing further for community involvement, Kage stated that this would help expedite society-wide contribution to the identification of needs and priorities, would assist implementation and provide effective monitoring. On the other hand, without the involvement of a civil society, especially after a civil war or high alert conditions, post-war conflict or disaster reconstruction efforts, he argued, are unlikely to succeed. However, despite the general framework developed by Kage, this study failed to provide any comprehensive solution or framework for post-conflict/high alert reconstruction and only provided a basic and general framework as well as suggesting the need for including the affected society's requirements during post-disaster reconstruction processes.

A similar conclusion to Kage's study was drawn by Bowen (2009) in his report, *Hard Lessons*, published by the Special Inspector General for Iraq Reconstruction (SIGIR); this report aimed to examine the reconstruction effort which was carried out in Iraq from 2002 to 2008. The report was based on interviews with hundreds of key players in the Iraqi reconstruction experience as well as a review of thousands of relevant documents. In addition, the report utilized SIGIR's audits, inspections and investigations as well as reports drawn from other agencies and investigative bodies.

The report revealed that the first and foremost cause of the reconstruction failure was a clear lack of planning. There was a reconstruction gap between the number of projects promised and

planned and the number of projects completed. This was the result of the rise in spending on military and security needs, in addition to project delays and cost overruns. Because end-users had been excluded from the reconstruction procedure as a key element, *multiple re-programming of reconstruction priorities*, added maintenance expenses, employee turnover and higher material costs were incurred.

Waste and mismanagement, as Bowen reported, were other decisive factors. For instance, companies such as Bechtel and Halliburton signed contracts valued at billions of dollars for a variety of work allowing up to 15 percent profit in award fees alone but ignoring standard contract procedures as well as the agreement of a certain time-frame for job completion. As a result, the US government had to cancel over 1,250 contracts for mismanagement and cost overruns, bearing in mind 600 million dollars had been already spent. However, Bowen stated that corruption was the least contributor to the post war reconstruction failure; rather he considered the following factors to be the more critical contributing factors:

- lack of proper planning and integration of efforts;
- the regular changes in reconstruction strategy (reactive measure);
- the instability caused by frequent personnel turnover at every level;
- the waste triggered by poor contracting and program management practices;
- weak leadership and end-users' non-involvement.

In other words, the absence of a long-term comprehensive reconstruction approach, the non-involvement of the Iraqi people as well as improper contracting strategies undermined progress in reconstruction in post-war Iraq resulting in billions of dollars in losses (Jabareen, 2013a).

The importance and the successful consequences of end-user involvement are demonstrated by the Japanese experience post World War II when the rebuilding stage of their society commenced. Goldman (2005), to assist the reconstruction of Japanese industry following the Second World War II, examined the origins and development of quality initiatives in US business through comprehensive history, discussion and literature reviews. The consequence of using quality

control, he found, as developed by Americans, Edwards Deming, Joseph Joan and others, was more successful in Japan than in the US for which it had been developed. With the help of their unique culture (embodying collectivism) as well as shifting their focus onto quality, the Japanese then developed what has come to be known as the best management technique in the World, namely, Total Quality Management (TQM).

End-users' involvement as well as employees' empowerment were some of the unique aspects of the TQM technique which were identified as contributing significantly to Japan's post World War II rebuilding. This means end-users' requirements, needs and desires must be included into the design and development of the products or services. Kage cited participation, involvement, employees' empowerment, teamwork and commitment as management responsibilities for 'producibility'. TQM describes individual participation and commitment as empowerment. Each employee becomes, at the same time, then, both a producer and a consumer.

The results of this study are in line with another study undertaken by Saha (1989). Saha's study aimed at examining, through literature review, post-war Japan's development and the methods and procedures which Japan had to adopt in order to become a leading producer world-wide. Several key success factors were highlighted. The most critical factors were: greater focus on both employees' and managers' training, massive investment in research and technology (Japan had looked to the West for advanced technology), quality circles as well as motivation.

Of all these factors, the group-oriented mechanism inherent in Japanese culture was the decisive and key success factor when applying or developing any management techniques such as quality circle (QC) and TQM. In other words, the Japanese culture had a profound effect on managerial practices and on the work behaviour of individual employees. The second important factor could be attributed to training. Saha provided the word "Massive" to best describe the learning programmes undertaken in Japan post-war, involving thousands of managerial personnel at all company levels, including directors and top executives. Through such programs, managers and executives became competent in obtaining product quality as part of their normal responsibilities.

This study, however, failed to offer any comprehensive reconstruction approach for post-conflict countries generally and only delivered, as was the case with Goldman's study, key success factors that had contributed specifically to Japan's post-war success.

Another study which highlighted the significant factors for Japan's post war success was carried out by Hull et al. (1985). Their study aimed at outlining major differences between the American and Japanese approach to resource and development management. Data from a comparative study of US and Japanese organizations were utilized to assess differences. The main findings of the study were that Japanese organizations invested relatively more in employee training, embraced more group processes, such as quality circles, and obtained more suggestions per employee than American organizations. The rate of innovation was also higher in the Japanese companies. Hull attributed these differences to the fact that Japanese organizations progressively emphasize new product development along with a determination of the most appropriate Western approaches to their management of R&D. On the other hand, American organizations seemed to place greater emphasis on cost reduction and quality enhancement; at the same time they encouraged a more participative management style. This study confirmed the conclusion that Japanese organizations place extensive emphasis on R&D, frequent exploration and adoption of the most appropriate technology and management techniques used in the Western world.

Another study undertaken by Botes and Rensburg (2000) investigated, through a case study, the dynamics of community participation in the South African urban upgrading context. The study uncovered vital drawbacks to the community participation approach and then discussed several guidelines to be considered by governmental sectors/organizations when involving community. The critical drawbacks pointed out were:

- The paternalistic role of development professionals (intentionally or un-intentionally) undermined or disempowered local people from making their own decisions;
- The over-reporting of development successes in comparison with failures;
- Selective participation (involving only elite and educated people);

- Hard-issue bias: factors such as technological, financial, physical and material were considered (by the NGOs and the international organizations) to be more vital for the successful implementation of projects than the ‘soft’ issues such as community involvement, decision making procedures and empowerment;
- Conflicting interest groups;
- Excessive pressures for immediate results;
- The lack of public interest in becoming involved as a result of past experiences where their requirements were not considered, even after public discussion.

Botes and Rensburg (2000, pp. 53-54) further offered twelve important guidelines for successful community involvement:

- ✓ Show an awareness of the status of the community and the potential consequences of their involvement;
- ✓ Respect the community’s indigenous contribution as manifested in their knowledge, skills and potential;
- ✓ Become good facilitators and catalysts of development to assist and stimulate community based initiatives and practices;
- ✓ Promote co-decision-making in defining needs, goal-setting, and formulating policies and plans in the implementation of decisions for community rebuilding;
- ✓ Communicate both programs/project successes and failures;
- ✓ Believe in the spirit of ‘Ubuntu’ – a South African concept encompassing key values such as solidarity, conformity, compassion, respect, human dignity and collective unity;
- ✓ Pay attention to community members, particularly the more vulnerable;
- ✓ Stand against the domination of some interest groups, elite for example;
- ✓ Include a cross-section of interest groups to collaborate as partners in jointly defining development needs and goals, and designing appropriate processes to reach these goals;
- ✓ Recognize that process-related soft issues are as significant as product-related hard issues;

- ✓ Aim at releasing the energy within a community without exploiting or exhausting the community;
- ✓ Empower communities to share equitably in the fruits of development through active processes whereby beneficiaries influence the direction of development initiatives rather than merely passively receiving a share of the benefits.

Botes and Rensburg concluded that, despite some issues associated with community participation, development would be possible only with appropriate community involvement. However, this study discussed community participation drawbacks and future guidelines for general development and did *not* consider such participation in difficult times such as post-conflict/high alert situations.

Similar findings were uncovered by Brown (2005) in his study which evaluated the impact of post-war reconstruction methods in Iraq and also examined to what extent Iraqis had been involved in the reconstruction plans. This study was based on the experiences of Brown who had worked as an engineer for the Coalition Forces in Iraq, specifically, in Basrah and Baghdad between 2003 and 2004. He also interviewed key executives as well as civil engineers. Brown stated that the general outline plans for ‘rebuilding Iraq’ were mostly developed by the White House, US government agencies and the US Department of Defense (with the Pentagon appointed as authority for reconstruction on 20 January 2003). Other studies have sought subsequently to review disaster management in Iraq (Al-Dahash et al., 2014), albeit that Brown’s (2005) argument that the initial plan for Iraq was primarily developed using a top-down approach (centralized approach) and this remains key. Moreover, US procurement instructions and short timescales permitted little opportunity for a participative approach.

As in the Botes and Resberg study, further factors contributing to the community involvement failure post-conflict were: no plans for community involvement in the reconstruction programs; lack of primary and clear strategic picture and therefore conflicting project priorities arose; lack of appropriate technology; non-existent charging mechanisms for funding operational and

maintenance expenditure; absence of training programs and, finally, the lack of systemic reconstruction as well as a comprehensive strategic planning approach.

Brown (2005) argued that a participatory approach would have made the re-development successful through being people-focused rather than just project-focused. To achieve sustainability, Brown concluded, the following factors must be addressed: a proper governmental sector/organization (to plan and manage its design; construction, operation and maintenance); an applicable specification and level of technology; community involvement; a holistic approach for planning, specification and design. However, he did state that *solutions for post-war reconstruction will always be subject to each individual or specific situation.*

A further study undertaken by King and Mason (2006) aimed at, through a case study, examining the post-war recovery of Kosovo. They found that the international community had failed to accomplish sustainable project outcomes in rebuilding Kosovo after the conflict. The factors, however, were different to the two previous studies in that they were due to: unskilled staff, corruption, limited economic opportunity, lack of sustainable employment opportunities for its citizens due to 'interethnic hatreds', lack of an operative local legal system. In addition, community members' views and requirements were not utilized in the post-war reconstruction recovery process. Consequently, crucial infrastructure was not reconstructed, corruption was still prevalent and violence against minorities was common. King and Mason suggested that, in order for any post-war recovery process to be successful, the rule of law must be established; then there must be a clear set of goals along with a comprehensive post-war reconstruction recovery approach.

In line with the theme of post-conflict/high alert reconstruction, a further study that examined post-war reconstruction techniques was carried out by El-Masri and Kellett (2001). This study evaluated the reconstruction of war-damaged villages destroyed during the civil war that had occurred between 1975 and 1991 in Lebanon and compared top-down and bottom-up techniques used in post-war reconstruction. A detailed case study of one Lebanese village, namely, al Burjain, was chosen as a case study. This study was based on fieldwork, which utilized a qualitative

approach. El-Masri and Kellett found that the best way to approach post-conflict reconstruction was by applying bottom-up techniques as they require the involvement of end-users, offer empowerment, call for the adoption of applicable technology, and incorporate rebuilding and development as essential measures in dealing with reconstruction after conflict or disaster. This conclusion has been supported by other researchers who have strongly suggested a bottom-up approach for post-conflict reconstruction (Cockburn and Barakat, 1991; Landewijk and Shordt, 1988; Aysan and Oliver, 1987; Anderson, 1985; Cuny, 1983; UNDRO, 1982; Davis, 1981).

Unlike top-down techniques where local conditions, and users' needs, desires and potentials are ignored resulting in frequent project alterations, the *bottom-up approach*, they stated, would offer superior benefits if appropriately and comprehensively planned and carefully implemented and monitored. The critical and success factors of the bottom-up technique, they reported, were the inclusion and appreciation of end-users' requirements and desires. El-Masri and Kellett concluded that, given the destruction that wars and conflicts leave behind, a careful consideration of pre- and post-disaster conditions, better identification of community needs, desires and requirements as well as an appreciation of opportunities and constraints are crucially needed in order to create economic opportunities, to maximize the use of available resources and strengthen social collaboration.

On the other hand, as in the case of other studies (Kage, 2010; Bowen, 2009; El-Masri and Kellett, 2001; Saha, 1989), this study also did not provide any comprehensive approach for post-conflict reconstruction but rather supported the other researchers' conclusions that end-users' and private sectors' involvement, long-term and comprehensive reconstruction plans as well as strong leadership were needed for a successful post-conflict reconstruction plan.

International aid for post-conflict situations is another form of a post-conflict reconstruction approach. A recent study by Pemunta (2012) evaluated the effect of international community aid as a post-conflict reconstruction technique on post-reconstruction in Sierra Leone. A bottom-up approach 'through the eyes of the poor' was designed for this study as well as a combination of primary and secondary research methods. Pemunta found that aid without the required local

institutional structure and a comprehensive approach, as in the case of Sierra Leone, caused a narrow focus which suppressed sustainable and effective reconstruction, growth and development. This study indicated clearly that aid without a comprehensive post-conflict reconstruction plan would be pointless and thus such aid would be wasted. *Pemunta suggested there was a need for comprehensive reconstruction plans.*

A similar conclusion was drawn by Addison and McGillivray (2004). Their study aimed at, through extensive literature review, evaluating the effectiveness of aid to conflict-affected countries. The literature review considered a wide range of findings about the effectiveness of aid and found that there was agreement among many researchers and policy makers on the fact that aid would be ineffective without proper measures being taken to achieve security, especially in developing countries. These measures included hindering the global flow (as well as within war-affected countries) of weapons and the resources which have contributed to the destruction in those societies, developing better policies (which do not differentiate among different ethnic groups), long term planning techniques as well as endeavouring to have early involvement after the conflict. Yet, the absence of long term reconstruction planning has not been considered in research studies to date.

Another post-conflict reconstruction approach, autonomy in building environment approach, was examined by Turner in 1977. A case study in Lebanon, namely, al-Burjain, was examined. Turner found that there were many disadvantages to this approach; design weaknesses, infrastructure shortage, and unavailability of materials were critical factors. Those who were still in control of the whole reconstruction procedure repeated the same mistakes (design related mistakes for example) and therefore intervention (community and government) to rectify the mistakes was lacking.

This approach led to several critical failures. It was found that the approach had been limited by the compensation assigned either by key providers such as the local government or, in most cases, by international aid organizations. This approach clearly lacked a long term and comprehensive reconstruction plan. In addition, the money compensated had not been entirely

used for the purposes to which it had been assigned – to enhance their community’s infrastructure, to assist construction practice, to source quality and to retain their culturally-rooted architecture. In contrast, the compensation, Turner stated, had inspired individual approaches to reconstruction design, forms, materials and architectural features ignoring common interest as well as accessibility within the village. Turner raised further drawbacks to this approach. Compensation had been claimed by individuals who never undertook the reconstruction of their homes. Many factors could be attributed to this issue. For instance, individuals who already had settled in another country (emigrated as a result of the civil war in their home country) and who never intended to live in their home country, still claimed the compensation. Some individuals, who had already settled in another country, still undertook minor reconstruction and utilized this build as a second home. Consequently, Turner argued that cash compensation does not guarantee optimal physical, social and economic results, not to mention the fact that individuals may never intend to settle in their original home country.

This study highlights the fact that it is vital for a specific governmental sector to be in charge of the whole reconstruction process and develop a long-term and comprehensive reconstruction plan for post-conflict situations, while at the same time accounting for end-users’ requirements and needs.

Unlike all the studies discussed earlier, a more recent study by Earnest (2011) examined the complexities and challenges of post-conflict reconstruction in Kosovo and then developed a tailored post-conflict reconstruction approach. The study also aimed to detect any deficiencies in the implementation of post-conflict reconstruction planning and to utilize *project-based concepts* to develop a project management framework for managing projects in post-conflict societies. To develop the framework, Earnest further examined the possibilities of adopting internationally accepted project management tools and techniques (PMBOK) designed to assist the implementation of post-conflict reconstruction planning. Kosovo was chosen as a case study and interviews as well as survey data were utilized to address the study’s aims.

Earnest found that there was poor quality planning as well as poorly implemented post-conflict reconstruction projects. Incompetent staff and corruption were perceived to be other critical factors. Another significant discovery was that both local and international aid organizations did not work in a community service delivery setting. Consequently, this study identified the urgent need for community involvement in post-conflict project identification, planning and implementation. Earnest's study clearly revealed that the success of post-conflict reconstruction planning depended on a community's ability to identify their needs and requirements as well as the complexities of the political environment and their ability to coordinate this critical stage in an operational manner.

Earnest proposed a project management framework based on utilizing the Project Management Body of Knowledge (PMBOK) as a base model. Unlike the other post-conflict reconstruction techniques discussed earlier, this framework seemed to have procedures which were more suited to reconstruction and rebuilding in post-conflict settings. This framework utilised nine knowledge areas of PMBOK: integration, time, cost, quality, human resource, communication, risk and procurement (refer to Figure 4).

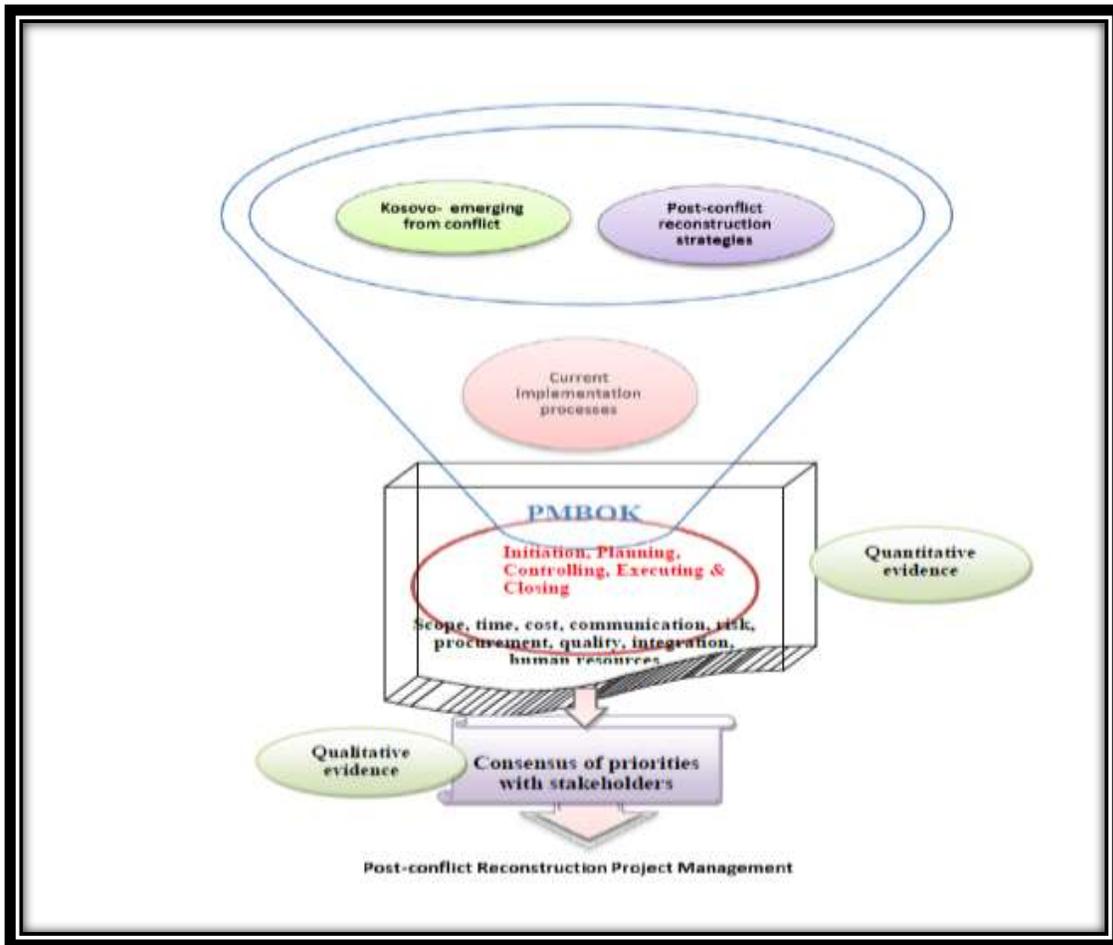


Figure 4: Hypothetical project management research model

Source: Earnest (2011)

This framework, *however*, lacked the inclusion of key activities such as an economic evaluation technique, for instance, life cycle costing technique that would be beneficial in developing alternatives prior to choosing the most efficient and cost effective alternative. A further key activity which this framework did not include, was a flexible change strategy able to be amended with regard to specifications, design, standards, human resources and legislation (when appropriate) as well as being able to accommodate the cost of whole life values. Earnest concluded that, as the utilization of a project-based management approach for post-conflict reconstruction is relatively new, further research is required. In addition, this framework was proposed for Kosovo's

conditions and thus might not suit other post-conflict countries because of completely different circumstances and environment. Consequently, further studies, *he suggested, were needed to investigate the needs of other post-conflict countries.*

The significance of the need for comprehensive post-conflict reconstruction plans stem, according to Sugiura (2010), from their contribution to peace building, increasing employment as well as enhancing a country's economy and thus its wellbeing. Sugiura's study clearly showed how the reconstruction stage post man-made conflict, if started in a timely manner, can contribute to promoting the process of peace. A case study was chosen, namely, The Manner District Rehabilitation and Reconstruction, and then examined through a community based approach post-conflict period in Sri Lanka between 2002 and 2008. The targeted infrastructures were roads, buildings, water supply schemes and market facilities. These projects were foreseen to help build the affected community and thus enhance peace building during the post-conflict era.

The study found that, regardless of any disparities, building, maintaining and improving Sri Lanka's infrastructure were effective techniques to improve the economy. Some of the gained benefits, he stated, were: opportunities for jobs, training, education, demand for commodities, transportation, and natural resources like water. In other words, infrastructure can enhance the distribution mechanism of several resources, work and materials, if enough materials are available and the budget is secured under the unsettled situation. Sugiura concluded that 'people considered reconstruction as an opportunity to create a better society, which would help to avoid the problems of the past and respond to future development' (Sugiura, 2010, p. 99).

Pathirage et al. (2010) undertook a different study which aimed at identifying key success factors in managing disaster to improve the understanding of disaster management. This study utilized a broad literature review as well as interviews with experts (involved in the disaster management process), supported by a large questionnaire survey, with special focus on the Asian tsunami and case examples from Sri Lanka.

The researchers identified several success factors and then grouped them into eight key categories. These categories were: technological, social, legal, environmental, economic, functional, institutional and political. These factors, according to the researchers, must be considered for successful disaster management. For instance, technological success factors include any tools, techniques, procedures and methods developed using the application of scientific advances that could be used to enhance disaster management (warning systems, information and communication technology are two key aspects).

Despite highlighting key success factors for disaster management, this study failed to provide any comprehensive solution/framework to approach such disasters; it also did not provide success factors for man-made disasters, e.g. war.

This literature review has demonstrated that there is a clear lack of long-term and comprehensive post-war reconstruction planning. Many, if not all, studies have provided a general framework with very basic elements for approaching post-conflict reconstruction, have discussed success factors, have identified the significance of successful post-conflict/high alert reconstruction planning as well as the need to consider community requirements. The absence of a long-term comprehensive reconstruction approach has undermined progress in reconstruction in many countries such as Iraq (Jabareen, 2013a). Achieving good results in post-conflict/high-alert conditions requires making educated decisions, promoting good governance as well as better allocation of scarce resources. Furthermore, a clearer focus and understanding of the planning and implementation processes of post-war/high alert reconstruction projects and programs are required as well (Rondinelli & Montgomery, 2005). Consequently, there is a critical need to develop a comprehensive plan or framework for post-conflict reconstruction.

This study has been designed, therefore, to examine the existing asset-management frameworks; evaluate the post-conflict reconstruction approaches that already had been applied to post-conflict settings, and then to develop an integrative asset-management framework for post-conflict/high alert conditions.

2.5 CONCLUSION

In conclusion, this literature review has highlighted many important findings. One of the main findings is that an asset-management concept would be a very beneficial technique for addressing the fiscal and technical drawbacks facing governmental organizations world-wide. Management of infrastructure, however, is changing as a result of growing difficulties triggered by many factors such as technical, economic, environmental (natural disaster is an example), political (war and both internal and cross-border conflict are significant factors), human resources and social challenges. These factors have not yet been addressed in totality and this represents a gap in the current knowledge. In other words crises as a result of natural or man-made disaster have not been incorporated as criteria of concern in asset-management frameworks. Also, a review of the existing post-conflict reconstruction approaches showed that there is a clear lack of a comprehensive long term post-conflict reconstruction approach, coupled with lack of the inclusion of end-users' requirements and needs.

Thus, this study was designed to develop an asset-management framework for post-conflict/high alert conditions. This framework(s), it was envisaged, would form the basis of workable and flexible sets of comprehensive procedures able to be amended with regard to specifications, design, standards, human resources and legislation (when appropriate) as well as accommodating the cost of whole life values.

The next Chapter presents the methodology of this study.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

In any given research or study that aims to create solid/concrete results, a well-defined methodology for the sake of establishing those tangible results is vital. Research methodology is a systematic way to solve a problem. It is a science of studying how research is to be carried out. Without methodology, clear and correct results are very difficult to attain. With methodology they are clear and achievable. Basically, methodology is the core/heart upon which scientific research/study is built (WaterkenInc, 2002).

This chapter describes the reasons for the selection of the study's research methodology. A framework of the planned study was prepared which contained the research study design, research mechanisms, data collection strategies as well as the analytical methods utilized to answer the research questions governed by the research objectives. Qualitative research methodology approaches integrating both qualitative data collection, document analysis as well as a case study strategy, were utilized to identify key, currently utilized post-conflict/high-alert reconstruction approaches and drawbacks in order to develop an asset-management framework for post-conflict/high-alert conditions.

3.2 MAIN STUDY AIM AND OBJECTIVES

The objectives of a study or research basically set out what is to be achieved or established by the study or research. Objectives should be closely related to the statement of the problem. Objectives are basically intended goals that are set by researchers so that the whole research can work toward its fulfilment. They are very important to the research as they provide a clear understanding of what is to be achieved, direction and guidance for the research. Well-formulated, specific objectives will facilitate the development of any study or research methodology and will help to orient the collection, analysis, interpretation and utilization of data (International Development Research Centre, 1999).

The main aim of this project was to evaluate the current post-conflict/high-alert reconstruction approach, and asset-management techniques as well as the economic evaluation techniques currently utilized by the Department of Housing and Utilities in Libya and Tunisia with a view to **developing an Integrative Asset-Management Framework for infrastructure facilities in adverse (post-conflict/high-alert) conditions using Libya and the surrounding region as a representative location;**

this framework(s), it's hoped, forms the basis of workable and flexible sets of comprehensive procedures able to be amended with regard to specifications, design, standards, human resources and legislation (when appropriate) as well as accommodating the cost of whole life values.

Specifically, the objectives of this study were as follows:

I. With regards to post-conflict reconstruction:

- a. to examine specific utilised conflict reconstruction approach(es) related to post-conflict environs in 2011 North Africa;
- b. to identify the affected community's requirements and needs post-conflict/high alert conditions in Libya (Tripoli, Bengasi, Misurata, Sirte and Sabha). The aim of this step was to understand the current affected communities' requirements and needs and then compare them against the governmental approach which had already taken place in post-conflict/high alert Libya.
- c. to determine if the Libyan communities were paying any tax for maintenance of existing infrastructure assets/services and if they were willing to pay tax to finance the maintenance/ building of new infrastructure assets/services.

II. With regards to asset-management techniques:

- a. to examine the major current asset-management frameworks utilized in developed and alternatively newly developing regions;
- b. to determine the current asset-management techniques utilized by the Housing and Utilities departments in (high-alert) zones of interest such as Libya (*Libya's five main cities*) and Tunisia;
- c. to identify factors, if any, preventing or slowing the adoption of AM techniques.

III. With regards to economic evaluation techniques:

- a. to determine the current economic evaluation techniques utilized by nations in environments of flux, specifically Libyan (the five main cities) and Tunisian main Housing and Utilities departments;
- b. to determine the barriers, if any, preventing or slowing the adoption of the most efficient and effective techniques in these countries.

IV. With regards to human resources:

- a. to examine training program content, frequency and length pre and post-conflict conditions;
- b. to evaluate the upper management involvement in the adoption of asset-management techniques in the two countries of this study;

V. With regards to standards/specifications:

- a. to examine the standards, specification, design and regulations that had been set by the main transportation department in Libya, with regards to roads in general, and the **Gharyan-Mizdah Road** project case-study specifically;
- b. to identify how the case-study departments deal (t) with required change.

The above objectives, it's hoped, lend themselves to the development of a flexible management structure able to be amended with regard to design, standards and legislation in adverse situations and then to be incorporated into the proposed integrative asset-management framework.

3.3 RESEARCH METHODOLOGY

To decide on the most appropriate methodology for any given research study is a challenge. There are many types of research methodologies, but this study focused mainly on two types which were qualitative and quantitative research. Each type has advantages and disadvantages and the following section describes them in more detail. Moreover, the justification for the most appropriate research methods applicable to this study is presented as well.

3.3.1 THE METHODOLOGICAL FRAMEWORK OF THE STUDY

This research utilised a case study approach, survey questionnaire, interviews, and document analysis. The case study incorporated literature reviews, individual interviews and document analyses. The work of the project was carried out in the following sequence:

a) **Detailed analysis of the literature review:**

- 1) a suitable economic evaluation technique was identified and justified from the range of existing techniques in order to be then integrated into a proposed future development of a new asset-management framework;
- 2) the current asset-management frameworks were analysed to identify areas which had not been considered;
- 3) a review of post-conflict reconstruction approaches/strategies was undertaken in order to identify any areas which had not been previously addressed.

- b) **Quantitative data collection** through a questionnaire survey with the affected communities in Libya (Five cities) in order to recognize their requirements and needs. This was started before the semi-structured interviews with senior managers and civil engineers responsible for the management of infrastructure.
- c) **Qualitative data collection** through semi-structured interviews with senior managers and civil engineers responsible for the management of infrastructure assets at the main department of Housing and Utilities in the two regions (discussed above and including the five cities in Libya), to identify:
- 1) the utilized post 2011 conflict reconstruction approach;
 - 2) current utilized asset-management techniques by these departments and, factors, if any, affecting the adoption of the AM technique in these departments;
 - 3) current economic evaluation techniques and factors, if any, affecting the adoption of the this technique;
 - 4) perspectives related to life cycle costs, other evaluation techniques, and procedures related to the management of infrastructure assets.
- d) **Documents analysis** and statistical significance evaluation was utilized in order to examine:
- 1) The Housing and Utilities Departments' policies and procedures regarding the management of adverse (post-conflict/disaster-zone/high-alert) conditions;
 - 2) current utilized standards and codes, especially for roads and bridges (The case study);

- 3) The Housing and Utilities Department' policies and procedures regarding human resource management, training programs in specific, post-conflict/disaster-zone/high-alert conditions;
- 4) opportunities to expand upon existing techniques towards the development of updated frameworks.

The Methodological framework for this study is shown in Figure 5.

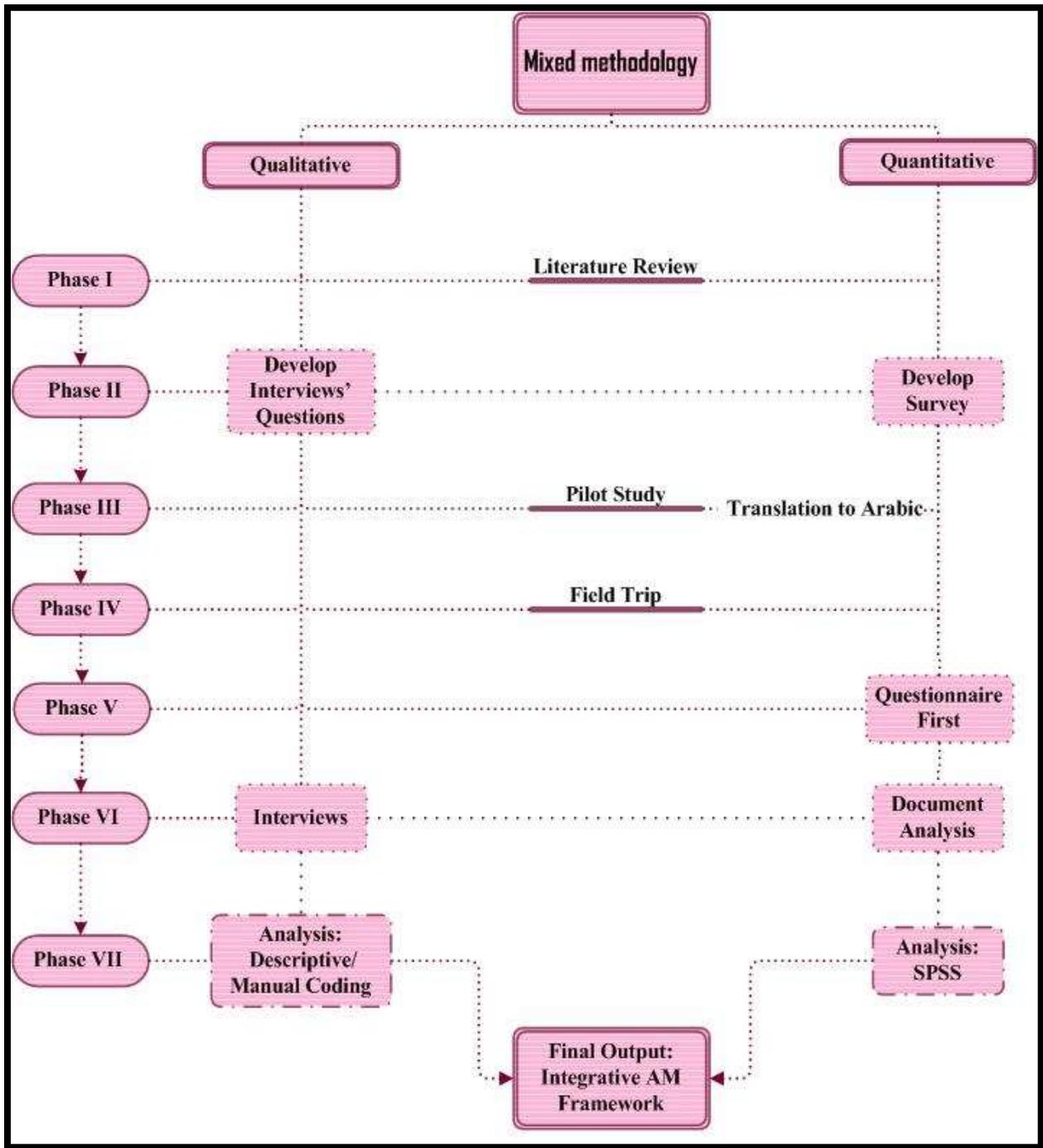


Figure 5: Research Methodology

3.3.2 QUALITATIVE RESEARCH METHODOLOGY

There are a number of qualitative research definitions. Denzin and Lincoln (1994) define qualitative research as ‘multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them’ (383). Creswell (1998) defines qualitative research as an ‘inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem’ (15). The researcher constructs a complex picture, analyses words, reports detailed views of informants, and conducts the study in a natural setting. Qualitative research is a form of scientific research that:

- Seeks to understand a given research problem from the perspectives of the people involved;
- Seeks answers to a particular question;
- Uses predefined sets of procedures to answer that question;
- Collects evidence and produces findings (Mack et al., 2005).

Qualitative research method is effective, particularly in attaining information about personal opinions, values, behaviours and social context of a particular population. The main goal of qualitative research is to determine models/guidance after close observation, careful documentation and precise analysis of the research topic or question. It also offers the researchers much valuable information, informative and ‘rich’ answers to the questions being examined (Ewings et al., 2008)

➤ **Advantages of qualitative research methodology**

The following advantages can be gained from qualitative research:

- Produces more carefully, comprehensive information (Richness of data) (James, 1997);
- Searches for a wide understanding of the whole situation;

- Uses subjective information and participant observation to describe the natural setting of the variables under consideration (James, 1997);
- Not limited to definable variables (Hair et al., 2008);
- Seeks to examine complex questions that can be impossible with quantitative methods (Okstate, 1998);
- Aims to explore new areas of research and can build a new theory;
- Can be very economical and timely data collection (James, 1997);
- Allows (interviewers) interaction with respondents as well as between respondents themselves (Hair et al., 2008)

➤ **Disadvantages of qualitative research methodology**

Although this research methodology has many advantages, some disadvantages unfortunately exist as well. These disadvantages are:

- Subjectivity may lead to technical issues (Hair et al., 2008)
- Not well- understood by 'classical' researchers (James, 1997)
- It is very difficult to avoid researcher induced bias. In other words, researcher bias is built in and cannot be avoided (Hair et al., 2008)
- Sometimes it lacks reliability and generalizability (Hair et al., 2008)
- It is unable to distinguish small differences (Okstate, 1998);
- It is unreliable as a predictor of the population (Hair et al., 2008).

3.3.3 QUANTITATIVE RESEARCH METHODOLOGY

The Quantitative research methodology is defined as 'a formal, objective, systematic process in which numerical data are utilized to obtain information about the world' (Grove & Burns, 2005, p. 23). A study by Easton (2001) described the quantitative research method as a research method that relies less on observations, interviews, focus groups, case studies but rather is focused on the

collection and analysis of numerical data and statistics. Quantitative research allows familiarity with the question/problem under study and generates hypotheses to be examined. Thus:

- The emphasis will be on facts (Bogdan & Biklen, 1998);
- It is a structured research instrument and a mathematical procedure used to analyze the identified data (Speziale et al., 2011);
- The information required is in numbers and thus can be easily analyzed and summarized;
- Its objective is to test hypotheses about well-defined, quantifiable problems;
- It is generally based on relatively large, representative samples;
- The data obtained are subjected to statistical analysis (Marketing Research Association, 2011);
- The final result is expressed in statistical terms (Charles, 1998).

➤ **Advantages of quantitative research methodology**

Quantitative research methodology has several advantages. According to Nykiel (2007) Shuttleworth (2008), these advantages are:

- Quantitative research design is a way of finalizing results and proving or disproving a hypothesis;
- Its results are statistically reliable as the quantitative research method can reliably determine whether one concept, idea, product, and so on, is better than its alternatives;
- These results are projectable to the population. In other words, researching a small group can give a reliable indication of the views of a larger population;
- Possible greater data accuracy than other methods;
- Problems with participants refusing to respond (e.g. not at home), false responses, or non-cooperation are absent;
- The results are precise and correct and they are easy to summarize and analyze.

On the other hand, Nykiel (2007) and Shuttleworth (2008) have highlighted the primary disadvantages of quantitative research methodology. These are:

- The issue/problem is only measured if they are known prior to the beginning of the study or survey;
- Quantitative research methods can be difficult and expensive and require much time to perform;
- Too many things to observe;
- Difficulty in determining root cause of the behavior;
- May not be suitable for all research purposes;
- Inability to control the environment when respondents provide the answers to questions in a survey;
- Quantitative studies usually require extensive statistical analysis, which can be difficult, due to most scientists not being statisticians. The field of statistical study is a whole scientific discipline and can be difficult for non-mathematicians.

3.3.4 JUSTIFICATION OF THE SELECTED METHODOLOGY

As can be seen from this discussion, both qualitative and quantitative research methodologies have their own advantages and disadvantages. The qualitative research methodology, for example, explores attitudes, behaviour and experiences through such methods as interviews or focus groups. It attempts to gather in-depth data from participants. Moreover, it is often not costly, produces rich/comprehensive data and it is not time consuming. On the other hand, it sometimes lacks reliability and generalizability. On the other hand, the quantitative research methodology may offer greater data accuracy and its results can more easily be summarized and analysed, but also it is considered to be more expensive, time consuming and its mathematical process might pose difficulties.

Obviously, the decisive aim of the qualitative research methodology is to provide a pure perspective and well-written research that reflects the researcher's ability to demonstrate and describe targeted phenomena. The greatest strengths of this research methodology are the richness of its data, depth of exploration and description, and the fact that it consumes less time and money. Also, it aims to discover meanings and understandings, rather than predicting outcomes (Myers, 2000). Quantitative research methodology helps the researcher to familiarise him/herself with the research problem as this methodology emphasises facts and causes of behaviour, and the information is in the form of numbers that can easily be quantified and summarised. For these reasons a mixed research method case study was used in this research as this study aimed to collect rich qualitative data concerning the utilized post-conflict reconstruction approach as well as the perspectives of LCC, asset-management procedures/frameworks, and to collect quantitative data on end-users' requirements and needs, as well as standards/specifications regarding a specific case study.

The Department of Housing and Utilities for Libya was a suitable location for the case study (Five branches throughout Libya were available). These were: Tripoli, Benghazi, Misurata, Sabha and Sirte, as well as the main Housing and Utilities Department of the bordering country, Tunisia.

3.4 CASE STUDY

Throughout the years, researchers have used the case study research method across various disciplines in order to inspect contemporary real-life situations and offer the basis for the application of ideas and extension of methods. Yin (1994) defined case study research method as 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used' (23). Another definition of qualitative case study is 'an intensive, holistic description and analysis of a single entity, phenomenon or social unit' (Merriam, 1988, p. 9). Case studies are particularistic, descriptive and heuristic, and rely heavily on inductive reasoning in handling multiple data sources (1988).

A case study can be used with an individual, entity, a country. For this research-work the Gharyan-Mizdah Road project is included and detailed in Chapter 6. Case studies are included in qualitative research studies in order to establish concrete illustrations of findings as they aim to explore the meanings and details of experience and do not attempt to test a prior hypothesis (Johnson, 1991). Feagin et al. (1991) describe case study as an ultimate method when a holistic, in-depth investigation is needed. It often reports on a system of actions rather than on an individual or group of individuals. Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined. The case study approach is often used in order to maximize what can be learned in the period of time that is available for the study. There have been four primary and important sources of evidence identified by Yin (1994) for case study (refer to Figure 6).

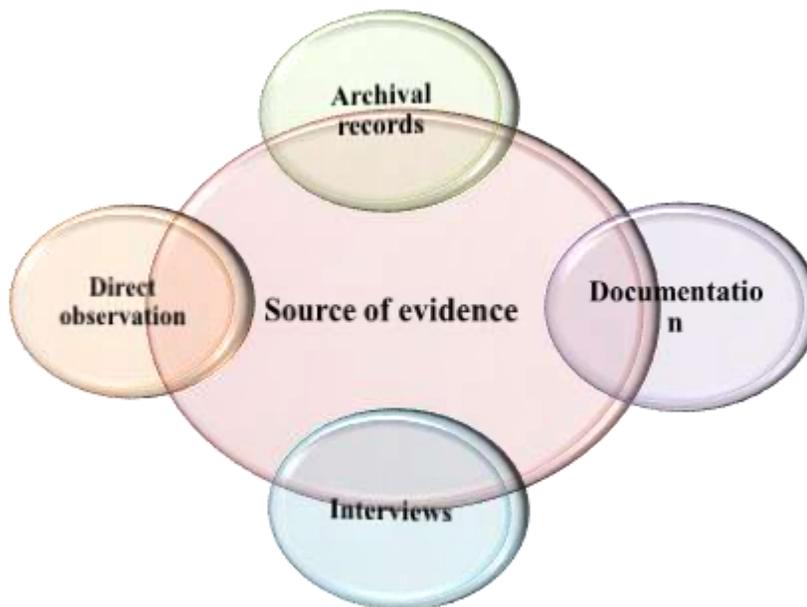


Figure 6: Source of evidence

Source: *Adopted from Winston (1997)*

It should be borne in mind that not all of these resources are necessary in every case study and no single source has a complete advantage over the others, but rather more of them means that the study is more reliable and well-established.

3.4.2 ADVANTAGES OF CASE STUDY

Blaxter et al. (2006, p. 74) identified the following advantages of the case study approach:

- Good method to study rare phenomena;
- The researcher can retain more of what he/she learns because he/she is actively participating rather than just listening;
- Benefit from the vast experience, knowledge and insights of other participants;
- Good source of hypotheses;
- Unusual cases can shed light on situations or problems that are impractical to study in other ways;
- Case study can provide a data source from which further analysis can be made;
- Develops analytic and problem solving skills;
- Allows for exploration of solutions for complex issues;
- Allows researchers to apply new knowledge and skills;
- Good source of ideas about behavior;
- Good opportunity for innovation and to challenge theoretical assumptions.

3.4.2 DISADVANTAGES OF CASE STUDY

Even though case study has many advantages, it has disadvantages as well. According to Wimmer and Dominick (2006), these are:

- With a researcher observing the case closely, the behaviour of the case in question is likely to change;
- Difficult to generalize from a single case;
- Possible biases in data collection and interpretation;

- Vital information may be missing, making the case hard to interpret;
- The participants' memories may be selective or inaccurate;
- The participants may not be representative or typical.

Despite these disadvantages, qualitative case study research method has proven its efficiency and effectiveness to the outcome of any research as it helps to analyze rare phenomena, helps to provide a data source from which further analysis can be made and it enables good opportunities for innovation. Consequently, the case study research method was adopted for this research in order to gain comprehensive data from a sufficient number of respondents. Moreover, document analysis as well as semi-structured interviews were incorporated into this case study to collect further research data.

3.4.3 THE CASE STUDY

As can be seen from the literature review's analysis of the examinations of post-conflict reconstruction approaches, there is a clear lack of long-term and comprehensive post-war reconstruction planning. Many, if not all, studies discussed in the literature review either provided a general post-conflict reconstruction approach or framework with very basic elements, debated success factors, emphasizing the importance of an effective post-conflict/high alert reconstruction plan or stressing the need for consideration of community requirements (Kage, 2010; Bowen, 2009; El-Masri and Kellett, 2001; Saha, 1989; Earnest, 2011; King and Mason, 2006). The absence of a long-term comprehensive reconstruction approach has undermined progress in reconstruction in many countries such as Iraq (Jabareen, 2013a).

Another vital aspect is that the management of infrastructure is changing as a result of growing difficulties initiated by various factors such as technical, economic, environmental, political (war and both internal and cross-border conflict are significant factors), human resources and social challenges. The technical and economic challenges were addressed in many of the asset-management frameworks (Lemer, 1992; Dornan, 2010; Lemer and Wright, 1997; Vanier, 2001;

Too, 2009; Younis and Knight, 2012; Elhakeem and Hegazy, 2012). However, challenges as a result of high alert or man-made disaster have not been incorporated as criteria of concerns in asset-management frameworks. Consequently, in order to approach adverse conditions in a comprehensive manner (to develop an integrative asset-management framework), this study was designed to evaluate the current post-conflict/high-alert reconstruction approach, and asset-management techniques as well as the economic evaluation techniques currently utilized by the Department of Housing and Utilities in Libya and Tunisia. As this department was appointed by the government to be in charge of the post-conflict reconstruction, it was chosen as the main case study.

Research, moreover, addressing recent adverse conditions such as post-conflict and high-alert conditions in developing countries, is lacking. The focus of this case study then was on addressing these issues in developing countries that had recently undergone a conflict or high-alert situation such as Libya and Tunisia.

The Department of Housing and Utilities in Libya including five cities, namely, Tripoli, Benghazi, Misurata, Sabha and Sirte as well as the main department in Tunisia, were chosen as a case study. Apart from being the five largest cities in Libya, these cities were severely damaged either by internal conflict or NATO strikes during the Libyan Civil War, particularly Sirte, Misurata and Tripoli.

The main Department of Housing and Utilities in Libya is located in the capital city (Tripoli) and this has its own branches throughout the country. Five branches as indicated in Figure 7 along with the main Departments of Housing and Utilities in Tunisia (Tunis City) were selected to be the case study for this research. This case study incorporated a questionnaire survey and individual interviews in each of the cities already specified.

The mission of this department is to plan, implement, execute, maintain any new or existing public buildings, roads, bridges, tunnels and other construction; water networks and stations; pumping and lifting network stations as well as sewage and rainwater treatment networks. In

addition the department arranges manufacture of building materials related to operating activities and executes tasks and other projects assigned to the department from the supervisory authority.

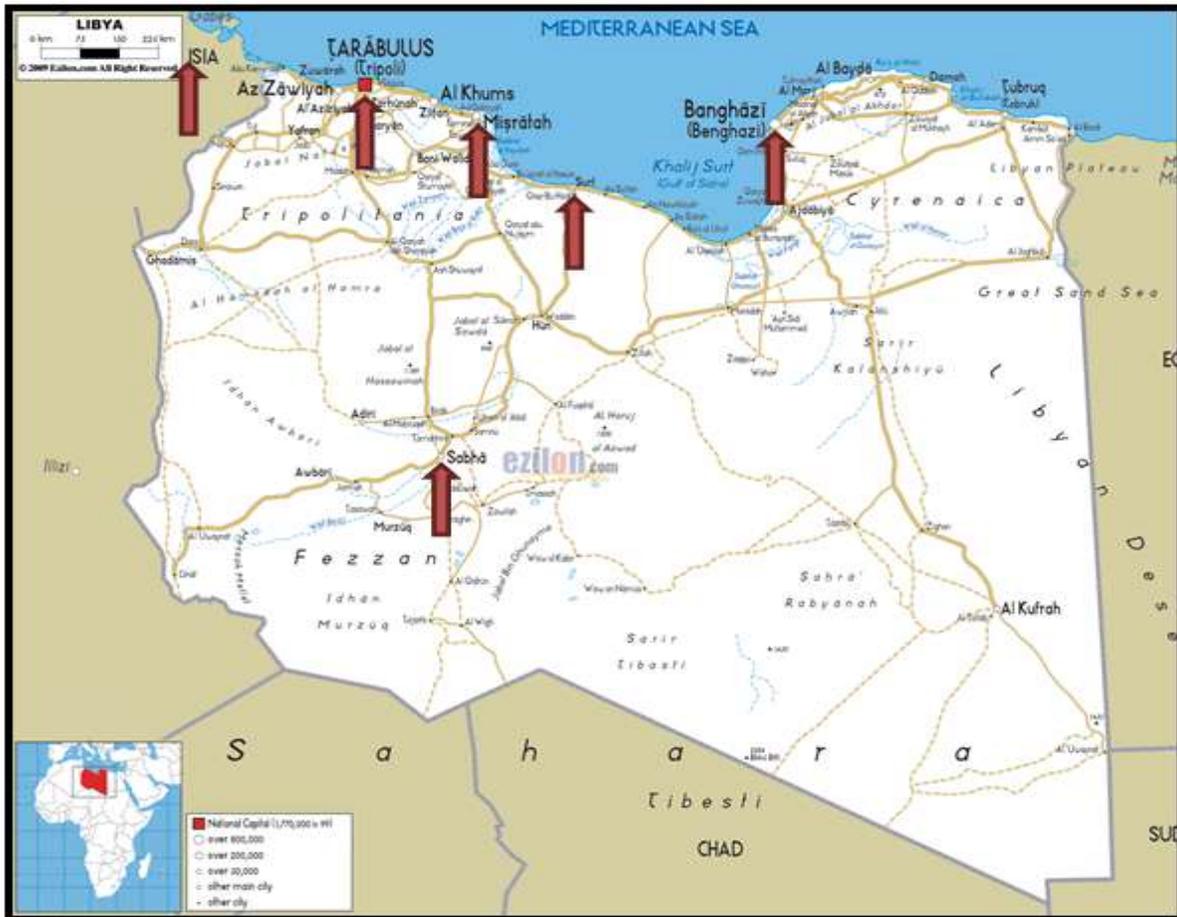


Figure 7: The cities incorporated into the Case Study

Source: Google Map (2014)

The Case study incorporated individual interviews. Interviews are now discussed.

3.5 INTERVIEW

The qualitative research interview is defined as ‘an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena’ (Kavale, 1983, p. 174). Frey and Oishi (1995) defined it as ‘a purposeful conversation in which one person asks prepared questions (interviewer) and another answers them (respondent)’ (1). Collecting the necessary information about a subject, idea or program can be done in several ways - through face to face interviews, interviewing by telephone, group interviews and interviewing by internet (by MSN, Yahoo or Skype messenger). Case study research involves conducting intensive individual interviews with a small number of respondents (can be two or more) in order to investigate their perspectives on a particular idea, program or situation (Oatey, 1999).

Formerly, face to face interviews were the main approach in the field of qualitative research. Recently, due to the continuous explosive growth of new communication forms and technology, telephone interviewing has become progressively common (Opdenakker, 2006). Telephone interviews allow researchers to gather information quickly with less cost and time (Waltz et al., 2010). More importantly, they enable the interviewer to conduct his/her interview worldwide with the flexibility of a mutually appropriate time arrangement.

3.5.1 TYPES OF INTERVIEWS

There are several types of interviews. These are, according to Kavale (1996):

1. Informal, conversational interview: this means no predetermined questions are asked (interviews goes with the flow).
2. General interview guide approach: this basically means predetermined questions are set and they act as a guide approach for the interview. However, this approach still allows a level of flexibility in extracting the information from the interviewees.

3. Standardized, open-ended interview: this means that the same open-ended questions are asked to all interviewees. The major advantage of this kind of interview is allowing a faster interview that can be more easily analyzed and compared.
4. And finally, closed, fixed-response interview where all interviewees are asked the same questions.

3.5.2 ADVANTAGES OF INTERVIEWS

The main advantages of qualitative research interviews are:

- They provide much more detailed information (quality information) from every single subject (Hair et al., 2008);
- They create flexible and relaxed environment when the interview is being conducted (Hair et al., 2008);
- Unlike mail surveys, the interviewer has the opportunity to investigate or ask continual questions (Evidence Base, 2006);
- Interviews are generally easier for respondents, especially of what is pursued-opinions or impressions;
- Personal interviews often yield a high percentage of returns because most people are willing to cooperate (Miller & Salkind, 2002);
- The information secured is more likely to be more correct than other techniques (Miller & Salkind, 2002);
- They enable interviewers to learn things that cannot be directly observed;
- They increase the accuracy of responses as the respondents' own words are recorded (Evidence Base, 2006).

3.5.3 DISADVANTAGES OF INTERVIEWS

The qualitative research interview method has disadvantages as well. These are:

- Interviews are time consuming and they are resource intensive (setting up, interviewing, transcribing, analyzing, feedback and reporting) (Miller and Salkind, 2002);
- They can be costly (Miller and Salkind, 2002);
- Different interviewers may understand and transcribe interviews in different ways (Miller and Salkind, 2002);
- Generalizations about the results are difficult to make because usually the sample size is small (Hair et al., 2008);
- Subject to interviewer bias as well as respondent's bias may be present (Hair et al., 2008);
- Some issues might occur as the result of interviewer errors such as poor listening, faulty recording procedures and so on (Hair et al., 2008).

The Qualitative research interviews method is considered to be one of the most effective forms of data collection. Collecting data/information by this method can be done in several ways: face to face, telephone or group interviews. As mentioned before, the interview research collection method has both advantages and disadvantages but it still is considered an effective qualitative research method (Hair et al., 2008).

As well as face to face interviews with key executives and civil engineers at the Housing and Utilities Department in Libya and Tunisia, document analysis was used as an important key tool for the sake of collecting comprehensive data for this study.

In addition to individual interviews and document analysis, a survey questionnaire was also undertaken.

3.6 SURVEY QUESTIONNAIRE

A survey is ‘any activity that collects information in an organized and methodical manner about characteristics of interest from some or all units of a population using well-defined concepts, methods and procedures, and compiles such information into a useful summary form’ (Statistics Canada, 2003). A survey questionnaire is defined as a document designed with the purpose of seeking specific information from the respondents (Polgar, 1995). Survey questionnaires are considered as a beneficial instrument to collect data from a diverse and large number of people (Jones, 2008).

There are several types of questionnaire (Oppenheim, 2000):

- face-to-face interviews
- telephone interviews
- paper questionnaires and mail
- online questionnaires
- mail questionnaires
- a combination of these methods

Telephone interviews, for instance, are an efficient instrument for collecting some types of data and are being increasingly used, especially in situations where time is a crucial factor or the extent of the survey is limited. Mail survey, on the other hand, is considered to be comparatively low in cost compared to both face to face interviews and telephone interviews. However, when complex information is to be collected, face to face interviews are more favourable (Scheuren, 2004). According to Statistical Canada (2003), face to face interviews often have the highest response rates (typically around 80-95%).

3.6.1 Survey

The literature review has signalled a very important issue - a very limited/non-end-user involvement in post-conflict reconstruction approaches. Often, a community's requirements, needs and desires have not been included in reconstruction approaches and that has led to post-conflict reconstruction failure. Taking Kosovo as a case in point, King and Mason (2006) stated that community members' views and requirements were *not* utilized in the post-war reconstruction recovery process. Consequently, crucial infrastructure was not reconstructed, corruption was still prevalent and violence against minorities was common. In Iraq, Bowen (2009) mentioned in his report, named *Hard Lessons*, that, because end-users had been excluded from the reconstruction procedure as a key element, multiple re-programming of reconstruction priorities, added maintenance expenses, employee turnover, and higher material costs were incurred. Many other researchers (discussed in the literature review) have come to the same conclusion and emphasized the vital need for end-users' involvement (Botes and Rensburg, 2000; Kage, 2010; Pemunta, 2012; Earnest, 2011; El-Masri and Kellett, 2001).

For that reason, the main focus of the questionnaire survey for this study was on the identification of the affected community's requirements and needs post-conflict/high alert condition in Libya. The purpose of the survey was to allow the affected communities (end-users) post-conflict/high alert condition to specify their requirements, needs and desires. This survey was undertaken before the semi-structured interviews with key executives, civil engineers, project managers, and experienced personnel, were conducted at the Departments of Housing and Utilities in Libya and Tunisia, in order to understand the following concerns from these departments:

- Have they already listened to the affected community's requirements?
- If so, have their requirements been considered?
- Have the requirements been implemented?
- Have the communities contributed to the post-conflict reconstruction plan?

The aim of this step was to perceive in advance the affected communities' requirements and needs and then compare them against the governmental approach which had already taken place in post-conflict/high alert Libya and Tunisia.

3.7 DATA ANALYSIS

After collecting the qualitative data, (individual interviews) coding or descriptive analysis technique was used to create a provisional list of key vital variables (Miles & Huberman, 1994). The main purpose of the coding technique is to discover commonalities and patterns, in other words, to observe and categorize similar phenomena (Seidel & Kelle, 1995).

In order to answer the research questions, the findings of the semi-structured interviews were appropriately coded according to their commonalities and patterns. For successful and effective coding, various systematic techniques were utilized such as reading the full manuscripts, as well as the transcripts' summary and choosing categories and linking them to themes.

With regards to quantitative research data, SPSS (*Version number 17.0*) was utilized to analyze the data from the survey questionnaire. Frequencies were run on all variables. A Chi-square analysis was used to determine if there were any substantial differences among all responses based on demographic variables.

3.7.1 Comparing multiple groups: Parametric versus Non-Parametric Statistics

Statistical tests are utilised to analyse aspects of a sample. In practice, results of the test have to be generalizable to the population from which that sample is drawn. In other words, when the sample meets this requirement, then the parametric statistics can be used. However, if the sample

data violate the requirements, then it is safer to use non-parametric statistics (Allen & Bennett, 2012).

1. FIRST: Parametric Tests: ONE WAY ANOVA

One way ANOVA is a variance analysis technique which is used to decide the possibility of any significant differences among the means of three or more independent (unrelated) groups (Stoline, 1981). **Specifically, it tests the null hypothesis:**

$$H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$$

Where μ = group mean and k = number of groups. If the results are of a significance value (≥ 0.05), then the alternative hypothesis (H_A) will be accepted, which indicates that there are at least 2 groups that are significantly different from each other. However, if the significance value is less than ≤ 0.05 , this is an indication of the absence of any difference between the groups (1981).

There are some assumptions underlying the one-way ANOVA. These are, according to Stoline (1981):

1. **The assumption of independence:** this means that the null hypothesis actually indicates that the samples derived from populations have the same mean. These samples have to be independent and random in order to be considered as representative of the populations. The value of one observation is not related to any other observation.
2. **The assumption of normality:** this indicates that the distributions of the populations from which the samples are selected are normal. In other words, the dependant variable has to be normally distributed in each of the groups.

- 3. The assumption of homogeneity of variance:** this indicates that the variances of the distributions in the population are equal. In other words, the variances on the dependent variable are equal across the groups.

To check the normality of the data the following two techniques were utilised:

- **Skewness and Kurtosis:** Z-Value (Statistic Skewness divided by Standard errors of Kurtosis) should be somewhere in the span of -1.96 to +1.96
- **Histograms:** should visually indicate that the data are approximately normally distributed.

In this research, the main reason to utilise this technique was to measure the agreement among all five cities to determine any significant agreement regarding satisfaction with post war reconstruction effort

2. Second: Non-Parametric Tests: One way- Kruskal-Wallis

The Kruskal-Wallis test is the analogue of a one-way ANOVA, or a 'distribution-free ANOVA'. It is typically utilised when the assumptions of normality are violated. This test is used to compare three or more independent samples of ordinal (ranked data) in order to identify the underlying factors structuring the data (Allen & Bennett, 2012).

3.8 VALIDITY OF DATA

The notion of validity implies that 'the research data have such a character that one can move legitimately from the level of the empirical variables to the level of theoretical concepts' (Lafaille & Wildeboer, 1995, p. 187). Bashir et al. (2008, p. 35) defined validity as the extent to which the data are plausible, credible and trustworthy, and thus can be defended when challenged.

The concept of validity, reliability and rigour to distinguish good research from bad research, and the improvement of these rigorous parameters, is a decisive factor in any research (Golafshani, 2003). Thus, the researcher utilized the technique endorsed by Hamberg et al. (1994) to ensure

validity, reliability and rigour (Figure 8). It is also important to understand that the validity and the norms of rigor that are applied to quantitative research are not entirely applicable to qualitative research. An explanation of the techniques used in this study is shown in Tables 2 and 3.

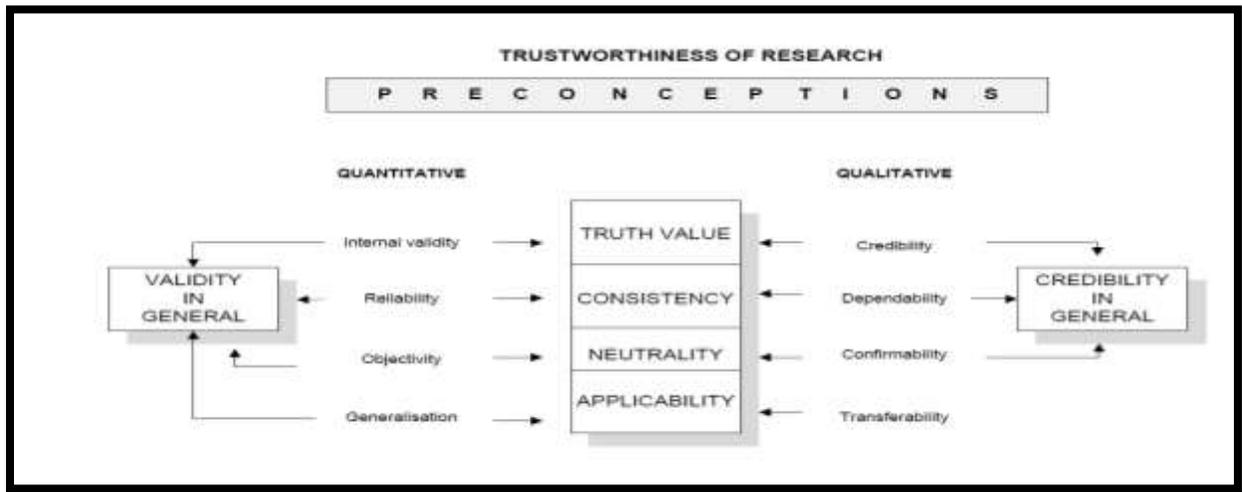


Figure 8: Indicators to describe scientific rigour in research

Source: Hamberg et al. (1994)

3.8.1 Establishing rigour in qualitative research

Qualitative research utilizes case study, personal experience, and interview, observational, historical, interactional and visual texts, that 'describe routine and problematic moments and meaning in individuals' lives' (Bashir et al., 2008, p. 38). Golafshani (2003) argued that maximizing qualitative research' validity or trustworthiness could lead to the establishment of more credible and defensible results which in turn may lead to generalizability which is considered as a structure for undertaking and documenting high quality research (Stenbacka, 2001). Generalizability is considered by Stenbacka (2001) as one of the vital concepts that ensure high quality and well documented research.

Reliability and validity are conceptualized as trustworthiness, quality and rigour which can be attained by eliminating bias and raising the researcher's reliability of a proposition about some social phenomenon using mixed data collection methods. Bashir et al. (2008) claimed that the validity of qualitative research relies upon data collection as well as analysis techniques and instrument. Seale (1999) emphasized that trustworthiness is a critical element to guarantee reliability in qualitative research. The following techniques (shown in Table 2) were utilized to guarantee trustworthiness after accomplishment of the research.

Table 2: Techniques to ensure the trustworthiness of qualitative research

Traditional criteria	Trustworthiness criteria	Methods for meeting trustworthiness criteria
Internal validity	Credibility	Field steps that ensured the prospect of high credibility: <ul style="list-style-type: none"> • Referential inquiry (recorded interviews could be tested for adequacy) • Mixed data collection methods to establish validity
External validity	Transferability (Fittingness)	Comprehensive description of: <ul style="list-style-type: none"> • Structures and processes related to processes revealed in the data • Everything required to understand the findings to make needed comparison in another similar setting
Reliability	Dependability (Auditability)	Beneficial sampling (that included key executives, civil engineers, project managers and experienced personnel who worked at the Department of Housing and Utilities were utilised as representative of the population to be generalised.
Objectivity	Conformability (Audit trail)	<ul style="list-style-type: none"> • Reporting clearly and precisely data management and findings • Literal transcription of interviews

Source: *Adapted from* Bashir et al. (2008, p. 97); Lincoln and Guba (1985, p. 328) and Shah and Corley (2006, p. 1830).

To ensure more validity of qualitative research, the researcher also utilized a combination of 6 strategies out of 10 suggested by McMillan and Schumacher (2006) as indicated in Figure 9.

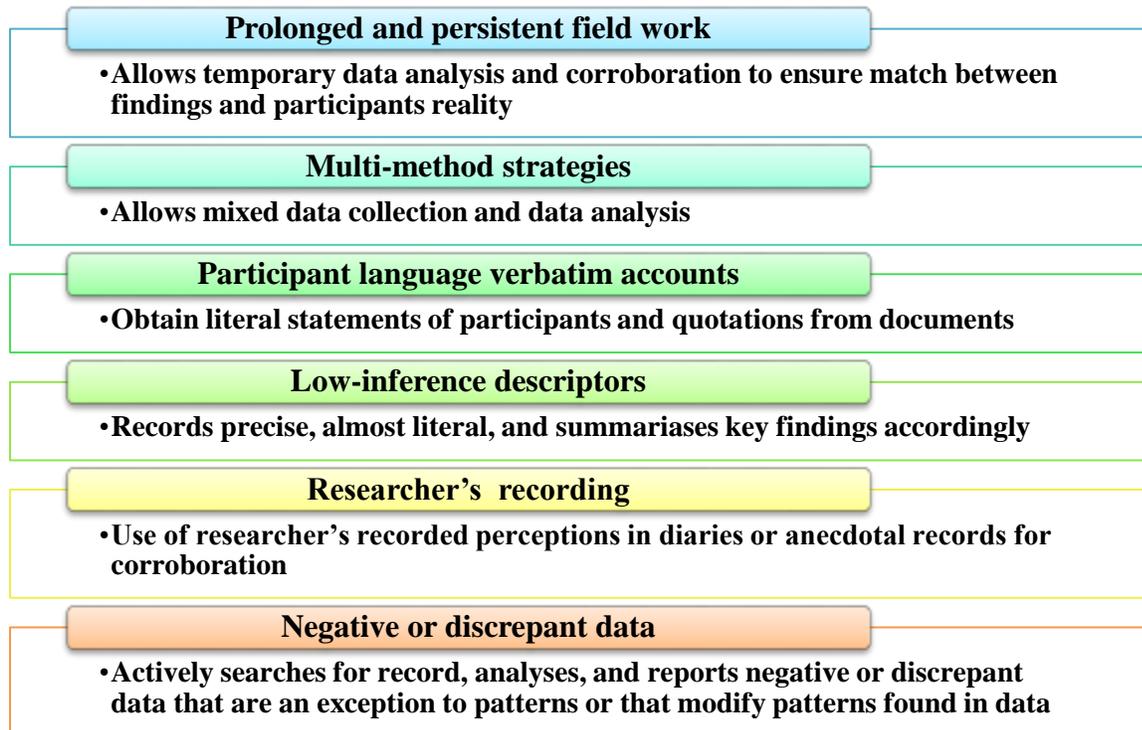


Figure 9: List of Strategies to Increase Validity in Qualitative Research Paradigm

Source: *Adapted from* Bashir et al. (2008)

3.8.2 Establishing rigour in quantitative research

Quantitative research uses experimental techniques and quantitative measures and generalizations in the form of charts and graphs to illustrate the outcomes of experiments or investigations. In quantitative research the stress is on facts and origins of behaviour; the result or information is in the form of numbers that can be quantified and summarized and thus generalised; the mathematical procedure is the model for analysing the numeric data; and the final result is communicated in statistical terms (Golafshani, 2003).

The most critical concern in quantitative research is to ensure credibility, reliability and validity. This depends upon the rigorous construction of the instrument and deciding whether it has succeeded in measuring what it has been designed to measure (Patton, 2002). To ensure rigour in quantitative research, the study required a real and precise commitment to accurately present the findings in detail. It is also vital to have the right representative sample for the case study conducted as well as well-defined and developed measuring instruments such as a questionnaire survey. Table 3 represents the techniques utilised to ensure the rigour of the quantitative research in this study.

Table 3: Rigour in quantitative research

Criteria	Methods for meeting rigour
Internal validity	<ul style="list-style-type: none"> • The rigour in which the study design was conducted in a stable and manageable way, and decisions concerning what was measured and what was not
Reliability	<ul style="list-style-type: none"> • Given the complexity of the study as well as the place where it was undertaken, namely, North Africa, it could be repeated in other post-conflict countries. • Prerequisite for validity, inter-rater, test-retest, alternate forms, internal consistency
Objectivity	<ul style="list-style-type: none"> • Structured questions followed by pilot study, well-representative sampling, randomisation, data free from bias • Appropriate sample size with individuals providing data anonymously leads to objectivity • Reducing bias by careful examination of questionnaire through pilot study as well as immediate back-translation
Generalisation	<ul style="list-style-type: none"> • Large sample size with numerous amounts of asset-management constituents from a post-conflict reconstruction allows an extrapolation to countries in similar situations • Providing study limitations

3.9 RECORDING

The main strength of case study data collection is the potential to use various sources of evidence. This encompasses interviewing participants within their real-life contexts as well as accessing appropriate sources of documents or any written information relevant to the issue that is examined (Yin, 2003).

As recording is considered an important aspect of interviewing (as it is very helpful for the researcher when carrying out the analysis and interpretations of the gathered data), the following techniques are very important to help researchers make well-recorded interviews (Mertler, 2008):

I. Before the interview:

- Decide a mutually suitable time and time limit;
- Pre-test the interview procedure;
- Communicate with potential participants;
- Determine recording techniques (audio-taping or note taking for example);
- Pre-determine data analysis needs and logistics of gathering data;
- Schedule each of the interviews;
- Inform participants of confidentiality.

II. During the Interviews:

- Introduce interviewer' name;
- Identify suitable interviewer style;
- Get the participant to talk freely;
- Create different types of questions;
- Give useful feedback to participants, without distorting potential data;
- Consider interview length concerns.

III. After the Interviews:

- Revisit the collected data for accuracy;
- Prepare the data for analysis;
- Allocate sufficient time for data analysis.

The main recording techniques that were assigned to this study were note taking and voice-recording during the interviews. However, voice recording had to be cancelled at the interviewees' requests. Despite being informed that their names and information they provided for this study would be kept confidential, the participants still asked that voice recording not take place. To ensure privacy and confidentiality, note taking was the main tool.

3.10 ETHICAL ISSUES

This research utilized, as well as quantitative research methods, qualitative research methods which involved semi-structured interviews, not to assess individual opinion, but rather to determine current technical application. Targeted participants were key executives, project managers, civil engineers, mainly managers and employees of the Housing and Utilities Departments in Libya and Tunisia. The ethical guidelines as set up in the national statement on Ethical Conduct 83 in Research involving Humans were followed in the current research.

The participants were informed that their participation in the study was voluntary and they were informed that they could withdraw at any time without consequence. In addition, all respondents were given an opportunity to enquire about any part of the research at any time during and after their participation in the research. Furthermore, confidentiality and privacy were assured for the research respondents and their identity was protected through first, the abandoning of voice recording, and second, through the use of non-identifiable code numbers, and data received from the respondents were kept in a confidential manner.

3.11 CONCLUSION

Methodology is a systematic means to solve a problem. It is a science of studying how research is to be carried out. More importantly, it is defined as the procedure by which researchers go about their work of describing, explaining and predicting phenomena. Its aim is to give the work plan of any study and it assists researchers to gather data required for their research (Weinberger, 2007).

Throughout the chapter, the advantages and disadvantages of qualitative and quantitative research methodology have been discussed. Also, the justifications for choosing mixed research methods for this study have been explained as well. The main means of gathering data was semi-structured interviews, document analysis as well as a questionnaire survey. Some guidelines for conducting the interviews and survey were carefully adopted for the sake of obtaining rich and valid data.

The Department of Housing and Utilities in Libya (namely, Tripoli, Benghazi, Misurata, Sabha and Sirte) as well as the main departments in Tunisia were chosen as a case study with the aim of determining the current techniques utilised by these countries in post-conflict/high alert conditions; to determine the current economic evaluation techniques utilized by nations in environments of flux; to determine the current asset-management techniques utilized by the Housing and Utilities in (high-alert) zones of interest such as Libya and Tunisia; to examine the standards, specification, design and regulations that had been set by the main Housing and Utilities in the regions identified above with regards to managing a crisis (specific case study); and finally to identify how the (two) case-study departments deal (t) with required change.

The next chapter presents the results and analysis from this study.

CHAPTER 4: RESEARCH ANALYSIS AND FINDINGS

4.1 INTRODUCTION

This chapter presents the research findings and analysis of the study. This chapter consists of two main sections. Section 1 presents the data obtained from the questionnaire survey in order to identify the affected community's requirements and needs post-conflict/high alert condition in Libya (five cities only). Section 2 presents the data which were obtained from interviewing 5 key personnel from the Libyan Housing and Utilities Department (LHU) in five cities, namely, Tripoli, Benghazi, Misurata, Sirte and Sabha and as well as from the main Tunisian department.

4.2 ANALYSIS OF THE DATA FROM THE QUESTIONNAIRE SURVEY

This section presents the data obtained from the questionnaire survey distributed in order to identify the affected community's requirements and needs post-conflict/high alert conditions in Libya (Tripoli, Bengasi, Misurata, Sirte and Sabha). The aim of this step was to understand the current affected communities' requirements and needs and then compare them against the governmental approach which had already taken place in post-conflict/high alert Libya. Another important aspect of the questionnaire was to determine if the Libyan communities were paying any tax for building new or maintaining existing infrastructure assets/services and if they were willing to pay tax to finance the maintenance/ building of new infrastructure assets/services.

The participants taking part in this questionnaire survey consisted of the local Libyan communities who had been directly affected by the recent conflict/war in the Libyan cities mentioned earlier.

4.2.1 LIBYAN CITIES' PARTICIPANTS

A total of 110 people (x 3 locations), aged between 18 and 67, in respectively the towns of Sirte, Bengasi, Misurata; plus, 120 people (x 2 locations) in respectively the towns of Tripoli and Sabha participated in the questionnaire survey; 570 people participated in the questionnaires.

Table 4 illustrates the participants' educational levels.

Table 4: Participants' Level of Education

Education Level	Libyan Cities				
	Sirte	Bengasi	Misurata	Tripoli	Sabha
High school graduate	6 (5.5%)	1(0.9%)	12 (10.9%)	20(16.7%)	13 (10.8%)
College graduate	65 (59.1%)	58(52.7%)	44(40.0%)	49(40.8%)	57 (47.5%)
Trade/technical/vocational training graduate	13 (11.8%)	22(20%)	22(20%)	18(15.0%)	24 (20%)
Master's degree	17 (15.5%)	21(19.1%)	20(18.2%)	18(15.0%)	20 (16.7%)
Doctoral degree	9 (8.2%)	8(7.3%)	12 (10.9%)	15(12.5%)	6 (5.0%)
Total	110 (100%)	110(100%)	110 (100%)	120 (100%)	120 (100%)

The majority of participants in the various Libyan cities had qualified with a Bachelor degree and above. In Sabha, for instance, while half of the participants had a bachelor degree (47.5%), around 20% were trade/technical/vocational training graduates, followed by 16.7% Master graduates and 5% PhD graduates. Only 10.8% of the participants were high school graduates. Similar trends were shown in the other cities as illustrated in Table 4. For example, in Tripoli, around 41% of the participants had a bachelor degree, while approximately 13% had a Ph.D. degree. From the high educational level of the participants it was assumed they had the ability to clearly identify the needs and requirements post-conflict and to provide responses with regard to tax contributions.

With regards to the participants' employment status, it is clear from Table 5 that most of the participants had a full time job within the various Libyan public sectors (71.7%, 56.4%, 54.5%, 52.5%, and 47.3% in Sabha, Misurata, Sirte, Tripoli and Bengasi respectively), followed by a small number of participants who were unemployed.

Table 5: Employment Status

Employment Status	Percentage %				
	Sirte	Bengasi	Tripoli	Misurata	Sabha
Public sector	54.5	47.3	52.5	56.4	71.7
Private sector	25.5	29.1	27.5	20.9	13.3
Unemployed	17.3	19.1	15.0	17.3	11.7
Retired	2.7	4.5	5.0	5.5	3.3
Total	100.0	100.0	100.0	100.0	100.0

4.2.2 POST-CONFLICT/WAR DAMAGE

Because the data were not normally distributed, an ANOVA test could not be used, and thus the equivalent non-parametric test was used, that is the Kruskal-Wallis U test. This test is used to compare three or more independent samples of ordinal (ranked data) in order to identify the underlying factors structuring the data (Allen & Bennett, 2012).

This test showed that the majority of the questionnaire survey participants confirmed that their cities had been impacted by the recent conflict in 2011. However, the severity of the destruction varied from city to city. As can be seen from Table 6, the Kruskal-Wallis ANOVA test indicated that there were clear differences in the mean ranks, indicating the degree of damage severity amongst all the cities (Bengasi=314.41, Misurata=280.73, Sabha= 300.38, Sirte= 231.50, Tripoli= 298), H (corrected for ties)= 36.852, $df= 4$, $N= 570$, $p= 0.01$).

Table 6: Damage Status

Kruskal-Wallis Test					
Ranks					
	Group	N	Mean Rank	Percentage %	
				Yes	No
Was there any Damage?	Bengasi	110	314.41	70.9	29.1
	Misurata	110	280.73	82.7	17.3
	Sabha	120	300.38	75.8	24.2
	Sirte	110	231.50	100.0	—
	Tripoli	120	298.00	76.7	23.3
	Total	570		100.0	100.0

In test statistics, the asymptotic probability of χ^2 at $k - 1$ (degree of freedom), is less than 0.05 (Table 7). Thus, the Kruskal-Wallis ANOVA is significant. In other words, there are significant differences between the mean ranks of the damage status amongst all five cities.

Table 7: Test Statistics 1

Test Statistics^{a,b}	
	Was there any Damage?
Chi-Square	36.852
df	4
Asymp. Sig.	.001
a. Kruskal Wallis Test	
b. Grouping Variable: Group	

- **Follow Up Analysis:**

1. **(Effect Size)**

The effect size is known as Eta-Squared (η^2), which is easily interpreted as an effect size measurement for the analysis of variance,

$$\eta^2 = \frac{x^2}{N - 1}$$

where x^2 can be read from the Test Statistics table (Table 7), and N is the total sample size. So,

$$\eta^2 = \frac{36.852^2}{570-1} = 0.1295$$

According to Cohen (1988) conventions, the effect size is strong (see Table 8).

Table 8: Interpretation of effect size

Effect size (ES)	Interpretation
≤ 0.20	small effect size
0.50	moderate effect size
≥ 0.80	large effect size

As the Kruskal-Wallis ANOVA is significant this indicates that there are at least two cities of experimental conditions which differed; however, it is not known specifically which ones differed. Therefore, the Mann-Whitney U Test was conducted in order to compare each pair of mean ranks to decide where this difference had occurred.

2. Mann-Whitney U Test

The Mann-Whitney U Test is typically used to compare two independent samples of ranked data. It ranks the data for each condition/group, and then shows how different the two rank totals are. In other words, the Mann-Whitney test statistic "U" reflects the difference between the two rank totals. Table 9 and Figure 10 present the comparison of the Mann-Whitney U Test among all five cities (1.2, 1.3, 1.4, 1.5, 2.3, 2.4, 2.5, 3.4, 3.5, and 4.5). Note the full comparison is provided in **Appendix A**.

Table 9: Comparison between the five cities using Mann-Whitney U Test

Mann-Whitney Test					
	Bengasi	Misurata	Sabha	Sirte	Tripoli
Bengasi	×	0.038	0.399	0.001	0.322
Misurata	0.038	×	0.200	0.001	0.256
Sabha	0.399	0.200	×	0.001	0.880
Sirte	0.001	0.001	0.001	×	0.001
Tripoli	0.322	0.256	0.880	0.001	×

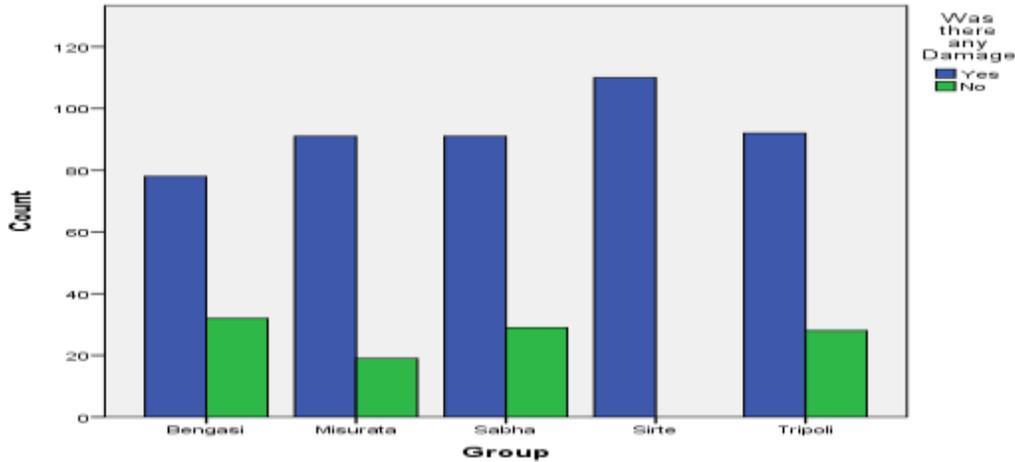


Figure 10: Graph form of Table 6 - Mann-Whitney Test (Variable Groups)

The Mann-Whitney U Test indicated that the level of destruction in Sirte city was significant ($p=0.01$), followed by Misurata ($p=0.038$). However, the test showed no significant differences in the damage status among Bengasi, Sabha and Tripoli (range between 0.200 and 0.880).

4.2.3 END-USERS’ REQUIREMENTS POST-CONFLICT/WAR

One of the vital aims of the questionnaire survey was to determine if the Libyan communities were paying any tax for building new or maintaining existing infrastructure assets/services as well as their willingness to pay tax to finance the maintenance/ building of new infrastructure assets/services.

As can be seen from Table 10, The Kruskal-Wallis ANOVA test showed that the mean ranks were roughly equivalent, indicating that all five cities’ requirements and needs were not accounted for (Bengasi= 285.68, Misurata= 283.09, Sabha = 297.13, Sirte= 298.64, Tripoli= 263.88), $H(4, N = 570, p = .156)$.

Table 10: Listening to end-users' requirements

Kruskal-Wallis Test						
Ranks						
	Group	N	Mean Rank	Percentage %		
				Yes	No	No idea
Listening to the Communities' Requirements?	Bengasi	110	285.68	--	78.2	21.8
	Misurata	110	283.09	--	79.1	20.9
	Sabha	120	297.13	--	74.2	25.8
	Sirte	110	298.64	--	73.6	26.4
	Tripoli	120	263.88	--	85.8	14.2
	Total	570		--	100.0	100.0
Reliability Statistics						
	Sirte	Bengasi	Tripoli	Misurata	Sabha	
Cronbach's Alpha						0.901

In the test statistics, the asymptotic probability of χ^2 at $k - 1$ (degree of freedom), *is more than 0.05*. As can be seen in Table 11, it was **0.156**; thus, the Kruskal-Wallis ANOVA Test indicated that there were no statistically significant differences among all five cities with regards to the participants' participation in post-conflict reconstruction decisions. The participants explained that they believed that their contribution to the post reconstruction stage was not perceived to be important by the government officials.

Table 11: Test Statistics 2:

Test Statistics ^{a,b}	
	Listening to the Communities' Requirements?
Chi-Square	6.639
df	4
Asymp. Sig.	.156
a. Kruskal Wallis Test	
b. Grouping Variable: Group	

4.2.4 WILLINGNESS TO PAY TAX (SERVICE FEES)

Generally, the government in Libya bears all costs associated with building new or maintaining existing infrastructure/service. In the past, relying on the country's richness of oil and gas and many other natural resources to support building and maintenance of new/existing infrastructures, assets and services, was effective. However, this seems to be no longer sustainable/effective post 2011 conflict/war since there have been less resources income and more building/maintenance to implement. As a result, the Libyan community participants were asked if they were prepared to share the burden of taking care of the various infrastructure/services. Table 12 shows the participants' willingness to pay service fees using Kruskal-Wallis Test.

Table 12: Willingness to pay service fees

Kruskal-Wallis Test			
Ranks			
	Group	N	Mean Rank
Do you pay Tax for looking after infrastructure?	Bengasi	110	289.04
	Misurata	110	283.87
	Sabha	120	282.37
	Sirte	110	296.78
	Tripoli	120	276.54
	Total	570	
Willingness To Pay Tax?	Bengasi	110	289.41
	Misurata	110	284.23
	Sabha	120	308.63
	Sirte	110	279.05
	Tripoli	120	265.88
	Total	570	
What percentage of your income are you willing to pay?	Bengasi	110	283.09
	Misurata	110	280.59
	Sabha	120	271.00
	Sirte	110	296.33

	Tripoli	120	296.78
	Total	570	

Table 13: Test Statistic 3

Test Statistics^{a,b}			
	Do you pay Tax for looking after infrastructure?	Willingness to pay tax?	What percentage of your income are you willing to pay?
Chi-Square	1.655	7.166	2.194
df	4	4	4
Asymp. Sig.	.799	.127	.700
a. Kruskal Wallis Test			
b. Grouping Variable: Group			

The Kruskal-Wallis ANOVA test in Table 12 and Table 13 showed that the mean ranks were roughly equivalent, indicating that all five cities confirmed that they were not paying any tax/service fees regarding building new assets/services nor maintaining existing assets/services (Bengasi= 289.04, Misurata= 283.87, Sabha = 282.37, Sirte= 296.78, Tripoli= 276.54), H (corrected for ties) = 1.655, $df = 4$, $N = 570$, $p = .799$). Also, with regard to the willingness of the Libyans to pay tax/service fees towards the cost of building/maintenance, the Kruskal-Wallis ANOVA once again demonstrated that the mean ranks were roughly equivalent, signifying the willingness of the participants to pay future tax/service fees toward taking care of all public infrastructure assets (Bengasi= 289.41, Misurata= 284.23, Sabha = 308.63, Sirte= 279.05, Tripoli= 265.88), H (corrected for ties) = 7.166, $df = 4$, $N = 570$, $p = .127$).

In the test statistics, the asymptotic probability of χ^2 at $k - 1$ (degree of freedom), *is more than 0.05 in all three previous tests (Table 13)*. As can be seen from Table 13, it was **0.799, .127 and .700**; thus, the Kruskal-Wallis ANOVA Test indicates that there were no statistically significant differences among all five cities' participants with regards to:

- their non-payment for taking care of all public infrastructure;
- their positive willingness to pay certain tax/service fees toward the same end;
- and finally their consensus to pay a certain percentage of their monthly salary toward building new or maintaining existing public infrastructure assets/services (as can be seen in Table 14, participants were *prepared to pay an average of 5.43%* of their salary).

The participants' willingness to pay the service fees could be a result of the deterioration of the overall condition of the cities' various infrastructure assets/services as well as their awareness of the government limited funds post-conflict conditions.

Table 14: The average Service Fees

What percentage of your income are you willing to pay?	Descriptive Statistics				
	Valid N	Minimum	Maximum	Mean	Std. Deviation
Sirte	110	1	10	5.5091	2.96074
Bengasi	110	1	10	5.3636	3.28110
Tripoli	120	1	10	5.4500	2.78003
Misurata	110	1	10	5.4091	3.24333
Sabha	120	1	10	5.4250	3.62453
Average Mean	5.43				

4.2.5 SATISFACTION WITH POST-CONFLICT RECONSTRUCTION EFFORTS

A question was directed to the affected communities in order to ascertain their satisfaction level with the post-conflict approach in the five cities. The Kruskal-Wallis ANOVA test showed that there were clear differences in the mean ranks, indicating the mixed levels of satisfaction amongst all five cities' participants with post-conflict reconstruction approach(es) (Bengasi=274.96, Misurata=89.97, Sabha= 335.55, Sirte= 419.40, Tripoli= 301.61), H (corrected for ties)= 265.450, $df= 4$, $N= 570$, $p= 0.01$) (refer to Table 15).

Table 15: Satisfaction with post-conflict approach (es)

Kruskal-Wallis Test			
Ranks			
	Group	N	Mean Rank
Satisfaction with post war reconstruction effort?	Bengasi	110	274.96
	Misurata	110	89.97
	Sabha	120	335.55
	Sirte	110	419.40
	Tripoli	120	301.61
	Total	570	

In the test statistics 4 (Table 16), the asymptotic probability *is less than 0.05* ($p= 0.01$); hence, the Kruskal-Wallis ANOVA Test indicates that there were statistically significant differences between at least two cities with regard to their satisfaction with post-conflict reconstruction approach(es). In order to pinpoint the differences the Mann-Whitney U Test was conducted in order to compare each pair of mean ranks to decide where this difference had occurred.

Table 16: Test Statistics 4

Test Statistics^{a,b}	
	Satisfaction with post war reconstruction effort?
Chi-Square	265.450
df	4
Asymp. Sig.	.001
a. Kruskal Wallis Test	
b. Grouping Variable: Group	

As the Kruskal-Wallis ANOVA is significant, there are at least two groups or experimental conditions which differed. Therefore, the Mann-Whitney U Test was conducted in order to compare each pair of mean ranks to decide where this difference had occurred.

- **Follow Up Analysis:**

1. **(Effect Size)**

As was described earlier, the effect size is known as Eta-Squared (η^2), which is easily interpreted as an effect size measurement for the analysis of variance. So,

$$\eta^2 = \frac{265.450}{570-1} = 0.9330$$

According to Cohen (1988) conventions, the effect size is strong (refer to Table 8).

2. Mann-Whitney U Test

As can be seen in Table 17 and Figure 11, the Mann-Whitney test statistic "U" reflects the difference between the two rank totals for all five cities (1.2, 1.3, 1.4, 1.5, 2.3, 2.4, 2.5, 3.4, 3.5, and 4.5). Note that the full comparison is provided in **Appendix B**.

Table 17: Satisfaction comparison among all five cities

Mann-Whitney Test					
	Bengasi	Misurata	Sabha	Sirte	Tripoli
Bengasi	×	0.001	0.001	0.001	0.122
Misurata	0.001	×	0.001	0.001	0.001
Sabha	0.001	0.001	×	0.001	0.041
Sirte	0.001	0.001	0.001	×	0.001
Tripoli	0.122	0.001	0.041	0.001	×

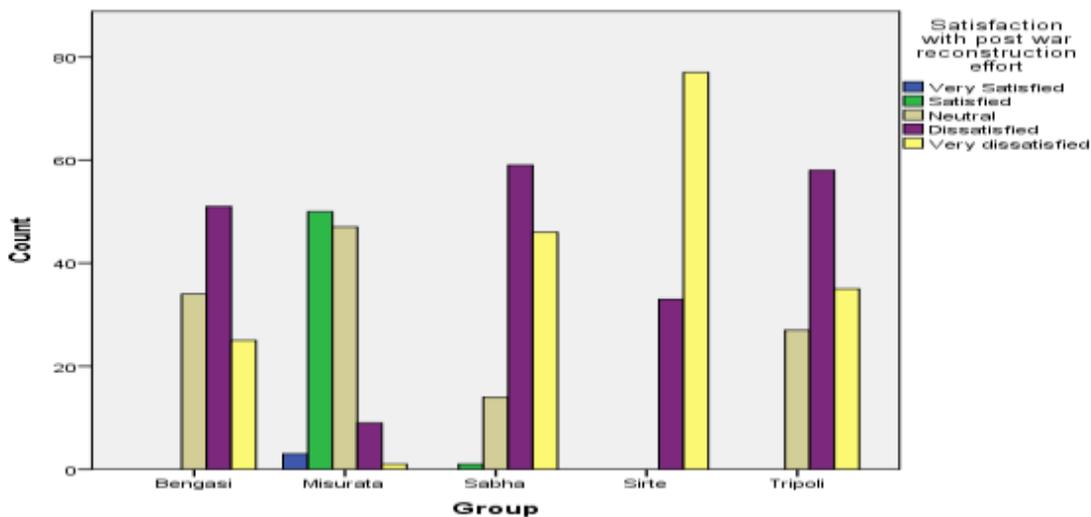


Figure 11: Comparison of satisfaction level using Mann-Whitney Test

On the one hand, a Mann-Whitney U Test indicated that the level of dissatisfaction in Sirte city was significant (*very dissatisfied where $p = 0.01$*), followed by Sabha (*dissatisfied where $p = 0.001$*). However, the test showed no significant differences in the dissatisfaction level with the post-conflict reconstruction effort between Tripoli and Bengasi (*dissatisfied where $p = 122$*) (refer to Table 17 and Figure 11).

On the other hand, as shown in Figure 11, the Mann-Whitney U Test clearly signifies that Misurata city is the only city which was satisfied with post-reconstruction effort(s). This could be because, as most participants stated, they received compensation in a timely manner; there were continuous efforts to reconstruct damaged infrastructure in their city; and, most importantly, they felt they had control of the political scene in Libya. This implies one of many drawbacks of the centralized system.

4.2.6 THE AFFECTED COMMUNITIES' REQUIREMENTS, POST-CONFLICT/WAR

The most important part of this questionnaire survey was to gather data on the end-users' affected communities' requirements and needs post the 2011 conflict/war and compare them against the governmental approach which had already taken place in post-conflict/high alert Libya. The essence of this step was to determine if the communities' requirements and needs were first listened to and, second, were pending or had been met.

The Kruskal-Wallis U ANOVA test showed that there were clear differences in the mean ranks, indicating the differences in the affected communities' requirements and needs, post 2011 conflict. For example, with regards to the first community requirement (Bengasi=**150.10**, Misurata=**347.22**, Sabha= **275.58**, Sirte= **215.00**, Tripoli= **427.59**), H (corrected for ties) = **204.944**, $df = 4$, $N = 570$, $p = 0.01$).

Table 18: Affected Communities' requirements and needs

Kruskal-Wallis Test			
Ranks			
	Group	N	Mean Rank
The Affected Community First Requirement	Bengasi	110	150.10
	Misurata	110	347.22
	Sabha	120	275.58
	Sirte	110	215.00
	Tripoli	120	427.59
	Total	570	
The Affected Community Second Requirement	Bengasi	110	394.83
	Misurata	110	251.88
	Sabha	120	222.61
	Sirte	110	197.70
	Tripoli	120	359.48
	Total	570	
The Affected Community Third Requirement	Bengasi	110	304.40
	Misurata	110	155.20
	Sabha	120	213.59
	Sirte	110	402.64
	Tripoli	120	352.14
	Total	570	
The Affected Community Fourth Requirement	Bengasi	110	183.33
	Misurata	110	348.61
	Sabha	120	359.87
	Sirte	110	301.36
	Tripoli	120	232.40
	Total	570	

In the test statistics 5 (Table 19), the asymptotic probability is *less than 0.05* ($p= 0.01$); hence, the Kruskal-Wallis ANOVA Test indicates that there were statistically significant differences in the affected communities' requirements and needs post 2011 conflict.

Table 19: Test Statistics 5

Test Statistics^{a,b}				
	The Affected Community First Requirement	The Affected Community Second Requirement	The Affected Community Third Requirement	The Affected Community Fourth Requirement
Chi-Square	204.944	129.032	172.073	98.588
df	4	4	4	4
Asymp. Sig.	.001	0.001	0.001	0.001
a. Kruskal Wallis Test				
b. Grouping Variable: Group				

- **Follow Up Analysis:**

- 1. (Cross tabulation)**

In order to pinpoint the differences in the requirements and needs amongst all five cities, Cross tabulation (Crosstab or Categorical Data Analysis) was utilized. Cross tabulation is defined as a statistical method that combines and summarizes categorical data from one or more sources to create a contingency table. It helps to present the data in a brief and precise format for analysis and reporting (CreateSurvey, 2012). Table 20 and Figure 13 illustrate the affected communities' requirements and needs, post 2011 war.

The Cross Tabulation statistical test clearly revealed that the affected communities' requirements and needs differed significantly from one city to another. For example, Bengasi city's participants revealed that their priority requirements and needs were: roads first, water facilities

second, drainage third, and hospital fourth. However, Tripoli city had completely different priority requirements; these were: water facilities first, homes second, public buildings third, and schools and electricity networks came together as the fourth requirement. This was the case with all five cities as each city's participants demonstrated significant differences in priority requirements and needs. Figure 12 summarizes the significant difference (in detail) among all five cities.

Table 20: Cross-Tabulation among all five cities

Community First Requirement Cross tabulation										
Assets/Services		Roads	Hospitals	Schools	Universities	Electricity Networks	Drainage	Homes	Public Buildings	Water Facilities
Groups	Sabha	1	0	8	1	71	0	22	16	1
	Tripoli	4	2	2	2	21	0	1	10	78
	Sirte	39	5	8	0	6	5	39	6	2
	Misurata	8	7	5	2	7	4	10	56	11
	Bengasi	48	12	18	6	10	5	1	4	6
Community Second Requirement Cross tabulation										
Assets/Services		Roads	Hospitals	Schools	Universities	Electricity Networks	Drainage	Homes	Public Buildings	Water Facilities
Groups	Sabha	57	5	4	0	6	0	24	24	0
	Tripoli	5	2	14	0	4	0	82	11	2
	Sirte	9	60	9	6	2	9	8	4	3
	Misurata	8	4	60	9	12	4	2	4	7
	Bengasi	9	3	18	10	2	2	0	13	53
Community Third Requirement Cross tabulation										
Assets/Services		Roads	Hospitals	Schools	Universities	Electricity Networks	Drainage	Homes	Public Buildings	Water Facilities
Groups	Sabha	1	63	21	0	4	1	23	6	1
	Tripoli	5	5	29	4	2	5	8	61	1
	Sirte	5	6	8	6	6	5	7	33	34
	Misurata	59	8	10	4	12	2	7	4	4
	Bengasi	8	4	11	3	4	57	8	15	0
Community Fourth Requirement Cross tabulation										

Assets/Services		Roads	Hospitals	Schools	Universities	Electricity Networks	Drainage	Homes	Public Buildings	Water Facilities
Groups	Sabha	2	11	9	4	5	42	25	17	5
	Tripoli	10	7	45	2	43	2	2	9	0
	Sirte	7	6	23	2	24	24	6	12	6
	Misurata	5	14	7	6	8	3	57	5	5
	Bengasi	10	60	9	2	6	0	12	11	0

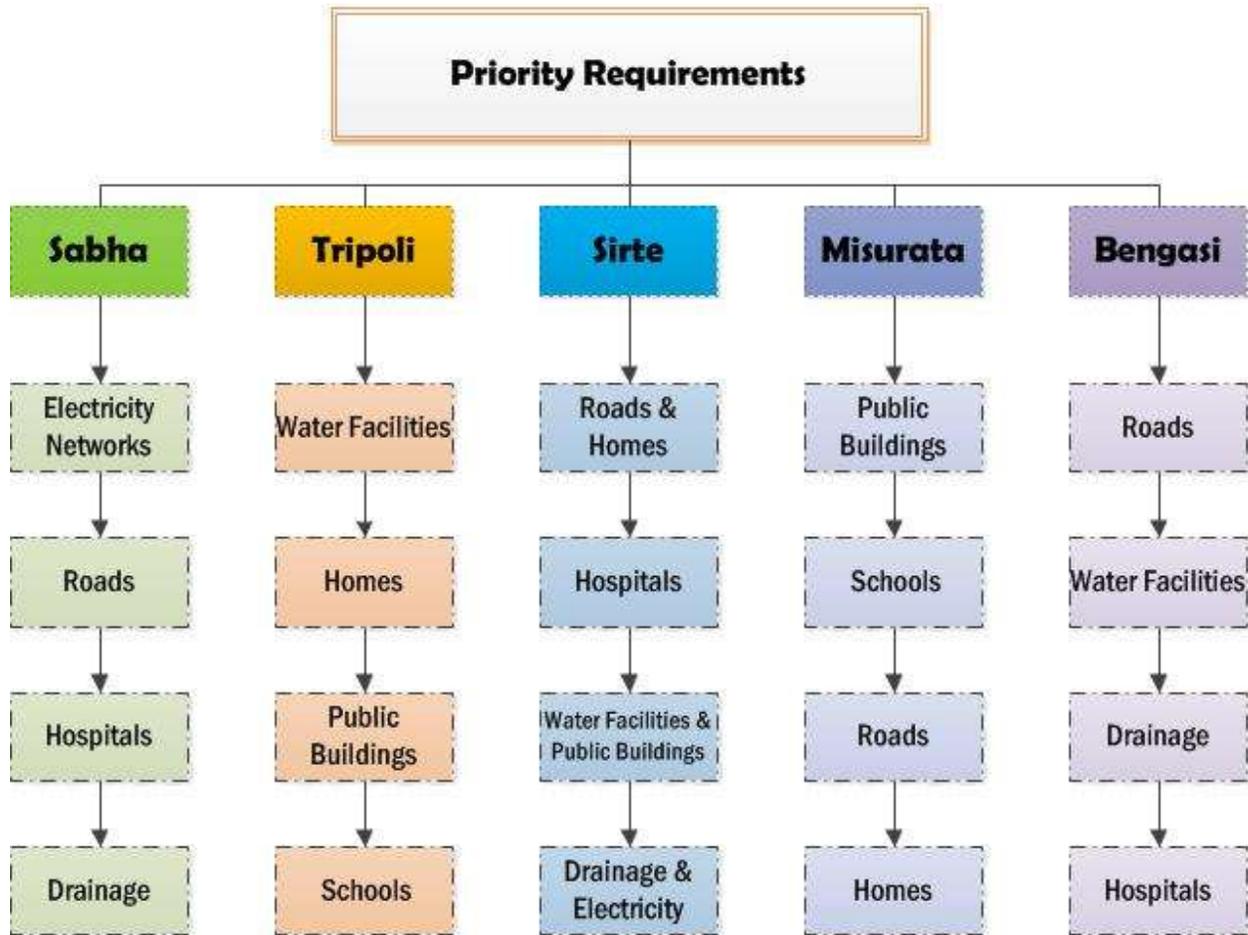


Figure 12: Priority Requirements

It is clear that each city had its own priority requirements and needs, pre 2011 war. This could be a result of the damage that had occurred during the recent conflict or as a result of the poor conditions of these assets/services pre-conflict conditions. The interviews with the governmental officials (Section 2 of this chapter) at the Department of Housing and Utilities will reveal the extent the post-conflict reconstruction plan had been developed in accordance with the affected communities' requirements and needs.

4.3 SECTION 2: ANALYSIS OF THE DATA FROM THE INTERVIEWS

The second part of the analysis reports the data obtained from interviewing 5 key personnel respectively from each of the Libyan Housing and Utilities Department (LHU) in five cities, namely, Tripoli, Benghazi, Misurata, Sirte and Sabha and as well as from the main Tunisian department.

In total twenty-five (25) respondents across the 5 locations.

4.3.1 SELECTION OF PARTICIPANTS

The participants were selected from different departmental divisions as well as different professional backgrounds so that a broad perspective could be gathered on the objectives of the study. The levels of experience working in the governmental department varied from 8 years to 22 years. In relation to the participants' qualifications, Figure 13 illustrates the participants' qualifications.

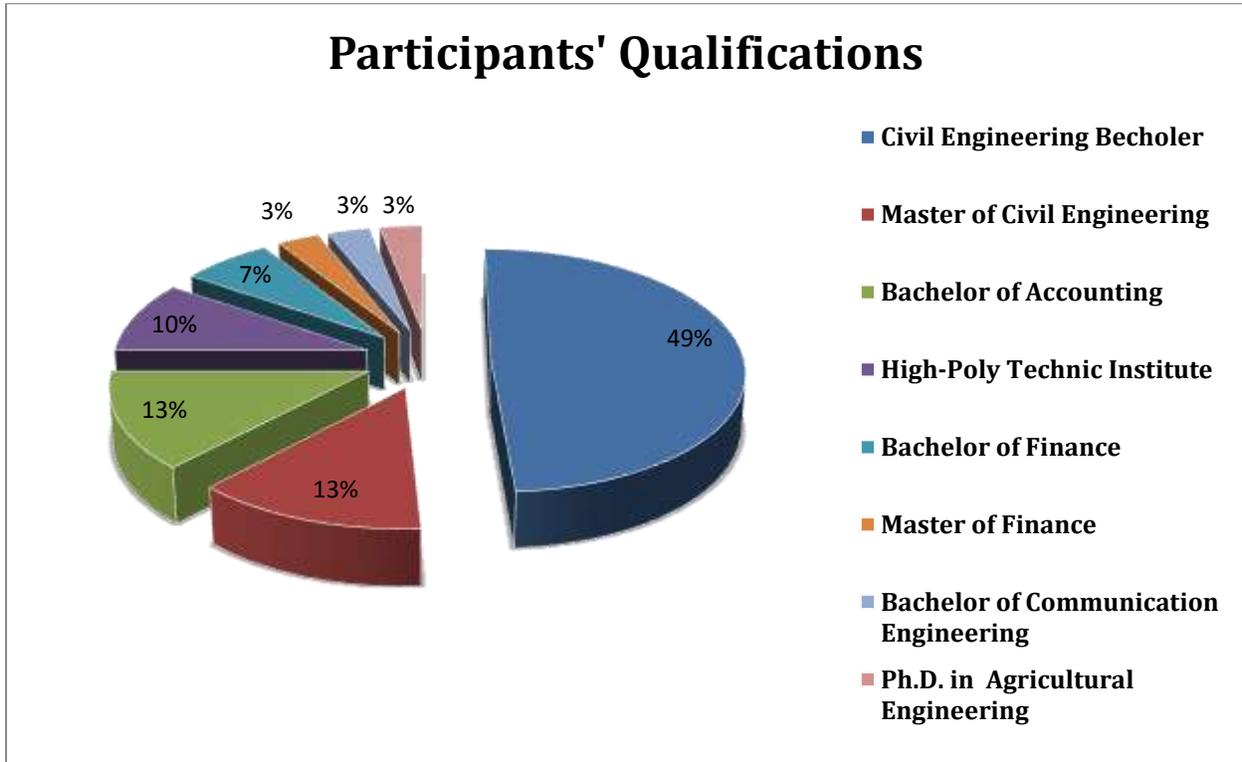


Figure 13: Participants' Qualifications

Figure 13 demonstrates that almost half of the participants (49%) had acquired a bachelor degree in civil engineering; 13% had a master degree in civil engineering and 13% had a bachelor degree in accounting. Only one participant had a Ph.D. degree in agricultural engineering; he serves as the head of the Libyan Housing and Utilities, Sabha Branch.

4.3.2 PARTICIPANTS' UNDERSTANDINGS OF PROJECT FINANCE AND FACTORS LEADING TO AWARD CONTRACT WORK

Most, if not all, participants in the Libyan housing and utilities' five branches confirmed that the main source of project funding for both pre and post-conflict/high alert infrastructure projects (building new infrastructure assets/services or maintaining existing infrastructure assets/services) is purely and entirely provided by the state of Libya. In Tunisia, on the other hand, it was confirmed by all participants that the Tunisian main department utilized a dual approach - governmental

funding as well as bank financing. Because government funding was not sufficient according to the Tunisian participants, they had to supplement with funding derived from investments. The lack of government funding may be due to the absence of natural resources in Tunisia. Almost all the participants in the Tunisian main branch believed that the current funding mechanism for pre- and post- conflict conditions was working.

The Libyan case is different. As the Department of Housing and Utilities is a not-for-profit organisation, it could only rely on government funds. Nevertheless many participants in the various Libyan branches believed that relying only on governmental funds was appropriate and effective. For instance, on the one hand, there seems to be a consensus on the funding mechanism's effectiveness amongst the 4 branches. Besides, all 5 participants in the Sirte branch, 4 participants out of 5 in the Tripoli main branch as well as in Bengasi and Misurata branches thought that the *pre conflict* funding approach was working. Their reasons for believing the mechanism was effective were: as Libya's population is small (around 6 million) and the oil and gas are abundant there is little need for any other funding approach.

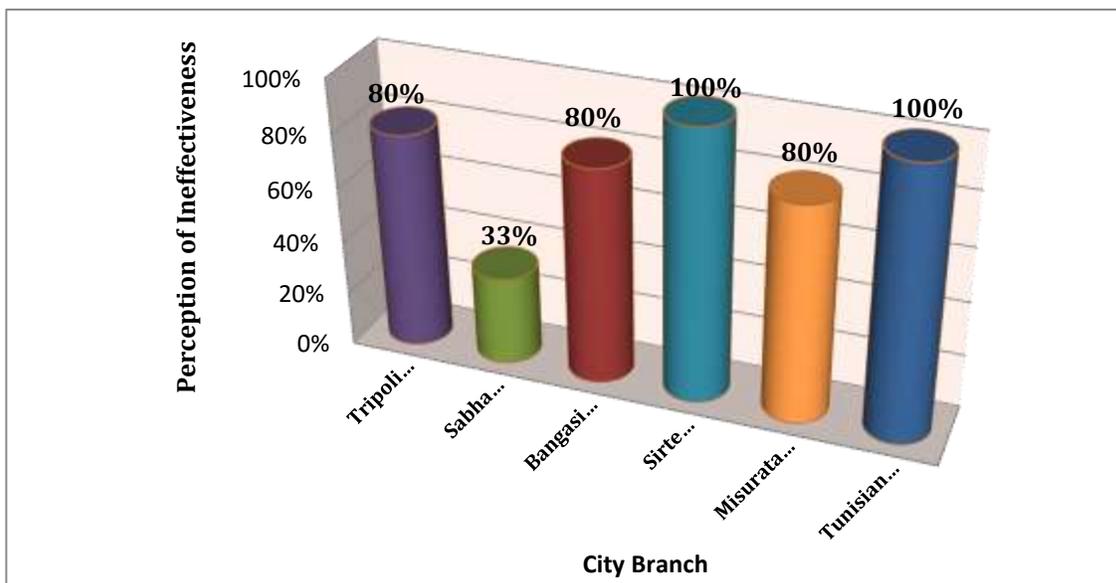


Figure 14: Participants' perception of the effectiveness of project funding mechanism pre conflict/high alert conditions in Libya (5 branches) and in Tunisia

Figure 14 shows that, with regard to *pre conflict/high alert conditions*, around 80% of the participants in the Tripoli main department as well as in the Misurata branch, and 100% of the Sirte branch thought that the existing funding mechanism was effective and the funding by government of all its infrastructure assets was appropriate because Libya is a rich country (oil and gas abundance) and the size of the population is relatively low. In addition, around 33% and 80% of the participants in Sabha and Bengasi respectively supported the same conclusion.

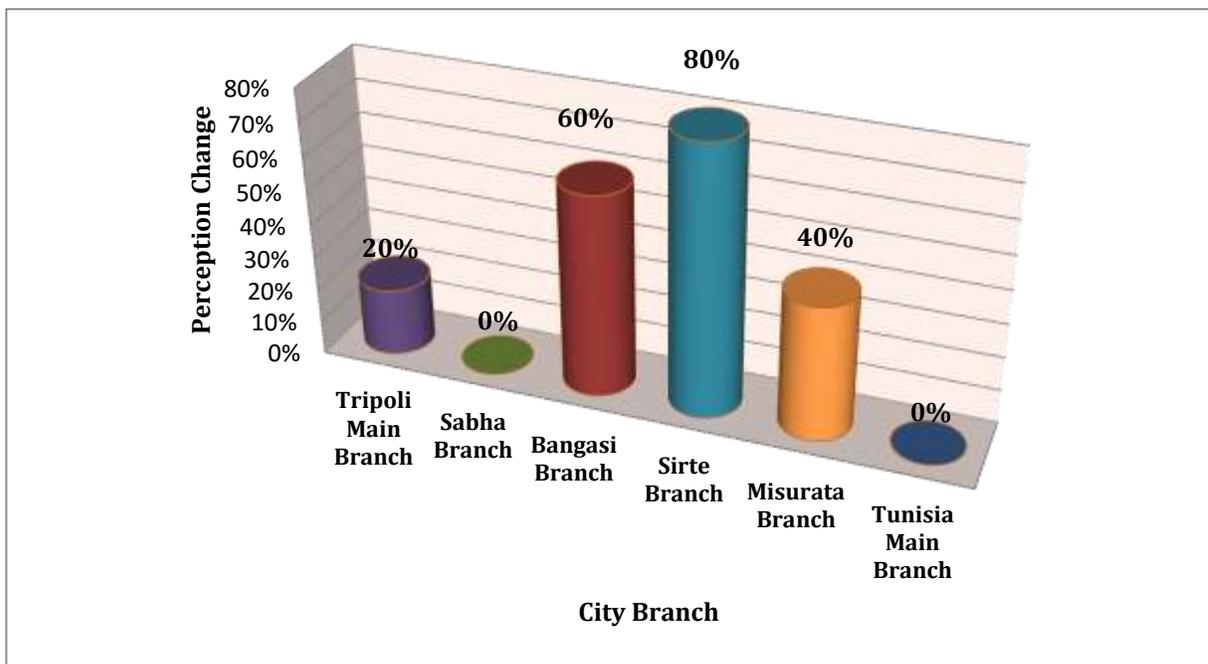


Figure 15: Shift in perception as a result of the recent conflict/high alert conditions

On the other hand, Figure 15 shows that, with regard to *post-conflict/high alert conditions*, only one participant in the Tripoli branch (total of 20%) against 3 participants in the Bengasi branch (total of 60%), 2 participants in the Misurata branch (total of 40%), as well as 4 participants in the Sirte branch (total of 80%) had changed their mind after experiencing funding issues post the conflict/high alert conditions. It may be that their change in thinking pre to post-conflict was due to scarcity of funding post-conflict. The participants believed they required another approach

to source funding. For example, many participants stated that investment strategies should be adopted in order to generate more funds.

One interesting discovery was highlighted by one of the participants in the Misurata branch; he stated, ‘project funding mechanism in post-conflict/high alert situations is better than that for pre situations’. He added that this was due to the unfair distribution of the funds pre conflict/ high alert conditions. He said he believed that things had changed post-conflict and the funds were being fairly distributed among all the states.

In the three Libyan branches, there seems to be a better understanding of the risk associated with relying on the state’s funds *for both conditions, pre and post-conflict/high alert situations* (refer to Figure 16).

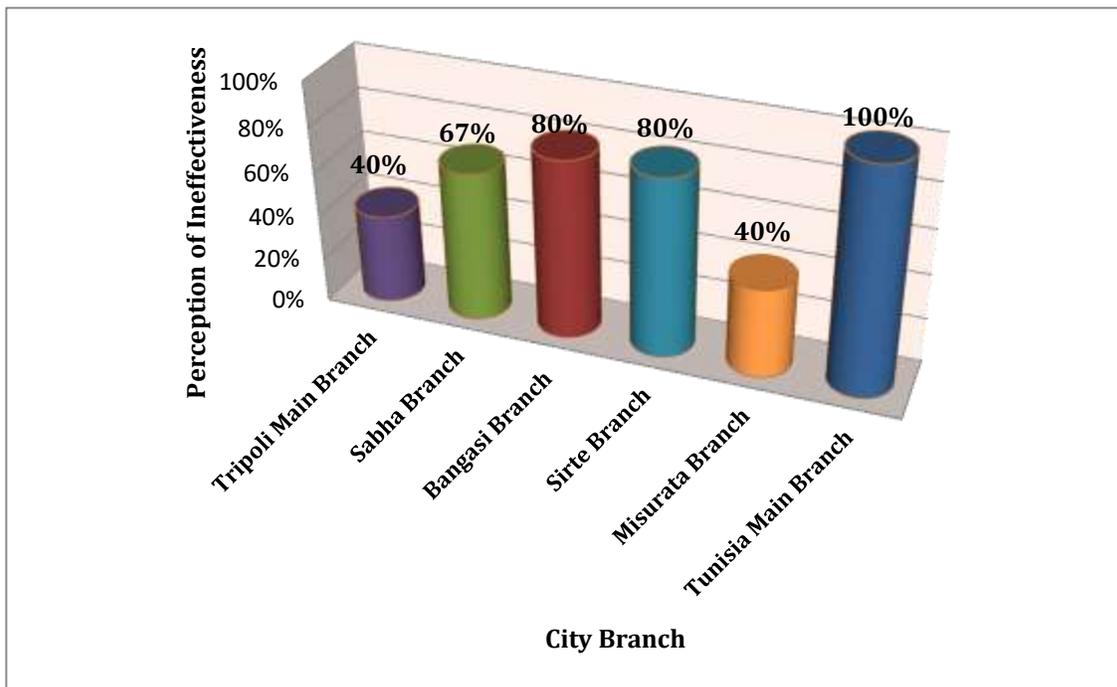


Figure 16: Participants' perception of the ineffectiveness of project funding mechanism post-conflict/high alert conditions in Libya (5 branches) and in Tunisia

In the Sabha branch, for example, approximately 67% of the participants perceived the funding mechanism as ineffective for both pre and post-conflict infrastructure asset projects. The participants in Bengasi and Sirte branches (80% each) supported the same conclusion.

According to the participants, this was due to the non-involvement of the private banking sector, both financially and technically, the absence of investment strategies, legislative instability as well as the absence of regulatory agencies (internal monitoring body); these factors, they reported, contributed to the funding mechanism failure during the current conflict. During and after the conflict it was very difficult for them to fix/maintain basic simple issues without an internal funding mechanism or profits.

4.3.2.1 WORK CONTRACT

In relation to the factors leading to the award of major contract work for the construction of new buildings or the maintenance of existing infrastructure assets or services, most of the participants agreed on the criteria for awarding a works contract.

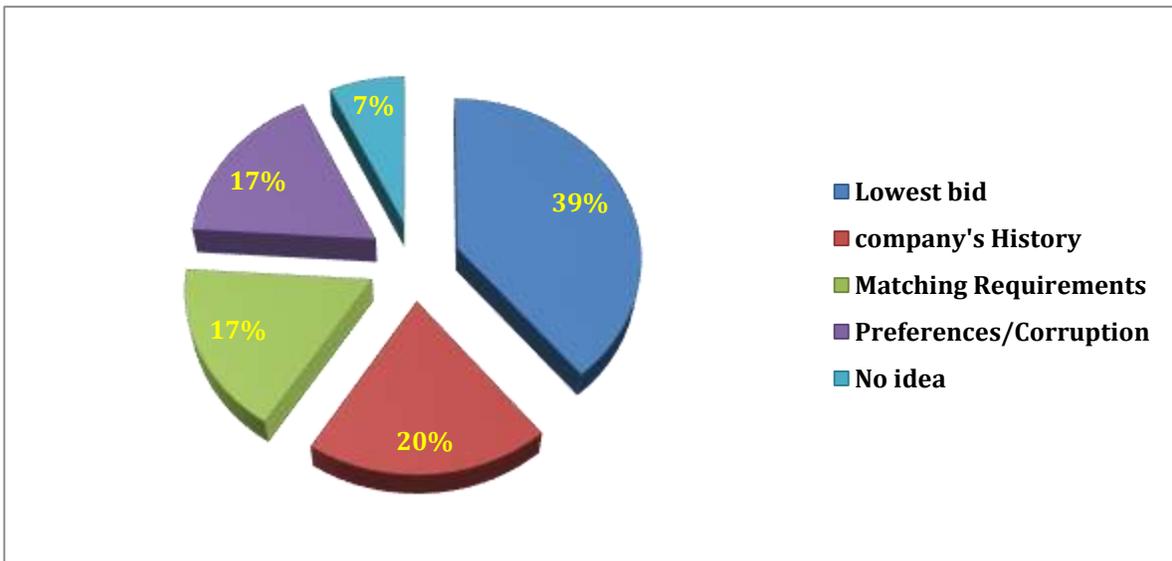


Figure 17: Factors leading to contract award in Libya

These criteria, shown in Figure 17 were: lowest bidding and relationship marketing (39%). The history of the company, they stated, is important too (total of 20%). However, some strongly felt that bribery and corruption (total of 17%) was also a major influencing factor compromising quality, design and overall quality. However, 17% of the participants believed that matching the legal, technical and financial requirements is a decisive factor.

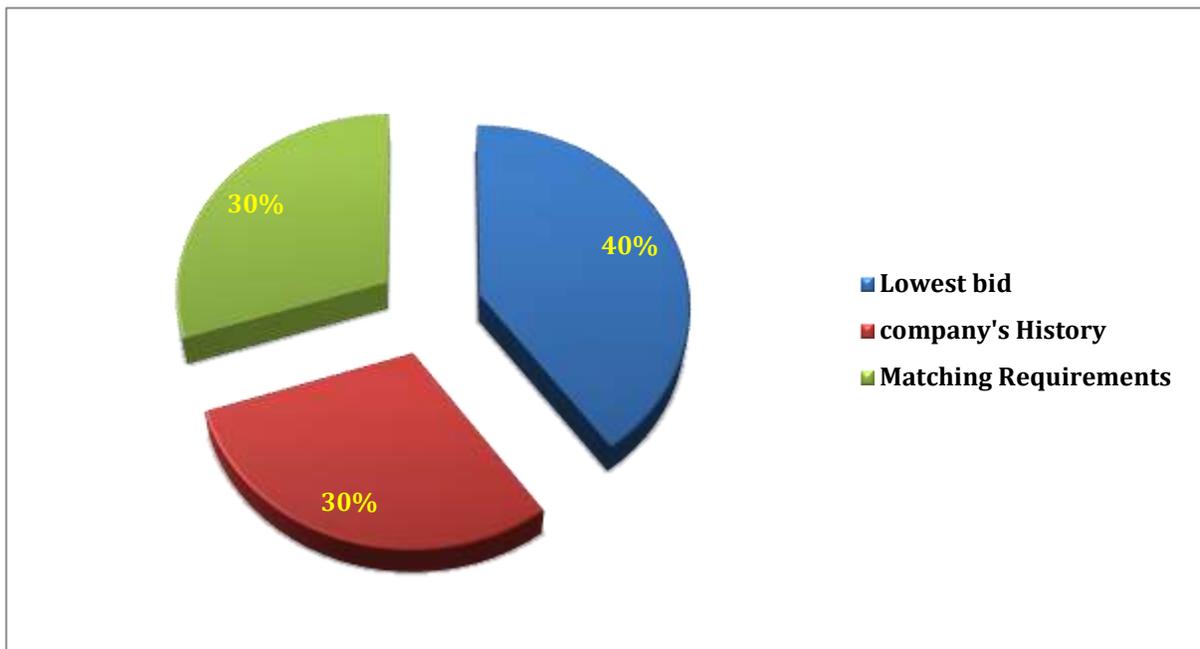


Figure 18: Factors leading to contract award in Tunisia

On the other hand, in Tunisia, most participants emphasized that, even if there is priority given to particular companies with regard to awarding the project contract, there is no room for compromise for project specification, design and overall quality. This may highlight the main differences between the two countries with regard to awarding a contract. On the one hand, awarding a contract on the basis of the lowest bid seemed predominant in the Tunisian main branch, followed by (at the same percentage 30%) matching the legal, technical and financial requirements as well as the company's history (refer to Figure 18).

In relation to the effectiveness of awarding a contract in Libya, against almost 46% of the participants who appreciated the current award mechanism, approximately 50% of the participants believed the opposite, that the current contract mechanism was ineffective and thus required further amendments.

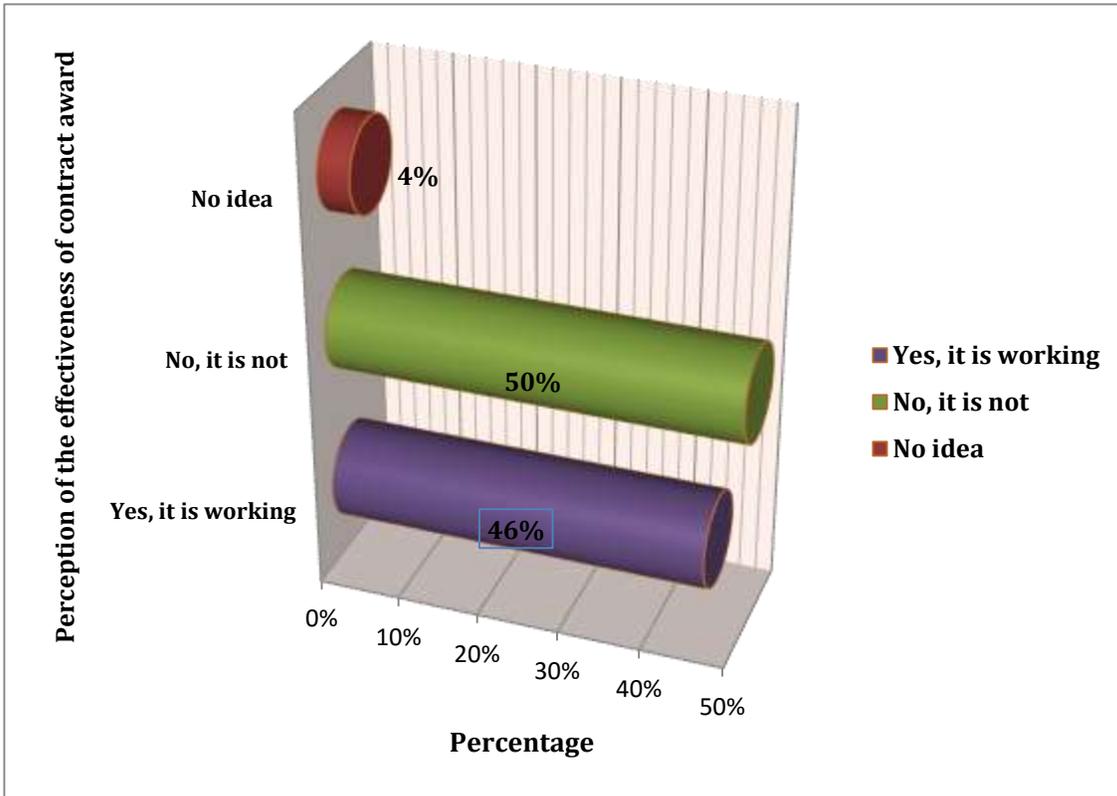


Figure 19: Perceptions of the effectiveness of contract award in Libya

Figure 19 shows the participants’ perceptions of the effectiveness of awarding contracts in Libya. In Tunisia, however, almost all participants showed positive appreciation of the current method of awarding a project contract. This could possibly be a result of the non-compromise technique that the Tunisian main department is utilising when it comes to a project’s quality, specification and design.

4.3.2.2 LEVEL OF LOBBYING

Figures 20 and 21 illustrate the participants' perceptions of the occurrence of preference/lobbying in Libya.

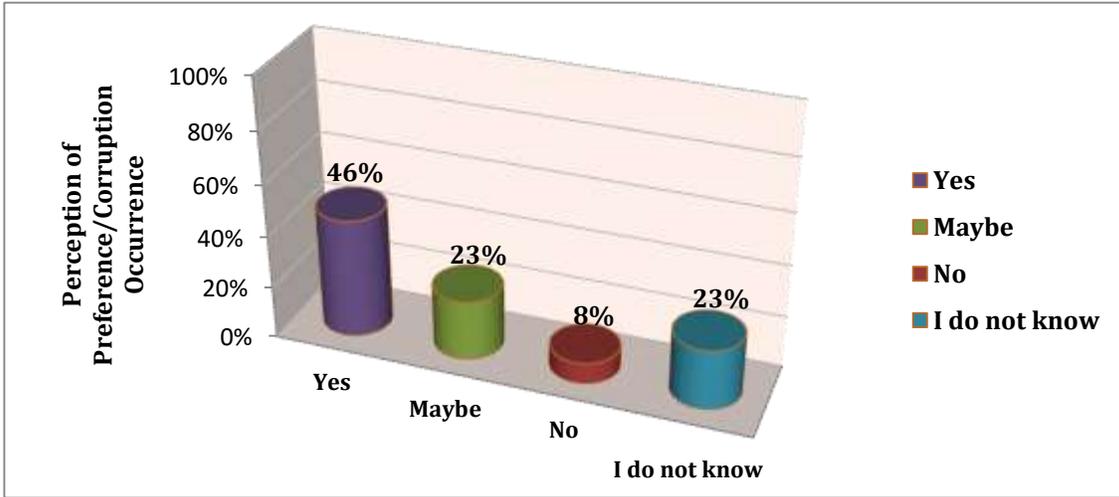


Figure 20: Participants' perceptions of occurrence of preference/lobbying in Libya

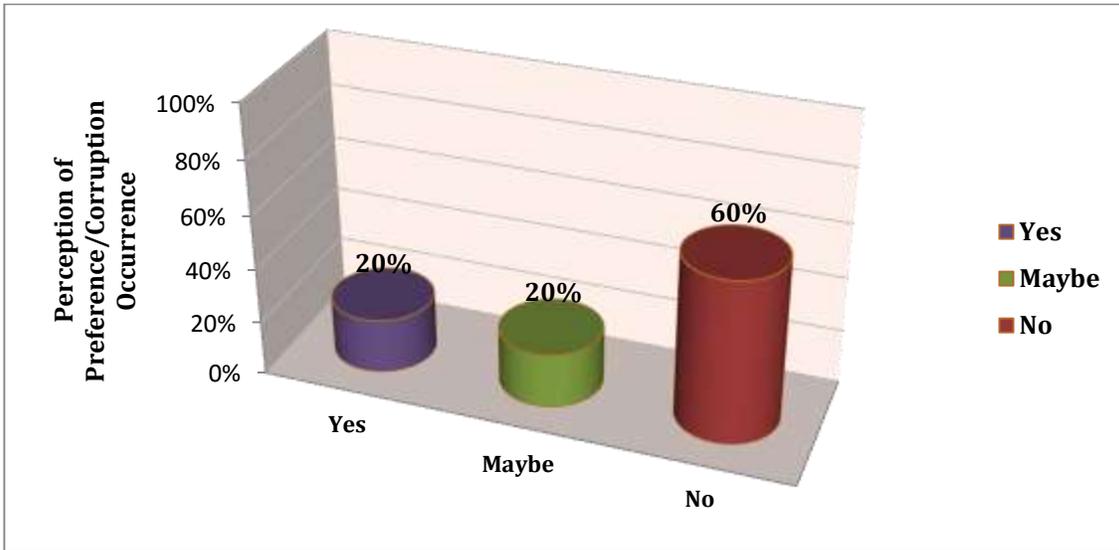


Figure 21: Participants' perceptions of occurrence of preference/lobbying in Tunisia

Unlike Tunisia where around 60% of the participants were certain that there was no preference/lobbying taking place with regard to awarding project contracts, there was a strong indication (46%) of the level of lobbying/preferences taking place in Libya with regards to awarding project contracts. However, 20% of the respondents in Tunisia confirmed that there was at least some lobbying taking place.

Figure 22 on the other hand shows the participants' estimation of level of preference/corruption in Libya.

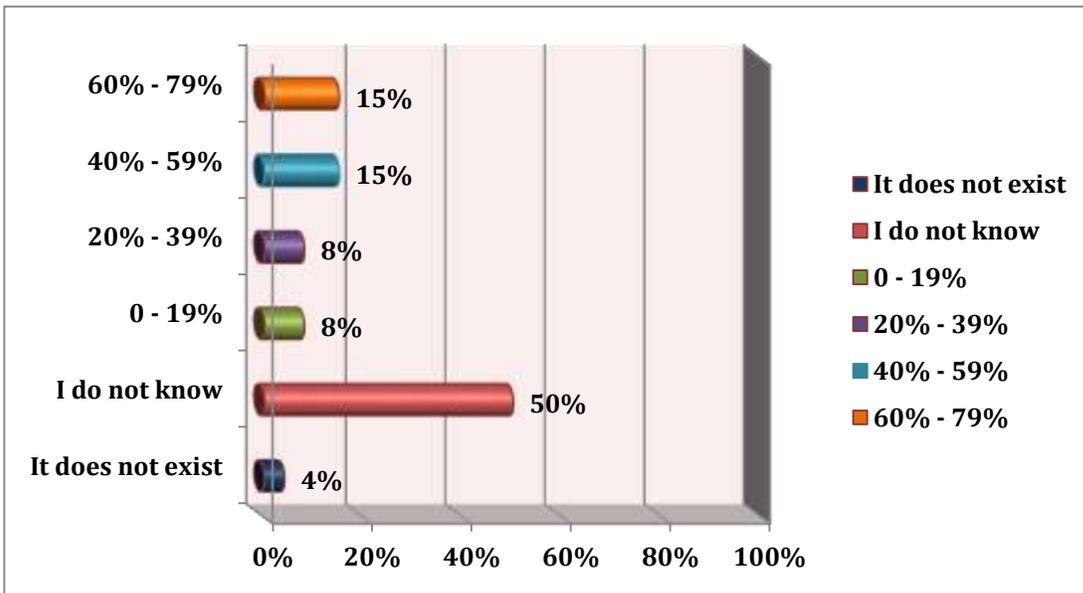


Figure 22: Participants' estimation of occurrence of preference/corruption in Libya

As can be seen in Figure 22, while almost 50% of the participants could not estimate the level of occurrence of preference/corruption, there were around 15% of the participants who thought that the level of preference occurrence was 60%-79%, followed by the same percentage (15%) of the participants who thought that the level of preference occurrence was 40%-59%. However, 4% of the participants believed in the non-existence of such phenomena. The reason why the highest number of the participants could not estimate the level of preference/lobbying occurrence could

be a result of their positions; most of them were staff members working in the planning or the execution section. There were a small number of participants who were working in managerial positions.

In the case of Tunisia, Figure 23 displays the participants' estimation of level of preference/corruption in Tunisia.

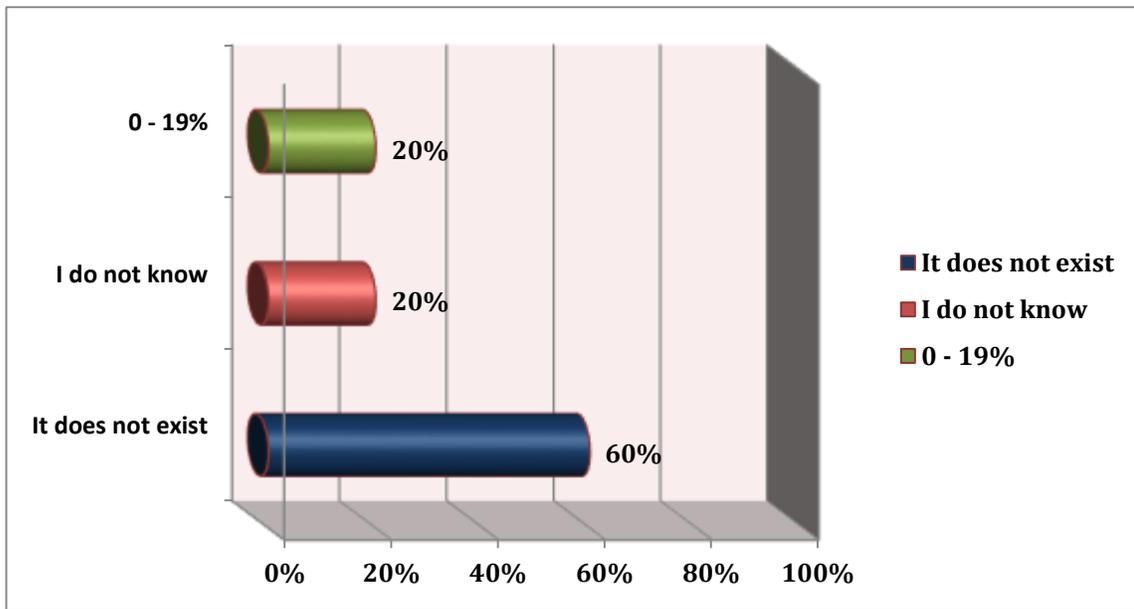


Figure 23: Participants' estimation of occurrence of preference/corruption in Tunisia

Unlike Libya, almost 60% of the participants believed that such phenomena do not exist at all. This could be a result of the strict tendering strategy that the Tunisian department is utilizing. However, one participant stated that he thought that preferences for awarding contracts did exist, and estimated its occurrence to be around 0-19%.

4.3.3 PARTICIPANTS' UNDERSTANDINGS OF ECONOMIC EVALUATION TECHNIQUES, PARTICULARLY LIFE CYCLE COSTING

➤ Economic Evaluation techniques

The participants were then questioned regarding their knowledge and understanding of different economic evaluation techniques. Most participants in the different departmental branches confirmed that they had some knowledge of economic evaluation techniques. With regard to use of evaluation techniques, in the Bengasi branch, 2 participants (40% of participants) acknowledged the casual use of benefit cost analysis, 60% of the participants (3 participants) confirmed the opposite that there were no economic evaluation techniques utilized in their branch. This conclusion was supported by Sirte branch participants where 4 participants (80%) confirmed the non-existence of any economic evaluation techniques. This could be, as they stated, as a result of not being required by the main branch to use such techniques. In other words, there were no rules/regulations in place at the time of this study. Moreover, both branches' participants had very limited understanding of the potential benefits of such techniques.

Despite Misurata branch's participants having the best understanding of economic evaluation techniques amongst all other branches, all participants confirmed that there were no evaluation techniques required or even in use. Sabha branch, on the other hand, came second in terms of better understandings of economic evaluation techniques and their benefits. However, 4 participants (67%) agreed that the reason behind the lack of the use of these techniques was because of the absence of regulatory requirements. This absence, they stated, should be addressed by government.

Most of the participants stated that the main department in Tripoli did not require them to use evaluation techniques. One participant did report the rare use of benefit cost analysis; 60% of the participants, however, stated that economic evaluation techniques were not used. All participants, therefore, had understandings of the potential benefits; however, they related the reasons why such techniques were neither in use nor utilized for the potential overall wealth of the country. They

explained that long term saving is not a priority for the government as there is an abundance of oil and gas. In addition, they explained that their organization was a not-for-profit organization.

The Tunisian case was not any different. 60% of the participants indicated that no economic evaluation techniques were utilized by the Tunisian main branch. They all stated that this was due to the country having no natural resources and thus funds were very limited. ‘We have to utilize the available funds for current projects only’ one participant said. Another participant, the Real estate affairs unit manager (a civil engineer with 22 years’ experience), emphasized that, if they were to think long term, most, if not all, of the funds could be deployed now and thus long term savings could be created and long term spending could be minimized/avoided. He added, however, that this scenario was not sustainable in their case. ‘The point is’, he stated, ‘we cannot afford to spend too much now because the funds are limited. Thus, the wise decision for us is to spend now and satisfy end-users and not to worry about any long term savings/thinking’.

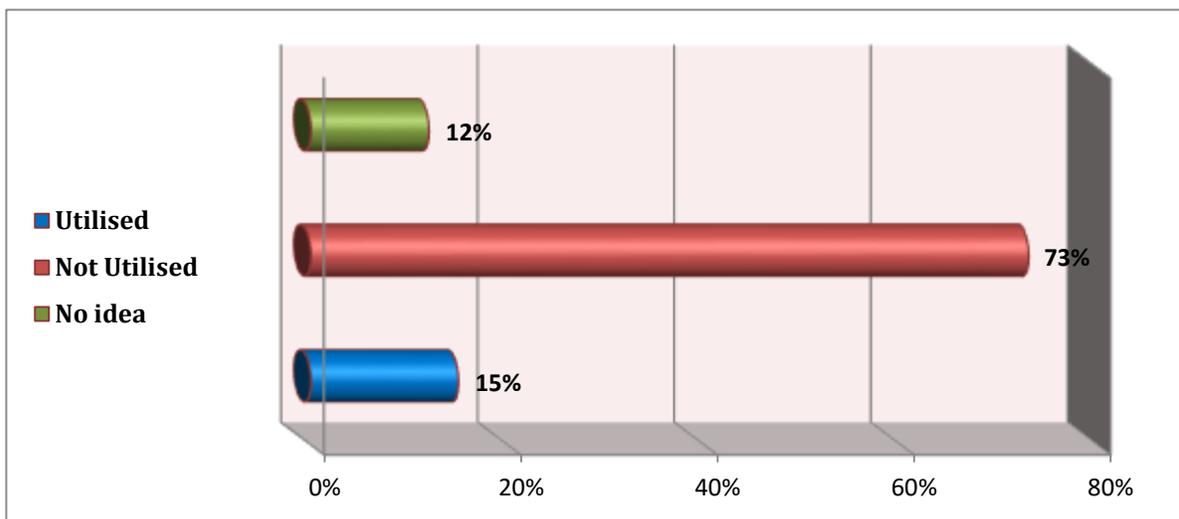


Figure 24: The use of economic evaluation techniques in the various Libyan branches

As can be seen in Figure 24, only a small percentage of the participants (15%) believed that a form of economic evaluation technique was in casual use-cost benefit analysis. However, 73% of the participants confirmed that no economic evaluation techniques were utilized in the various Libyan branches. In Tunisia on the other hand, the majority of participants (60%) agreed that no

economic evaluation techniques were being utilized by the Tunisian main department (refer to Figure 25).

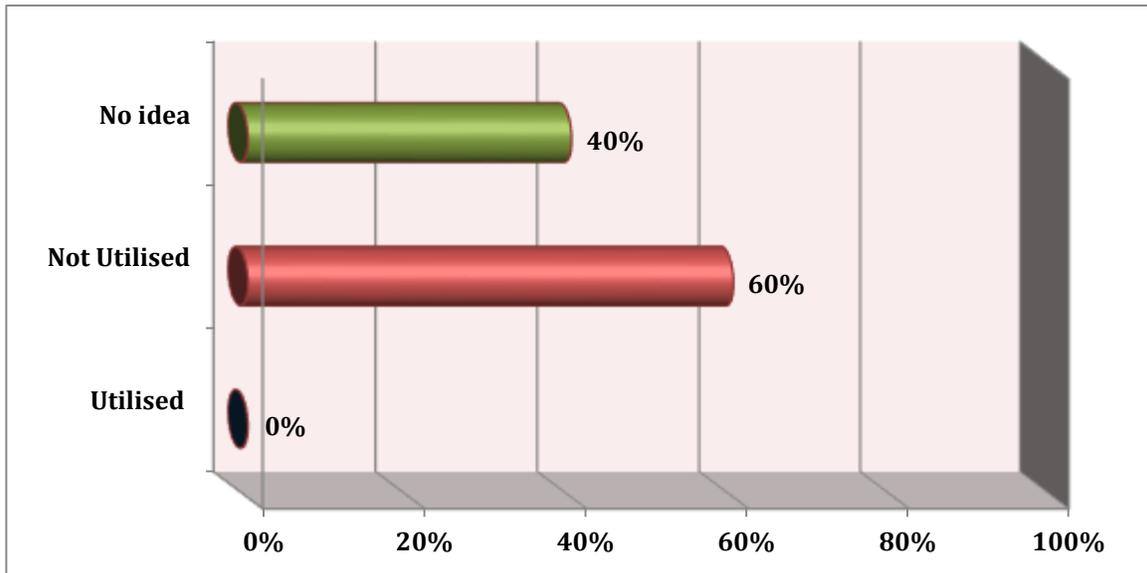


Figure 25: The use of economic evaluation techniques in the Tunisia

As the majority of participants in both Libya and Tunisia confirmed the non-utilization of the various economic evaluation techniques, they were then asked about the costs that the various branches considered or should consider when evaluating options for pre and post-conflict reconstruction projects. In the Tripoli main branch, Sirte branch as well as in the Misurata branch, 4 participants (80%) said that only capital cost should be used. One participant in the Tripoli branch stated the same but added that other costs should be considered in the evaluation process. This probably could be as a result of his involvement in the execution section only during his time working in the Tripoli main department. Another participant in the Sirte branch said, 'I do not see any relevance to any other costs other than the building cost (capital cost)'. He was also involved in the execution section and had never been involved with design or planning affairs. Similarly, responses from the Bengasi branch as well as Sabha branch supported the same conclusion with 80% and 100% respectively. In all Libyan branches, all participants who thought that capital cost

only should be considered also believed that other costs such as operation, maintenance, replacement or disposal were not relevant.

The Tunisian case is similar as all participants emphasized that, if any economic evaluation technique were to be utilized, the capital cost only would be considered. This response could possibly be because of the limited funds as well as the absence of natural resources.

➤ **Life cycle costing analysis**

Life cycle costing (LCC) is an economic evaluation technique that seeks to determine the total cost of acquiring, operating and maintaining an asset or service over time. Life cycle cost analysis is related to the application of different techniques in LCC, and choosing the most favorable. Most, if not all, participants clearly acknowledged the non-utilization of LCCA in their branches in both Libya and Tunisia.

For example, in the Bengasi and Sabha branches, 100% and 83% of the participants respectively believed that LCCA was not in use in either *pre or post-conflict situations*. Participants (80%) in the Sirte and Misurata branches believed likewise. In the Tripoli branch, 40% of the participants had no idea, 60% of them said such a technique was not in use. This may be attributed to the same facts stated previously, that long term saving is not vital for government as there is an abundance of oil and gas. Furthermore, they explained that their organization was a not-for-profit organization.

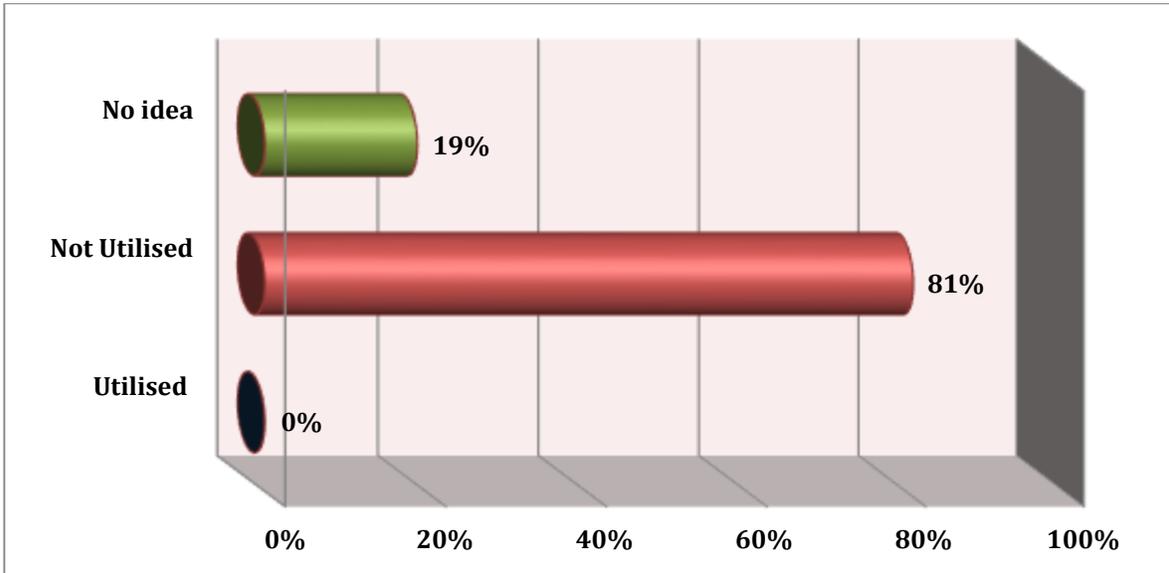


Figure 26: The use of LCCA in Libya

As can be seen from Figure 26, LCCA technique was not in use in Libya in either a pre or post-conflict situation; this was confirmed by all the branches' participants. Around 81% of all participants in the various Libyan branches confirmed that LCCA technique was not utilized. However, 19% of the participants were unsure as to whether or not LCCA had been adopted.

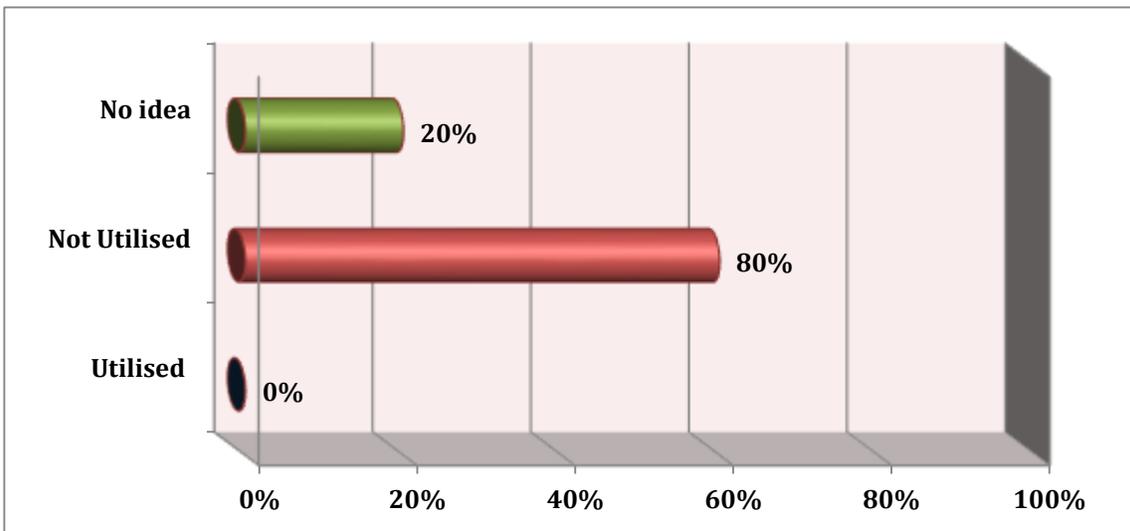


Figure 27: The use of LCCA in Tunisia

Figure 27, on the other hand, shows clearly that LCCA technique was also not utilized in Tunisia. This could be as a result of limited funds. In both countries, Libya and Tunisia, none of the participants showed any understanding of the application of LCC procedure or the utilization of specialized software or excel sheet for LCCA for the construction of various infrastructure assets/services. This may be explained by the fact that, in Libya, most of the government bodies have plenty of funds at their disposal and are therefore not too cost conscious, at the present time. Also, all the participants in both countries were not aware of any legal or compliance issues pre or post-conflict/high alert conditions in their department or in the nation or indeed internationally which required mandatory use of LCC procedures in their projects.

➤ **Factors affecting the adoption of the various economic evaluation techniques, especially Life cycle costing analysis**

In Libya, the factors affecting the adoption of the various economic evaluation techniques, especially life cycle costing analysis, according to all participants, were mainly:

- Not-for-profit organization thinking. Thus, there is no focus on either short/long term saving. In other words, the belief that Libya is a rich country could be a major and strong drive against adopting LCCA;
- The absence of regulations/rules as well as the absence of regulatory agencies;
- Administrative and legislative instability;
- Non-completion of building state institutions;
- No research and development division;
- Lack of awareness of potential benefits;
- The lack of awareness of the usefulness of LCCA. Moreover, LCCA has not been considered in the civil engineering curricula yet. So engineers do not know what it is;
- Training is a critical factor. Training from institutes is inadequate. Lack of funds for training programs is another issue. Also, the human resource division delivers training programs with inadequate curriculum and of too short duration;

- The new technology and software especially in the civil engineering field is not kept abreast of.

In Tunisia, on the other hand, participants stated that budget constraints were behind many decisions and hence training and new technology could not be enhanced.

4.3.4 HUMAN RESOURCE MANAGEMENT

The participants were also asked a series of questions related to human resource management (training aspect in particular) in both Libya and Tunisia. While most participants in the **Tunisia main branch** indicated no differences in training program opportunities *pre or post high alert conditions*, it seems that most participants in the various *Libyan branches* regarded the *pre conflict training* opportunities as being superior to those programs available in *post-conflict situations*. For instance, *in the pre conflict era*, around 100% of the participants in the Tripoli branch, followed by 83%, 80%, and 40% in Sabha, Sirte and Bengasi respectively, indicated that they undertook training programs. The higher percentage in Tripoli branch could be as a result of them being the main branch and thus they had first opportunity to undertake training programs.

On the other hand, the scenario was completely different for *post-conflict conditions* in Libya. In Sabha and Bengasi branches for example, 100% of the participants in each branch claimed that they had not been involved in any sort of training program yet. Similarly in the Sirte branch, around 80% of the participants stated there were not any training opportunities in post-conflict situations. **However**, the Tripoli case was different. 100% of the participants in the main branch of Tripoli stated that all of them undertook some sort of training program *pre conflict conditions*. This situation could be as a result of being the main branch and deciding and setting such activities for themselves. Similarly, the participants in Tunisia were chosen from the main department, and thus all participants were happy about both situations with regard to the training program opportunities.

However, if other branches were to be selected, the situation might be completely different. Tunisia is utilizing a centralized system as is the case in Libya.

The reasons why the training programs were not provided in *post-conflict situations in Libya* were because, as two participants in the Sirte branch stated (planning section staff member and human resource staff member), training programs were perceived as not important; thus less funds were offered. Another participant, the project execution staff member, said scrutiny on training content as well as fair distribution amongst employees was absent. In the Bengasi branch, one participant, the financial affairs unit staff member said ‘I think the two major causes are first: lack of awareness of the potential benefits to the employees as well as to the department; and second, the absence of a monitoring body within the department to scrutinize such activity and how it is taught as well as who to choose to undertake the training program. The latter should stop corruption in choosing between staff and allow fairness’. Another participant, the tender committee manager, claimed that ‘because training programs were taken randomly pre conflict situations, some staff undertook these training programs for the sake of money, and they did not care about strengthening weak side/knowledge. As a result of that, no feedback was gathered about the delivery of these programs as they were considered to be efficient. Further, the execution Section staff member emphasized that lack of training **post-conflict** situation might be a cost minimizing strategy.

In the Sabha branch, one participant branch manager claimed that no information came from the main department regarding the delivery of any training programs nor were any funds made available; another participant in the same branch, the manager of Information and Documentation management, believed the instability of state institutions was a major cause of lack of training. Furthermore, non-completion of the planning and strategic and security institutions was a serious challenge too. On the other hand, the Tripoli main department seemed to shift the blame towards the scarcity of funds as well as the fragile safety issue in the country.

With regard to the content of training courses, the participants were shown a series of training courses by this researcher in order to verify which training courses had been undertaken by the Department of Housing and Utilities in both Libya and Tunisia. These courses which were shown

to participants included, but were not limited to, reviewing/-assessing the need for a facility/service, reviewing/ assessing the need for maintaining an existing facility/service, the incorporation of the facility into the overall regional development plan, estimating the capital cost, estimating the cost-in-use of the facility over its useable life to ensure its ongoing life-cycle-fit-for-purpose, various evaluation techniques, and keeping up to date with evaluation technique software as well as newly developed techniques.

These training programs (as provided by this researcher) were almost absent in post-conflict situations in Libya; thus the focus of this question was on pre conflict conditions. The participants in most branches indicated that such course content was not provided even pre conflict conditions. According to most participants, the existing training materials provided were normally not well planned, always random and the length of these courses was very short.

Another vital training aspect to civil engineers and project managers is software programming. However, it seemed this had not been delivered at all according to all participants (100%) in all Libyan branches. This could be as a result of the lack of awareness of potential benefits of such programs or the lack of funds to support such vital training activities. Another significant cause, as 100% of participants stated, was the absence of a Research and Development Division in all branches. Even though most, if not all, participants appreciated the need for a Research and Development Division (an average of 80% to 90% importance), they could not indicate why research and development did not exist; they suggested that the Tripoli branch should be asked. The Tripoli branch, however, could not justify why a Research and Development Division was not developed within the Housing and Utilities Department.

On the other hand, it is clear that there had been some training provided to staff at the main Department of Housing and Utilities in Tripoli. For instance, in the case of the training criteria 'reviewing/-assessing the need for a facility/service', 80% of the participants acknowledged that they had undertaken this course. Other course content that had been undertaken by the participants in the main department were reviewing/ assessing the need for maintaining an existing facility/service (80%), as well as estimating the capital cost (100%). This could be attributed to

the fact that Tripoli participants had been undertaking some well-developed training because they worked for the main department where training funds and programs were decided. This showed one adverse disadvantage of the centralized system. Another cause might be, as indicated by most participants in all other Libyan branches, that the Department of Housing and Utilities did not partner with any training institution in the design and delivery of training opportunities.

Most participants clearly pointed out that, if any training programs were to be found, they normally were undertaken locally. In the Sirte branch for example, 80% of the participants said that training programs were undertaken locally. One participant, human resource management staff member, however, claimed that there were ongoing efforts to undertake some international courses. This was because he was involved in the restructuring and the delivery of training programs. 100% of the participants in the Sabha branch pointed out that all training programs were undertaken locally. Most participants in the Bengasi branch (80%) reported the same. On the other hand, in the Tripoli branch, 2 participants claimed that training opportunities were undertaken both locally and internationally. 60% of the participants in the same branch said local training programs were the predominant choice.

In addition, there was little availability of training opportunities. In the Sirte branch, for example, 40% of the participants believed that the training programs occurred once every three years. On the other hand, 40% of the participants claimed that they occurred once yearly. In the Sabha and Tripoli branches, most participants said they occurred at an average of once every 2-3 years. However, the Bengasi branch had the worst training program opportunities. This could be, as most participants stated, because of the last regime's attitudes toward the eastern part of the country (e.g. in relation to supply of funds for infrastructure).

In Tunisia, on the other hand, it seems that much training was delivered. All participants in the Tunisian main branch clearly indicated that the following training courses were delivered; they were, but not limited to: reviewing/- assessing the need for a facility/service; reviewing/ assessing the need for maintaining an existing facility/service; the incorporation of the facility into the overall regional development plan; estimating the capital cost. However, other courses related to

long term thinking and thus saving (such as estimating the cost-in-use of the facility over its useable life to ensure its ongoing life-cycle-fit-for-purpose, various evaluation techniques, and keeping up to date with evaluation techniques software as well as newly developed techniques), were not delivered. This probably could be as a result of the Tunisian department being faced with dilemmas regarding this particular point. They had limited funds and thus the decision for them was to utilize the available funds now to satisfy end-users and not to think about long term savings now. The latter justification could have led to the non-delivery of training of LCC, AM and other long term techniques.

In Tunisia, the availability of training opportunities was clearly far healthier and more efficient than in Libya. Most participants (80%) in the Tunisian main department acknowledged that they had received training programs twice a year. One participant, a civil engineer who works in the study section, added that training programs were undertaken 2-3 times a year. All participants were happy with the training content, the opportunities for training and delivery of the training programs. This could be as a result of the well-developed training programs that the Tunisian department developed on a regular basis and a list of training content was provided to the employees so they could choose the course they wished to undertake. Most participants felt that choosing which training program to undertake from a well-developed list of different types of content was a brilliant idea. Two participants, the Real estate affairs unit manager as well as a staff member in the human resource management section, confirmed that the training programs in Tunis were very efficient and well organized. Most of the Arabic and African countries, they further stated, undertook their training programs in Tunisia. The training institutions, they said, were very good. Normally they provided 2-3 training opportunities for all employees who had the opportunity to choose from a list of programs.

However, with regard to the software training, the Tunisian case was similar to the Libyan case. About 80% of the participants in the Tunisian main branch specified that there was not any training provided with regard to software engineering programs. This could be due they stated, to the limit funds; in the case of Libya it was due to the absence of a Research and Development

Division. Almost 80% of the participants in the Tunisian main department confirmed the existence of the research and development division.

➤ **Challenges regarding training and development for post-conflict/high alert conditions**

In Libya, the issues/causes of the unsuccessful delivery of training and development for post-conflict/high alert conditions, according to all participants, were mainly:

- lack of awareness of the potential benefits of the training programs. In addition, lack of assistance to staff to choose the areas they most needed to enhance their knowledge;
- lack of adequate funds. Training programs were perceived to have less importance within all branches;
- the absence of well-chosen/well-planned/strategic training curricula or training program;
- fighting preferences (corruption). The training program should be targeted at those most in need. In other words, fair distribution of the training opportunities amongst all employees;
- decentralized system is needed. Issues such as training curriculum as well as the place where the training program should be chosen internally within the branch are critical;
- the absence of more efficient/effective training programs especially with regards to new technology and software;

- how to shift the thinking/perception that training programs are saving/- or cash-grabbing opportunities rather than education and improvement opportunities;
- the absence of specialized local training institutions. Also, there was not any strategy regarding partnering with international training agencies;
- lack of adequate funds especially post-conflict conditions;
- the absence of a fair system for all employees who wished to undertake training opportunities.

Despite Tunisia having the best training programs in the Middle East, and presumably Africa, as acknowledged by all participants, some challenges still existed. Most participants stated the following issues had to be addressed in order to optimize training programs:

- budget constraints;
- more focus must be shifted towards software training as well as long term economic evaluation techniques such as life cycle costing analysis;
- employees need to be more aware of the relevance of training programs - not choose them as a ‘vacation’.
- more focus on newly developed technology.

Even though conflict/high alert conditions are perceived as a golden opportunity to pursue changes and re-review all strategic aspects in the Housing and Utilities Department and other governmental departments too, it seems neither Libya nor Tunisia have capitalized on this opportunity yet.

4.3.5 RISK MANAGEMENT

With regard to risk management, the participants were questioned about their understanding of this concept as well as any techniques adopted by their branches. Despite risk management

techniques not being utilized *either pre or post-conflict/high alert conditions*, as reported by approximately 80% and 75% of the participants in Libya and Tunisia respectively, it appeared that most participants had a fair understanding of the risk management concept. For instance, in the Bengasi branch, one participant, the financial management staff member, had no idea about the risk management concept; however, about 60% of the participants had a fair knowledge of this concept; another participant, the civil engineer, had the best knowledge of risk management techniques. His definition of risk management was ‘precaution planning that streamed during planning phase to determine potential risks and developing strategies to eliminate the identified risks accordingly’. Sirte and Sabha branches seemed to have the best understanding of risk management techniques with around 83% and 80% respectively. Tripoli main branch appeared to have the least understanding of risk management technique (only 40% of participants had any knowledge).

In the Tunisian main department, however, 60% of the participants had a good understanding of the risk management concept. Their understanding of the risk management concept could be a result of personal interest/reading to learn about different project management theories and concepts following on from their training.

According to all participants in the various Libyan branches, several causes appeared to contribute to the non-utilization of risk management techniques *especially pre conflict situations*. These were:

- lack of awareness of the potential benefits of such techniques which were perceived as additional and unnecessary costs;
- the absence of a Research and Development Division;
- no clear policy/regulation regarding utilization of risk management techniques;
- weak training institutions;
- lack of funds for specialized training, especially pre conflict conditions;
- some of the challenges stated above were due to Centralization, and in other times due to administrative instability;

- Not-for-profit organization thinking has contributed to the absence of such techniques and other cost saving techniques as well.

Most participants in the various branches confirmed that training programs with regards to risk management policies, procedures and mitigations were never provided by the Housing and Utilities Department. Furthermore, there was no form of encouragement from the Department to undertake or utilize any cost saving techniques at all, nor was funding directed toward such purposes. On the other hand, the Tunisian case was no different. Risk management techniques were not utilized as a result of limited funds as stated by 60% of the Tunisian participants and lack of awareness of potential benefits as stated by 40% of the Tunisian participants.

4.3.6 POST-CONFLICT/HIGH ALERT UTILIZED-RECOVERY METHOD(S)

As the Department of Housing and Utilities was appointed by the government to deal with post-conflict reconstruction in Libya, it seemed that the only recovery procedure that was utilized by the appointed department was the compensation approach as acknowledged by most, if not all, participants. For instance, in the Tripoli main branch, 100% of the participants stated that compensation was given to the affected communities to rebuild/repair their damaged assets such as homes, shops and private businesses such as clinics. All participants in the other branches agreed with this view. Figure 28 shows the main approach that was utilized by the appointed department to deal with post-conflict reconstruction in Libya.

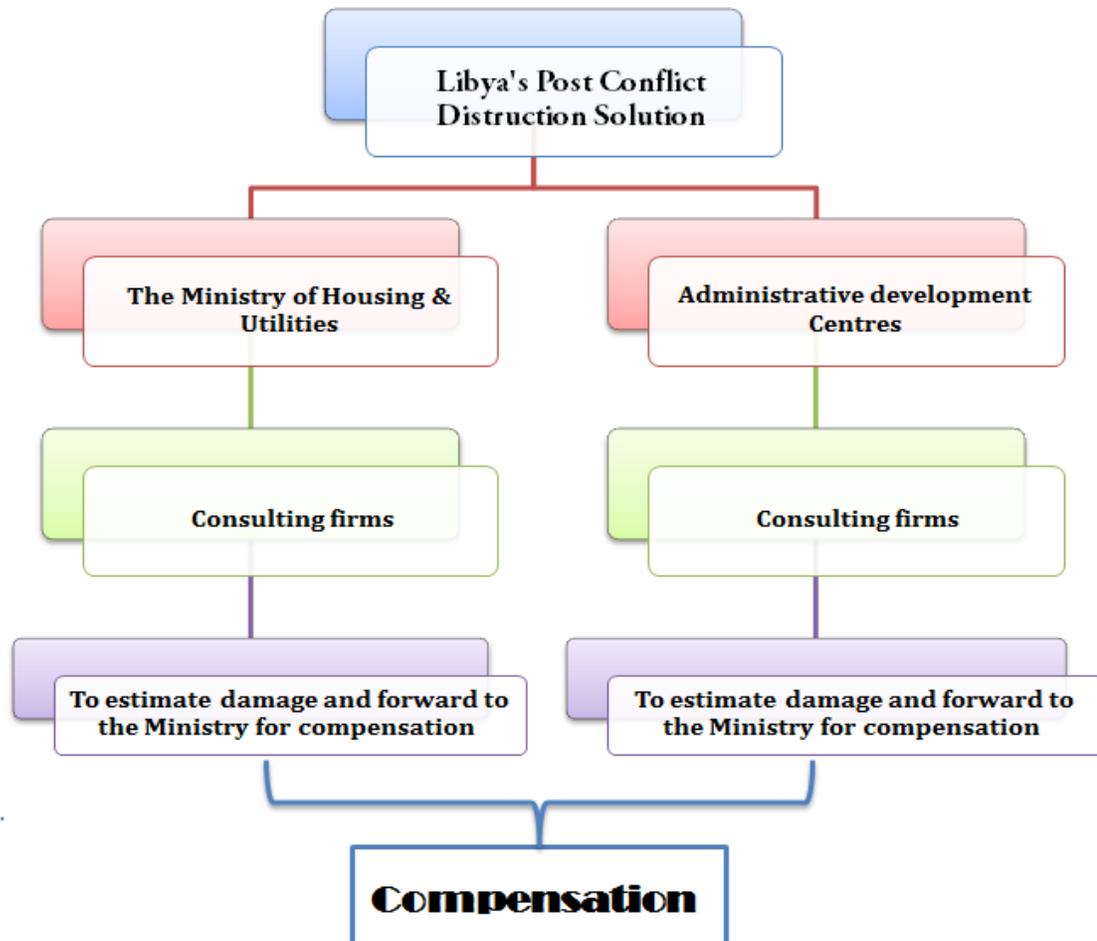


Figure 28: Libya's post-conflict reconstruction approach

As can be seen from Figure 28, the Department of Housing and Utilities partnered with the Administrative Development Centre, and then both these departments appointed consulting firms that helped to estimate the reconstruction costs and provide compensation to the affected communities accordingly.

The main post high alert recovery approach in Tunisia, as participants stated, was decided by the Law number 1 dated 16th of May 2012, which included first, demolishing the older homes and rebuilding or compensating the relevant communities; and second, building homes for the people with limited income who are most in need. According to most participants, the Tunisian department had an effective approach that involved the private sectors both financially and technically and which focused on generating profits as well as developing the 5 year plan.

The participants were then questioned about the appropriate post-conflict recovery approach, compensation approach or rebuilding approach by the appointed department. There were mixed opinions on which approach is better. For example, in the Bengasi branch, 80% of the participants thought that the compensation approach was better. One participant, a staff member in the management of financial affairs, stated that the compensation approach, in his opinion, was fast and effective. Two other participants agreed with him; these were the Execution section staff member as well as the Manager of the human resource section. These two participants placed more emphasis on effective monitoring to make this approach successful and thus eliminate any corruption. Another participant, the tender committee manager, stated that compensation was better as the affected communities were more grateful for the compensation as they could rebuild their homes the way they wanted to. However, one participant thought that both approaches were needed. On the one hand, for small to medium damage, compensation was considered preferable. On the other hand, huge destruction was considered to need a rebuilding approach.

In the Sirte branch, one participant, the human resource management staff member, was unsure about the appropriate approach; 80% of the participants claimed that the compensation approach was better even though most affected people, at the time of this study, did not receive the compensation as a result of the assigned money being stolen when they reached the city by armed militia in the city airport. These participants claimed that Sirte city was the most affected by the Libyan war; thus rebuilding by the appointed department was not an applicable choice. This was mainly because the appointed department was unable to perform simple refurbishment tasks because all machinery and related machines, cars and the like had been stolen by the militia when

they entered the city. They further stated that, as the last battle during the Libyan war was held here in Sirte city, the amount of destruction was shocking. The following pictures were provided by some of the participants. The researcher himself also witnessed the enormity of the destruction in this city (Figure 29).



Figure 29: The severe damage in Sirte city, 2011

Source: <http://www.dailymail.co.uk/news/article-2049108/Libya-wars-stand-Sirte>

It seemed that 80% of the participants in the Tripoli main department also thought that the current compensation approach was better and thus more appropriate for the current circumstances. For example, one participant, the human resource management staff member, claimed that the department did not have the right capabilities to rebuild as most machinery and the related

equipment had been stolen during the Libyan conflict. Another participant, the civil engineer, was in favor of the compensation approach and stated that, with the current safety issues, compensation was faster and more efficient. He further stated that, if the atmosphere were different, the rebuilding approach would be more favorable. However, one participant, the civil engineer in the planning section, believed the rebuilding approach could be the better option as some issues had arisen with the compensation approach such as overcompensation on some occasions, and too many false claims on other occasions.

In Sabha branch, however, only one participant was in favor of the compensation approach and explained that it was a quicker approach to start rebuilding and thus pleased the affected communities. However, the majority of the participants (around 67%) believed the rebuilding approach to be the most appropriate option. They all justified their claim by stating the disadvantages of the compensation approach which took place in Libya as the only post destruction recovery approach. Some of the stated disadvantages were: too many false claims; too much wasted money as a result of claiming the compensation and never rebuilding; corruption in giving compensation, and finally over-compensation. These issues seemed predominant and thus led to the compensation approach being ineffective.

➤ **End-users' involvement post-conflict/high alert conditions**

The participants were then questioned about the consideration of the affected communities' requirements and needs post-conflict/high alert conditions; it was clear that the affected communities were not consulted in both Libya and Tunisia about their requirements and needs, nor were they asked about the appropriate approach for them - compensation or the rebuilding approach. In Tunisia for example, 80% of the participants acknowledged that the end-users had not been consulted about their requirements and needs post high alert conditions. This could be the result of the limited destruction that had occurred in Tunisia at the end of their revolution in 2011 compared to the disastrous situation which had occurred in Libya. Most of the participants

throughout the various Libyan branches confirmed the non-involvement of the affected communities/end-users post-conflict conditions. For instance, 100%, 60%, 60% and around 83% of the participants in the Bengasi, Tripoli, Sirte and Sabha branches respectively, confirmed the non-involvement of the affected communities/end-users post-conflict conditions. This could be because, as some participants in the various Libyan branches claimed, the involvement of the end-users was perceived irrelevant and thus not important.

With regard to the current/existing plans regarding keeping up to date with technology, most participants in all Libyan branches (80% in Tripoli, 80% in Bengasi, 60% in the Sirte as well as about 83% in Sabha) as well as in the Tunisian main department (100%) confirmed the non-existence of any plans regarding that matter. In the Libyan case, this could be mainly, participants stated, as a result of the absence of a Research and Development Division; the inclusion of the private sector both technically and financially; weak training programs as well as no training institution; limited funds especially post-conflict situations; the centralized system; administrative and legislative instability; and more importantly, lack of awareness of potential benefits of keeping up to date with newly developed/developing technology. On the other hand, in Tunisia, it seems that budget constraints were the predominant cause.

4.3.7 THE USE OF ASSET-MANAGEMENT TECHNIQUE(S)

The Department of Housing and Utilities deals with a variety of infrastructure assets, including, but not limited to, homes, public buildings (hospitals, schools, offices), roads, water facilities and the like. The participants in these departments in Libya and Tunisia were questioned about their understanding of the asset-management concept, the current utilized asset-management tools and techniques.

First of all, with regard to the participants' understanding of the concept of asset-management, it was clear that there were limited understandings of the concept in both countries because of the

non-utilization of this technique, mainly as a result of lack of awareness of its potential benefits. For example, approximately 80% of all participants in all Libyan branches had no idea about the concept of asset-management. Similarly, most participants in Tunisia knew nothing about the concept.

With regard to the use of asset-management tools and techniques during pre and post-conflict/high alert conditions, it was clear that they were not utilized in either country. For example, in the Sabha branch, around 83% of the participants stated that no asset-management techniques were utilized. This response was supported by 80% in Bengasi, Tripoli and Misurata branches. All participants (100%) in the Sirte branch confirmed the non-existence of asset-management techniques. Similarly, in Tunisia, 60% of the participants believed that this concept was not utilized. In addition, 40% of the participants in the Tunisian branch knew nothing about the concept of asset-management, indicating presumably the non-existence of asset-management techniques.

The participants were then asked about the existence of any specialized asset-management framework(s) in both *pre and post-conflict/high alert conditions*. Almost all participants in both countries confirmed the non-existence of specialized asset-management framework(s). For instance, approximately 85% of the participants in the various Libyan branches stated that there was not any utilized asset-management framework(s). Similarly, in Tunisia, 100% of the participants reported the non-use of an asset-management framework.

All participants stated that the main asset valuation method utilized in both Libya and Tunisia was on-site inspection. Reports were then written up on the condition of the valued asset/service and filed. However, there seemed to be disagreement on the effectiveness of the asset/service valuation method. For example, in the Tripoli main branch, as well as in the Bengasi branch, about 80% of the participants believed that the current valuation method was working considering the branch's capabilities. However, around 83%, 80%, 60% in the Sabha, Misurata, and Sirte branches respectively believed that there must be a better asset/service valuation method available using new technologies such as GIS.

4.4 CONCLUSION

It is clear from the data gathered that the only post-conflict/high alert destruction recovery method applied by the Department of Housing and Utilities in Libya and Tunisia was the compensation approach. Clearly, asset-management tools and techniques, risk management and LCCA methods had not been applied by the Department of Housing and Utilities in either Libya or Tunisia to deal with post-conflict/high alert destruction. Moreover, end-users' requirements and needs were not accounted for which, in turn, may have contributed to the failure of post 2011 reconstruction efforts.

There was a lack of proper courses and training, centralization, the lack of awareness of the potential usefulness of asset-management and LCCA techniques as well as the concept of asset-management, LCCA and other economic evaluation techniques; these had not been considered in the civil engineering curricula, according to the participants; these factors were considered to be the major drives of post-conflict destruction recovery failure. In addition, the scarcity of funds during post-conflict conditions in Libya made it even more difficult to repair/maintain simple assets/services.

The next chapter discusses the implications/consequences of the results in more detail.

CHAPTER 5: DISCUSSION

In the previous chapter, the results and general analysis was presented. This chapter discusses the issues and implications that have been highlighted through the analysis of the key variables from the interviews, questionnaire surveys and the case study. This chapter discusses in particular the following:

- the utilised post-conflict/high alert recovery methods;
- end-users' requirements and needs;
- the use of the asset-management approach;
- economic evaluation techniques, particularly life cycle costing;
- project finance;
- risk management.

5.1 THE UTILIZED POST-CONFLICT/HIGH ALERT RECOVERY METHOD(S)

The importance of post-conflict reconstruction stems from its positive contribution to peace-building, and increasingly it is recognised around the world by international organisations, political leaders and field experts (Buckland, 2005). Moreover, it has also been seen as an opportunity to rebuild in a better way (Amaratunga & Haigh, 2011). However, the results from the current study from the interviews in Libya revealed that the main approach that was utilised by the Housing and Utilities Department was a compensation approach, in addition to only a short term plan to fix public offices and roads. The case in Tunisia was similar, as the interviews revealed that the post 2011 uprising reconstruction plan was decided by the Law number 1 dated 16th of May 2012, which included first demolishing the older homes and then rebuilding or compensating the relevant communities. It was also revealed that end-user requirements and

needs were not considered in either country within the post reconstruction approach. This was reported by both the government officials and the affected communities.

This finding is in line with many other studies which have also found that most, if not all, post-conflict reconstruction approaches have been short term and not comprehensive. The compensation approach as well as any short term plans, for example, which the Department of Housing and Utilities utilised to address post-conflict/high alert situations have been proven to be unsustainable and to have many drawbacks. Almost all studies in the literature, significantly, have urged the development of a comprehensive and holistic post-conflict reconstruction approach. For example, Turner (1977) determined some drawbacks of the short term plans such as autonomy or compensation. These were: lack of a long term and comprehensive reconstruction plan; design weaknesses, infrastructure shortage; compensation claimed by individuals who had never undertaken the reconstruction of their homes or by individuals who already had settled in another country. Turner further argued that cash compensation does not guarantee optimal physical, social and economic results, not to mention the fact that individuals may never intend to settle in their original home country.

A similar conclusion was drawn by Bowen (2009) who revealed that the first and foremost cause of the reconstruction failure in Iraq was a clear lack of long term planning; the regular changes in reconstruction strategy; weak leadership and end-users' non-involvement; poor contracting and program management practices. Similarly, King and Mason (2006) found that the international community had failed to accomplish sustainable project outcomes in rebuilding Kosovo after the conflict. This was mainly because community members' views and requirements had not been embraced in the post-war reconstruction recovery process. Consequently, crucial infrastructure had not been reconstructed, and corruption was still prevalent.

Arguing for the need for a holistic approach, Pemunta (2012) found that aid without the required local institutional structure as well as a comprehensive approach caused a narrow focus in Sierra Leone, which suppressed sustainable and effective reconstruction, growth and

development. Pemunta suggested there was a need for comprehensive reconstruction plans. Similarly, Addison and McGillivray (2004) found that there was agreement among many researchers and policy makers that aid would be ineffective without achieving security, without long term planning techniques and without having early involvement after the conflict. Hass (2006) stressed that achieving real-time reconstruction appears very difficult without utilising a comprehensive approach and real systems planning.

Hillman (2013) identified critical weaknesses/failures in the current donor approaches to public administration reform in Indonesian post-conflict situations. First, lack of long term planning was seen as the main obstacle. Due to budget limits, donors had not been able to mobilize the necessary expertise; they lacked understanding of the post-conflict situation; there was lack of specialised training; there were conflicting priorities due to weak leadership and poorly trained staff. Similarly, Barakat (2009) stated there were several significant limitations to the donors' approach: complicated implementation arrangements, donor-dominated coordination and overseeing bodies, short timeframes and less spending on post-conflict/disaster reconstruction. All these issues had contravened state-building objectives and thus had weakened aid effectiveness.

Figure 30 shows, on the one hand, to what extent donors are prepared to contribute resources at exactly those times when the government has the least capacity. On the other hand, as the government's capacity rises and the need for more costly forms of assistance (infrastructure assets, state services, and the like) arises, donors' willingness to contribute has frequently dissipated. As a result of the mismatch, the initial fruits of reconstruction and development assistance are normally disappointing. Hence, the entire contribution of international donors and agencies, according to Barakat and Chard (2005), could be re-structured to stress the need for capacity development, comprehensive and holistic procedures, and direct involvement in the process.

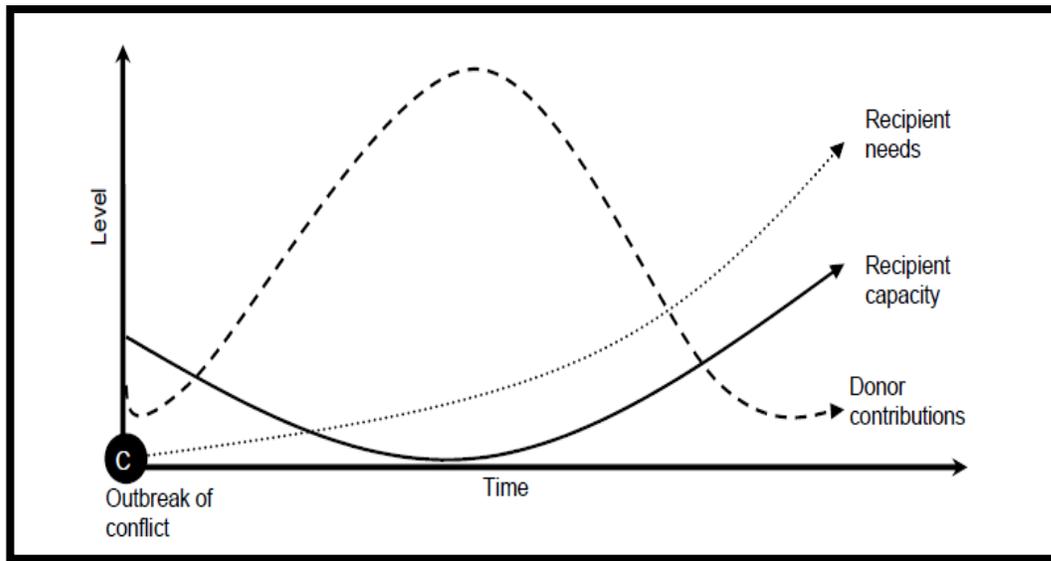


Figure 30: Incompatible trends in donor contributions and recipient capacity

Source: Barakat and Chard (2005)

A very similar finding to the current study was uncovered by Ahmed (2011) who found some challenges and drawbacks in the field of post-disaster housing reconstruction. The challenges identified were: typical or *short term plans*; pressure to rebuild houses within constraint time and budget; existing institutional and economic shortfalls; corruption and discrimination or **favouritism**. Some of the factors that may contribute to the success of a post-disaster reconstruction program were, according to Ahmed: scale of program, budget, political goodwill and cooperation of communities.

Similarly, Awotona (1992, p. 96) pointed out that one critical reason why the post-conflict approach in Nigeria had failed, was because of failure to spend the rehabilitation fund as it should be spent. He further stated ‘discriminating against the East Central State in the allocation of supplies and vehicles’ and reluctance to help ‘the East Central State to build up an effective capacity for relief work’, all led to the situation whereby relief work ‘was now largely in the hands of external agencies, which negated the intention of the Federal Government’. This

signifies another critical issue of the adapted Libyan post-conflict approach as described earlier in the case of Misurata city.

Misurata city was the only city in this study which was satisfied with post-reconstruction efforts. This could be because, as most participants stated, they had received compensation in a timely manner, there had been continuous efforts to reconstruct damaged infrastructure in their city, and most importantly, they felt they had control of the political scene in Libya.

Hence, the finding of this study as well as the studies mentioned in this review have clearly highlighted the fact that there has been a lack of long-term and comprehensive reconstruction planning for post-conflict situations as well as lack of consideration of end-users' requirements and needs.

The consequence of the absence of a long-term comprehensive post-conflict reconstruction approach is likely to be lack of progress in reconstruction in Libya and Tunisia and indeed, in any country experiencing adverse conditions, such as in Iraq. *Overspending or cost overrun* is one adverse impact of not adopting a holistic and long term approach. Cost overrun occurs as the result of the unclear vision of short-term planning resulting in reprogramming of the reconstruction efforts and priorities. The impact of progressive reprogramming has a significant detrimental consequence on the momentum of program execution (it slows the pace) and consequently results in increased overhead costs.

Similarly, another severe consequence can occur when there is a series of back-to-back reprogramming due to unstructured or short term reconstruction plans where, when the first reprogramming cycle is dealt with, it is yet followed by another round of reprogramming reviews. Again, this stifles momentum, generates added costs and typically reduces effectiveness of reconstruction programs. Similar consequences of this reconstruction reprogramming were reported by Bowen (2009). Figure 31 illustrates the reconstruction refund allocation by sector in Iraq due to the multiple reprogramming of post-war reconstruction efforts.

Iraq Relief and Reconstruction Fund Allocations by Sector for June 2004, December 2004, and June 2005 (\$ Millions)				
Sector	June 2004 Allocation	December 2004 Allocation	June 2005 Allocation	Percent Change from Original
Security & Law Enforcement	\$3,235.0	\$5,045.0	\$5,017.6	55%
Justice, Public Safety Infrastructure, and Civil Society	\$1,484.0	\$1,953.0	\$2,188.5	47%
Electricity Sector	\$5,465.0	\$4,369.0	\$4,318.5	-21%
Oil Infrastructure	\$1,701.0	\$1,701.0	\$1,723.0	1%
Water Resources and Sanitation	\$4,247.0	\$2,279.0	\$2,146.0	-49%
Transportation and Telecommunications Projects	\$500.0	\$513.0	\$508.4	2%
Roads, Bridges, and Construction	\$368.0	\$360.0	\$334.0	-9%
Health Care	\$786.0	\$786.0	\$786.0	0%
Private Sector Employment Development	\$183.0	\$843.0	\$840.0	359%
Education, Refugees, Human Rights, Democracy, and Governance	\$259.0	\$379.0	\$363.0	40%
Administrative Expenses	\$213.0	\$213.0	\$214.0	0%
Total	\$18,439	\$18,439	\$18,439	

Source: OMB, *Section 2207 Report*, Funding Table, July 2004; and DoS, *Section 2207 Report*, Status of Funds, July 2005. Note: Totals may not add up due to rounding.

Figure 31: Reconstruction fund allocation by sector

Source: Bowen (2009)

As can be seen from Figure 31, each funding shift, due to multiple reprogramming, caused an elimination or reduction of planned or ongoing infrastructure projects. For instance, the water sector suffered the most, losing approximately 50 percent of its funding (from \$4.25 billion to \$2.15 billion), which forced the cancellation of numerous projects. The electricity sector was the second-hardest hit, suffering a loss of nearly a quarter of its designated funds (from \$5.47 billion to \$4.32 billion), resulting in a reduction of proposed power projects. This in turn, however, resulted in losses of millions of dollars as contractors on the ground were accruing millions of dollars in overhead costs without producing much. Hence, as in the cases of Iraq, Libya and

Tunisia are already experiencing similar reconstruction programming, and thus significant project delays and cost overruns.

As discussed earlier, multiple reprogramming during the reconstruction effort will most probably lead to cost overruns and, hence, project delays. Project delays can result from changes in project scope and requirements; design errors; or inadequately defined roles and responsibilities. This is another adverse consequence of adopting a short-term and non-holistic reconstruction approach. Delays, in turn, have adverse effects on construction projects such as cost overrun, dispute, total abandonment and litigation. The most significant factors that adversely impact construction project delivery are: inadequate or short term planning, design changes, poor site management, insufficient experience, and financial and payment problems (resource shortages) (Kikwasi, 2013). All of these factors combined may lead to project delays and thus cost overrun. In fact, project delays and cost overrun are interchangeably linked together as they have hindered progress in reconstruction post adverse conditions, in Libya and Tunisia, and perhaps, in many other countries, due to mainly short term and unconstructive, non-holistic planning.

Overspending or cost overrun, project delays, conflicting priorities leading to increased costs and hence delay, as well as waste of valuable resources, possibly leading to inability to attract further funding, could well be the likely outcomes of the short term reconstruction plan that the Department of Housing and Utilities has adopted. In order for both Libya and Tunisia (and perhaps, other developing countries) to attain a positive outcome, the efforts as well as capabilities of a national government to adopt and apply effective management techniques will be required in order to make the best cost-effective and efficient decisions, within budget constraints. In other words, post-conflict disaster management can be viewed as public project management in which the government needs to be a major stakeholder (Moe & Pathranarakul, 2006).

Finally, a blanket ‘one-size fits all’ scenario for all post-conflict situations does not exist, since each conflict has a variety of unique attributes (Parver & Wolf, 2008). Hence, the North

African case-study locations, namely Libya and Tunisia will most likely require a specific holistic and comprehensive approach.

5.2 END-USERS' REQUIREMENTS AND NEEDS

International experiences of post-conflict reconstruction have clearly revealed the failure of typical top-down approaches, which neglect the users' requirements and needs as they largely concentrate on the urgency to re-house the affected community. Consequently, such approaches frequently ignore the complexity of the built environment, the local conditions, and users' needs and desires (El-Masri & Kellett, 2001). From the interviews as well as the questionnaire surveys, it was clear that the affected communities were not consulted in both Libya and Tunisia about their requirements and needs; it was found, moreover, that there were different requirements and needs in each Libyan city post 2011 conflict.

This finding is in line with many other studies which have shown that end-users' requirements and needs have been neglected. For instance, Brown (2009) stated that one of the main reasons behind failure in the post-conflict reconstruction stage in Iraq was the exclusion of the affected communities in the reconstruction approach (es). The report established two main causes of reconstruction failure: a clear lack of planning as previously discussed, and the *exclusion of the affected communities* from the reconstruction procedures. Because end-users had been excluded from the reconstruction procedures, multiple re-programming of reconstruction priorities, additional maintenance expenses, employee turnover and higher material costs were incurred.

A similar finding to the current study as well as Brown's, was revealed by Dikmen (2010). Dikmen studied the permanent post-disaster reconstruction of houses in both new and existing settlements in the villages of Çankırı Province, Turkey. He found that most of the beneficiaries refused to move to the new settlements because of *lack of user participation in the decision-*

making process (i.e. not considering the life style of the users); and inadequate site-selection criteria with inputs from users. Similarly, King and Mason (2006) found that the international community had failed to accomplish sustainable project outcomes in rebuilding Kosovo after the conflict. Apart from other causes uncovered by King and Mason (such as lack of local skilled staff, corruption, limited economic opportunity, lack of sustainable employment opportunities), community members' views and requirements *were not* considered in the post-war reconstruction recovery process. Consequently, crucial infrastructure was not reconstructed. King and Mason stated that, in order for any post-war recovery process to be successful, the rule of law must be established; then there must be a clear set of goals after acquiring the community requirements and needs, as part of a comprehensive post-war reconstruction recovery approach.

The finding of this study also was in line with another study by Earnest (2011) who examined the complexities and challenges of post-conflict reconstruction in Kosovo and then developed a post-conflict reconstruction approach. He found that there was poor quality planning as well as poorly implemented post-conflict reconstruction projects. Another significant discovery was that both local and international aid organisations did not work in a community service delivery setting. Consequently, this study identified the urgent need for community involvement in post-conflict project identification, planning and implementation. Earnest's study clearly revealed that the success of post-conflict reconstruction planning depended on the government's ability to appreciate the community needs and requirements as well as the complexities of the political environment and the government's ability to coordinate this critical stage in an operational manner.

Bouraoui and Lizarralde (2013) examined the relationship between the organisational structure of a specific team that had conducted a post-disaster reconstruction project conducted in 2003 in the village of Bousalem in Tunisia, and the satisfaction of end-users, and produced similar results to Earnest's study. Bouraoui and Lizarralde found that there is a need to decentralize decisions at a level that optimizes the efficiency of local stakeholders; that facilitates the participation of end-users; and that allows an appropriate distribution of responsibilities and

risks among stakeholders. This is because certain decisions may affect the match between the project initiators' capacity to provide an adequate solution and the users' expectations and requirements after the disaster. The study clearly demonstrated that there would be many drawbacks if a participatory approach is neglected in favour of centralized decision making. Some of the drawbacks were: hindering the ability to collect information and concerns from end-users; and reducing the ability to integrate end-users and local actors in strategic decision-making.

Awotona (1992) reviewed the post-war rehabilitation, resettlement and reconstruction programmes (the development plans) for the period 1970-1974 in Nigeria. His study aimed to determine if the affected communities' requirements and needs had been considered as the central focus of the reconstruction efforts. Awotona found that the development plans adopted by the Nigerian Government were not sufficiently comprehensive and holistic. One of the main causes was *the absence of active participation of the affected communities* in the establishment of planning programmes and changes in priorities and plans. In other words, the plans the government had created did not reflect the genuine needs and requirements of the affected communities in the war-damaged areas.

These studies already discussed have not specifically included end-user requirements and needs in a holistic post-conflict/disaster reconstruction approach. Other studies, on the other hand, have examined the relationship between end-user requirements and project success. Nevertheless, they also have not provided any comprehensive and holistic post-conflict reconstruction approach, while at the same time accounting for end-user needs. O'zden (2006) for instance, found that community involvement has a significant positive impact on the success of reconstruction projects in post-conflict situations. Similarly, Ahmed (2011) found that a key element to post-disaster reconstruction success is the understanding of local conditions gained from community-based consultative and participatory processes. Ahmed, like O'zden, emphasized the positive contribution of community consultation and participation to the reconstruction success post disaster conditions.

A similar study to Ahmed's was undertaken by Ophiyandri et al. (2013), who established a few factors contributing to the success of community-based post disaster housing reconstruction projects. Four out of the 12 established 12 factors by the study emphasised the need for identification of needs and community participation. These factors were: gathering trust from the community, allowing a significant level of community participation/control, involving all community members and identifying successful beneficiaries. The establishment of the critical success factors, the researchers concluded, helps key stakeholders to identify factors that must exist and be well managed during pre-construction in order to ensure the success of the programme. Consequently, there is a clear and critical relationship between user participation and project performance.

As can be seen in Table 21, this relationship strongly emphasizes the importance of listening to end-users' requirements and needs (effective user participation), as they have a positive contribution to make towards successful project performance (Barenstein, 2008; Arslan and Unlu, 2001; Oliver-Smith, 1992; UNDRO, 1982).

Table 21: Relationships between community participation and project success post-disaster/conflict conditions in developing countries

Author	Independent variable (IV)	Dependent variable (DV)	Results
UNDRO (1982)	Local community participation	Success of reconstruction projects	Positive relationship
Choguill (1996)	Community participation	Project success	Depends on the efficient practice of community participation and involvement
Alexander (2004)	Consideration of users' physical, emotional and economic attachment	Project success	Community participation increases the chances of Project success
O'zden (2006)	Community involvement	Success of reconstruction projects	Significant positive relationship
Lyons (2009)	Users' active participation and involvement	Users' acceptability	Users' active participation and involvement
Lizarralde (2004), Lizarralde et al. (2009)	Users' participation	Project performance	Weak positive relationship (project performance is more affected by strategic aspects)
	Project performance Decentralization decision-making	Users' satisfaction. Successful project management	Depends on the context Positive relationship
Maskrey (1989)	Community participation components	Successful implementation	Positive relationship
Davis (1978, 1981)	Community participation	Users' satisfaction	Positive relationship
Oliver-Smith (1992)	Effective community participation	Community satisfaction	Significant positive relationship
Engino' z (2006)	Users' participation	Users' satisfaction	Positive relationship
Barenstein (2008)	Users' participation	Users' satisfaction	Significant positive relationship
De Baar (2009)	Top-down approach	Users' dissatisfaction	Positive relationship

Adapted from Bouraoui and Lizarralde (2013)

As can be seen from Table 21, Alexander (2004) found that community involvement has a significant positive impact on the success of reconstruction projects in post-conflict situations. Barakat (2003) identified that reconstruction programs often fail to take into full account the requirements, needs and desires of disaster-affected populations. If proper attention is not given to the needs of affected people there is a possibility that newly constructed facilities become obsolete from the day the construction is completed (Oliver-Smith, 1991). Hence, reconstruction strategies should be implemented after studying requirements, needs and desires of affected people (Shaw et al., 2003).

The results from this study revealed significant impacts. For example, the exclusion of the consideration of the requirements and needs of the affected communities post-conflict/- adverse conditions both in Libya and Tunisia, and perhaps in any other country undergoing adverse conditions, will undoubtedly hinder the progress in reconstruction as happened in Iraq. One significant impact of the exclusion of end-users' requirements and needs, in this study, could be the refusal by the end-user community to accept some, if not most, of the finished project. The consequences of such refusal in both Libya and Tunisia would most likely hinder the progress of reconstruction programs and thus lead to waste in other valuable resources. Likewise in Turkey, it was found by Dikmen (2010) that most of the beneficiaries in the villages of Çankırı Province, Turkey, refused to move to the new settlements because *they had not participated in the decision-making process*. As a result, the government's effort, time, resources and money were wasted. This will most probably be the case in Libya and Tunisia, and perhaps, in other countries where end-users' requirements and needs are not accounted for.

Similarly, in Tunisia, too, the absence of citizens' participation post 2003 flood reconstruction project (conducted in in the village of Bousalem), resulted in the rejection of resettlement by local citizens (due to pure decisions made only by the government) (Bouraoui & Lizarralde, 2013). This led to significant waste of limited resources. This most probably will be the case in Libya and Tunisia too. In fact, according to Oliver-Smith (1991) and UNDRO (1982), authorities often do not recognize the significance of ignoring end-users' requirements and needs

(forced relocation without close consultation is one example), which can be as severe as the impacts of the conflict/disaster itself. According to Bouraoui and Lizarralde (2013), one of the main sources of post-conflict/disaster failure, is the non-acceptability of the project outputs by end-users due to absence of their involvement. Other researchers have found similar outcomes (Davis, 1978; UNDRO, 1982; Oliver-Smith, 1991; Dikmen, 2010; Barenstein, 2008) and the insufficient adaptation of project outputs to traditional values and local conditions (Barenstein, 2008; Boshier, 2008; Jigyasu, 2008). The risk of non-acceptability is closely related to users' dissatisfaction, and thus user participation (see Table 21).

Apart from wasting available resources, such as community participation, in Libya and Tunisia, there could also be cost overruns and time delays. In addition, project reprogramming may be required due to conflicting priorities. Since Libya relies solely on oil and gas revenues (see Figure 32), the issue here is compounded as the price of oil has decreased considerably, and there is on-going fighting among militants to control the largest oil and gas refineries; this in turn has affected the production line and thus the country's overall revenues. This will lead, too, to fewer funds for reconstruction and hence will impose significant pressure on the appointed government department to use the funding available in the most wise and efficient way.

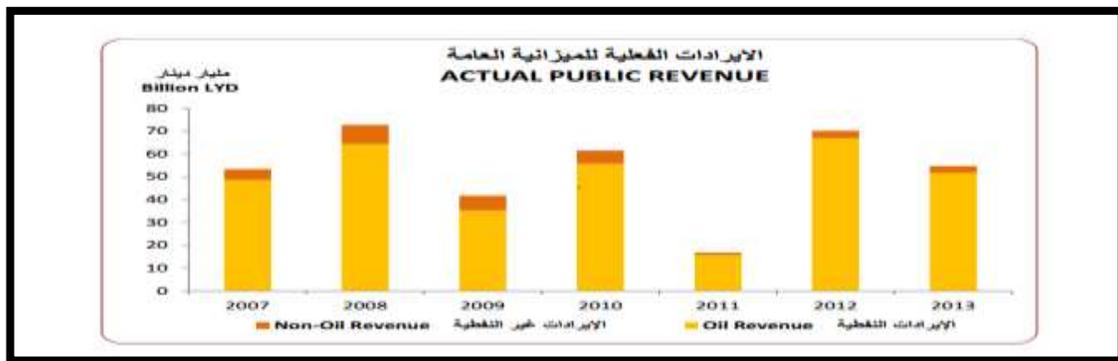


Figure 32: Actual Public Revenue in Libya

Source: Libyan Central Bank (2014)

Experience from Kosovo and Afghanistan reveals that the failure of the current reconstruction process is mainly due to apparent lack of adequate and long term planning, **lack of resources (limited funding)**, and most importantly, **lack of community participation** (Coyne, 2006). In addition, international agencies tend to bring with them their own crafted organisational policies, planning, project implementation and operating procedures (Rathmell, 2005).

The consequences of not consulting with end-users and the locals, can give rise to what has become known as the ‘reconstruction gap’ (Bowen, 2010). Increased spending on security needs, higher costs for materials, project delays, cost overruns, multiple reprogramming, and added expenses for maintenance all have contributed to the gap between the number of projects promised and the number actually completed in Libya and Tunisia. Similarly, in Iraq, the project scopes and requirements, as well as project priorities, have frequently been determined by US officials (Bowen, 2010). Moreover, companies require specialized engineering and design capabilities that call for international firms that generally employ non-Iraqi workers. Hence, Iraq, too, lacked local participation. Both Libya and Tunisia clearly lack an effective post-conflict/disaster approach that has to account for end-users’ requirement and needs.

Hence, local government officials or the international community’s efforts will likely be unsuccessful in post-conflict/disaster in the absence of civil involvement, and without a societal belief that these measures are beneficial. Further, an involved civil society may be of importance for holding governments accountable for their actions, for strengthening public policies, and developing the community following a conflict. Studies have found that civil society involvement is one of the most vital factors in determining whether post-conflict initiatives will be successful and sustainable (Wanis-St John & Kew, 2006).

5.3 THE USE OF ASSET-MANAGEMENT TECHNIQUE(S)

The asset-management approach is becoming increasingly important worldwide, especially since it has emerged as a tool that offers a sound approach to the management of infrastructure assets. However, the interview results showed that most participants in both countries, Libya and Tunisia, had a very limited understanding of asset-management concepts and procedures. More importantly, it was clear that this concept was not utilised nor were there any specialized asset-management framework(s) in both pre and post-conflict/high alert conditions in either country. Also, all the participants in both countries were not aware of any legal or compliance issues pre or post-conflict/high alert conditions in their department or in the nation or indeed internationally which required mandatory use of asset-management frameworks/software in their projects.

On the one hand, this finding is in line with several studies which also have found that the concept of asset-management is not being adopted in a newly-developing region such as Indonesia, as well as within other local governmental sectors such as the iron and steel sector in Libya. For example, a study undertaken by Hanis (2011) aimed at identifying the main challenges that would be faced by a local government in a newly-developing region, Indonesia, if it adopted a public asset-management framework. The findings indicated there were significant challenges that the government would have to manage when adopting a public asset-management framework: the absence of an institutional and legal framework to support the asset-management application; the non-profit principle of public assets; multiple jurisdictions involved in the public asset-management processes; the complexity of local government objectives; the non-availability of data for managing public property; and limited human resources. Hanis recommended that the (case-study) government address these challenges before accepting and applying a developed asset-management framework.

A similar finding was uncovered by another study undertaken by Hokoma (2010) investigating the present status of the implementation levels of asset-management (quality and

manufacturing) techniques, and philosophies within the Libyan iron and steel industry. The study revealed that there was a lack of knowledge of key management techniques and their benefits across the surveyed industry. Of concern was the lack of senior management support indicated by all the respondents as an obstacle for non-implementation of the TQM practices.

A study by Vanier (2001) aimed to determine the extent of the asset-management market in North America. The study found that the needs were: unified data integration; improvement and standardization of currently obtainable tools; information exchange and technology transfer; and a need to address the lack of willingness to adopt asset-management principles by both the employees and senior management. Gondo (2012) reviewed the practices, challenges and policy options used in municipal-asset water and sanitation sector(s) in newly-developing countries. The results indicated that the water sector had gone through a number of reforms but had not resulted in any knock-on cascade into improved infrastructure asset-management. Lack of financial resources, human resource expertise and appropriate organizational strategy had constrained the adoption and application of systems-software for effective asset-management.

On the other hand, unlike this study's finding, many other studies, organizations and industry sectors' findings, have investigated already implemented asset-management as it is believed asset-management is an effective tool. For example, the concept of asset-management has gained acceptance in developed countries such as Australia, the USA, the UK and several newly stable environments such as Kuwait. Other countries are progressively adopting and implementing asset-management principles as their regions (re)develop (Kiwelu, 2009). FHWA (1999, p. 7) stated that, through the use of proper asset-management techniques, governments can improve program and infrastructure quality, increase information accessibility and use, enhance and sharpen decision-making, make more effective investments and decrease overall costs.

The consequences of not adopting asset-management techniques could be that the construction sector, both in Libya and Tunisia, and perhaps, in many developing countries, miss out on the benefits; the benefits include: improved performance, cost reduction, customer service

satisfaction, control of service delivery and optimised use of limited finances (BSI, 2004). This in turn could lead to also missing out on more benefits such as: more effective use and maintenance of existing assets; increased opportunities for partnering with private sectors; improved processes and accountability for capital and recurrent works; better allocation of limited resources; and realisation of a return from surplus assets (APCC, 2001).

Danylo and Lemer (1998) stated that one of the many benefits to asset-management is controlling and reducing the costs of public infrastructure assets. It was clear that asset-management tools and techniques were not used in Libya and Tunisia. Therefore, it is likely that the Department of Housing and Utilities in both countries would miss out on the many benefits discussed earlier; and that in turn will lead to having more financial losses in the future due to the lack of application of such techniques by the Department. As a result, the construction industry, both in Libya and Tunisia, may well be unable to improve program and infrastructure quality, increase information accessibility, make effective decisions, make more effective investments, and decrease overall costs.

However, unlike this study's finding, that no asset-management process or framework was in place, several asset-management frameworks do exist elsewhere, but there are no reference-models documenting all key activities and change-management strategies for the implementation of asset-management. This lack is an obstacle to the prompt implementation (needed in adverse conditions) of an asset-management system in a sector or an organization (Kiwelu, 2009). In other words, there are limited structured guidelines that show the key activities enabling successful implementation/integration of all concept variables timeously. For instance, in a published paper by the researchers (Abuzayan et al., 2014), a secondary research discussion of reviewed studies sought to examine asset-management procedures and implementation. Abuzayan, Whyte and Bell (2014) found that there are major challenges to public sectors in adopting and implementing public asset-management. For example, Brighu (2008) developed a generic asset-management framework and applied it to a case study. The research indicated that it is possible to take a 'low cost' first step towards asset-management, but it requires a change in

the management approach. However, the study found that a lack of relevant data was a crucial factor influencing an effective and comprehensive application of a generic asset-management framework. Another study, carried out more recently by Younis and Knight (2012), developed a new integrated asset-management framework for wastewater collection systems using a modified balanced scorecard model. The elements of the proposed management framework and modified balanced scorecard were developed based on multiple collaborative working sessions held in 2009 during the first Canadian National Asset-management Workshop (CNAM, 2009). The framework took into account social/political, financial, operational/technical and regulatory perspectives. This framework, the researchers stated, would only be suitable for waste water utilities and waste water collection. Some asset-management frameworks, then, might be argued to be discipline specific; this presents a challenge for authorities seeking to adopt a generic system to manage facilities.

Another study which followed through by developing an asset-management framework was carried out by Vanier (2001). Vanier developed an asset-management framework with each 'what' establishing a growing framework for asset-management plan implementation. This study, however, did not discover any comprehensive solution that addresses the current and future needs for investment planning for municipal engineers and managers.

Through a review of the research on current asset-management practices in-use, Too et al. (2006) developed an asset-management framework which consists of three core components: strategic analysis, strategic choice and strategic implementation. His developed framework, presented as a process model, is generic and seeks to be applicable to various types of infrastructure assets.

As can be seen from this review, traditional engineering management techniques for managing infrastructure require review, not only to meet the needs of all key players when developing an infrastructure management framework (namely regulators, policy makers, infrastructure managers, users and operational staff), but also to address the vital need for an integrative approach that allows infrastructure decision-makers to deal with conditions in flux.

A successful implementation of asset-management requires that, in Libya and Tunisia, and, in fact, developing stable countries, the construction industry needs to re-evaluate its methods of doing business. For example, the industry needs to focus on the life-cycle aspect of product/infrastructure rather than on the initial capital cost; this requires also a series of changes in specific management methods, organizational structure, and the overall approach to infrastructure decisions. Furthermore, growth requires not only a clear appreciation of all the activities related to the asset-management techniques, but also real commitment to change-management, investment in resource training and reward, consideration of life-cycle costing perspectives, enhancement of data collection and storage, as well as the adoption of structured approaches (Kiwelu, 2009); asset-management provides a framework for handling both necessary short and long-range planning (FHWA, 1999).

In order to apply a successful asset-management framework to public sectors many challenges must be overcome. According to Kiwelu (2009), being able to recognize those challenges will help to design value-adding strategies with the development of alternative solutions. Asset-management systems require a full appreciation of the variables concerned and a commitment to implement the factors in a structured way and, not least, an appreciation of the challenges to be overcome.

Libya and Tunisia, and indeed many countries, are facing serious and compounding challenges concerning increasing resource scarcity, an ageing public infrastructure and increasing population. These authorities need to be aware of these increasing stresses and ensure that their infrastructure assets/services operate efficiently and economically. As population increases, the demand for more assets and their increased utilisation will require more funds and efforts; hence there is a significant need for effective/ sustainable decision making processes.

Asset-management processes will most likely help the construction sector, as well as all other governmental sectors, both in Libya and Tunisia, and perhaps, other developing countries, decrease operating costs and improve productivity. Poor asset-management, or, in the case of this study's finding, the absence of asset-management techniques, will most likely lead to poor

data quality. This in turn might impact the construction sector over time. Possible effects on the Libyan and Tunisian Housing and Utilities Department, could be an increase in the total asset cost of ownership, a decrease in workforce productivity, an increase in non-compliance issues, a decrease in customer satisfaction, lower capital investment and a decrease in project quality and performance.

5.4 ECONOMIC EVALUATION TECHNIQUES, PARTICULARLY, LIFE CYCLE COSTING

The interview results showed that most participants in both countries, Libya and Tunisia, had a fair knowledge of the usefulness and benefits of the various economic evaluation techniques. However, there was not any single technique that was utilised by the main department in both countries. Similarly, with regards to life cycle costing analysis (LCCA) technique, most, if not all, participants clearly acknowledged the non-utilization of LCCA in their branches, as well as their very limited understanding of the concept. This could be because of the participants' limited awareness, or perhaps, because of the absence of any legal or compliance issues in their department or in the nation or indeed internationally, which required the use of LCC procedures in their projects. This could also be due to, according to the participants, the perception that Libya is a rich country; and hence there would be the assumption that Libya did not require economic techniques such as life cycle costing analysis.

Unlike this study's finding, many research studies have asserted the importance of LCC application and have proved its reliability, effectiveness and usefulness. Dunk (2012) clearly stated that LCCA is becoming increasingly important to all organizations and businesses as it provides more cost effective products/services to keep up with the daily international competition and rapid technological change. Kirk and Dell'Isola (1995), and Whyte (2014) pointed out that the LCC technique can help designers to evaluate economic consequences of continuing to use a new or an existing building/system or service in comparison with the expense

of substituting some alternatives and then choosing the most effective option (based on the LCC, choosing the lowest life cycle costs) which may offer better long-term efficiency, improved performance and cost effectiveness. Hussein (2008), for example, provided some of LCCA's benefits to the civil engineering field; it can be beneficial for assessing the efficiency of planning (by comparing actual with budgeted life cycle costs); for enhancing the assessment of product profitability; and for assisting in the design for more environmentally desirable products.

In contrast to this study which indicated that LCC had *not* be adopted, many studies have found that a country with limited funds such as Tunisia, or other countries that are considered rich, such as Libya, *should* adopt an LCC application (or any other economic evaluation techniques). Langdon (2010) claimed that, since the International Organization for Standardization was published latterly (mainly assigned for life cycle costing application), it has become obvious that many countries (including rich and poor countries) are moving towards its adoption (LCC application). Some of these countries have adopted international standards as they are deemed to be in their best interest. Others have developed their own standards and procedures. A further study by the International Monetary Fund (2010) argued that many resource rich developing countries fail to appreciate the full potential of their natural resources. Rich countries are better equipped and prepared than poor countries and thus they should adopt economic evaluation techniques such as LCC analysis technique to better enhance the decisions regarding their assets' management in the long term. The effect of adopting such applications, according to the IMF, should make them richer, can boost economic growth and generate larger revenues for the government.

This study also showed that no single economic evaluation technique had been utilized at the time of the study by the Housing and Utilities Department in either Libya or Tunisia. The consequence of not adopting any technique is that these countries, Libya and Tunisia, and perhaps other countries, will not be able to observe the big picture (complete financial picture) about long-term costs of their infrastructure assets and services. As LCCA examines the

economic benefits of competing alternatives and provides a means to make the most cost-effective decision (out of these competing alternatives), another vital impact of not adopting LCCA is that Libyan and Tunisian officials would not be able to evaluate several alternatives (for any particular project) and select the most favourable one. Hence, they would be limited to a specific option, bearing all relative cost. This in turn could lead to significant money losses due to the absence of screening other alternatives. Overspending on future maintenance and rehabilitation costs is one significant long-term effect. Furthermore, the total life costs of owning an asset would most probably decrease as a result of not examining, for example, the cost of different materials in the long run. This could also lead to weakening the ability to make better pricing decisions and thus there could be less transparency of future operational/maintenance costs.

Another consequence could be the inability to plan for future expenditure or inability to influence and optimise future costs at the design stages, thus not achieving value for money in any project. This most likely would lead to the failure to minimise long term running and operating costs due to the lack of improved awareness of total costs. LCCA provides the appropriate standard or benchmark for measuring and comparing among competing alternatives. It offers best value for money by creating cost awareness right from the beginning of any particular project. In addition, it emphasizes a greater focus on the maintenance and operating costs of assets rather than on capital costs alone and thus delivers significant long term financial benefits, offering a systematic, rational and credible tool that helps in the decision making process, preferably at the early stage (Kirk & Dell'Isola, 1995; Whyte, 2014).

The effect of the absence of life cycle costing techniques could be that the Libyan and Tunisian Authorities are missing out on many benefits that LCCA offers such as:

- saving money (weighing up options through considering whole life cycle costs);
- LCCA encouraging more logical decision-making;
- It supports local/global sustainable development;

- LCCA encourages the wise and sustainable use of public funds by planning and budgeting on the long term and therefore improving risk management

Another vital discovery from the interview in Tunisia was that, with the available funds, Tunisian officials' options had been limited and thus they had not been able to apply long term measures. However, this contradicts the finding of Kirk and Dell'Isola (1995) that the main motivation for using LCC is to increase the possibility of cost reductions when making decisions in the design stage regarding the operational costs, even if this leads to additional investment cost. By applying the LCC method, cost optimization for the main-actors in Libya and Tunisia might be realized. To halt the unnecessary waste of money, long term cost optimization is needed. Moreover, Libyan and Tunisian officials are more likely to be assisted at various stages in the life of their infrastructure assets/services through the use of LCCA; the stages are: planning and analysis of alternative solutions; selection of preferred options; securing funding; and review of predicted and actual outcomes.

The positive consequences of applying LCCA in Libya and Tunisia, and perhaps other less stable and stable developing countries, could be that it will assist designers, planners, civil engineers, as well as governmental officials to evaluate, for example, the economic consequences of continuing to use an existing building/system in comparison with the expense of substituting some alternative which may offer better long-term efficiency, improved performance, newer technology or changing the existing asset/building (Kirk and Dell'Isola, 1995). Early estimation (in the design stage) of the life cycle costs of a building, system or component is very important as it creates the golden chance to evaluate options and select the most cost-effective one. Early identification of the ownership costs assists the decision-maker to balance performance, reliability, maintainability, maintenance support and other goals against life cycle costs. According to NSW Treasury (2004), decisions made early in a building's life cycle have a much greater influence on Life Cycle Costing than those made late in its life cycle.

Another vital positive impact, to the Libyan and Tunisian authorities, and perhaps other developing countries, when using LCCA, is the considerable long term cost saving. Figure 34 illustrates how LCCA can lead to cost savings.

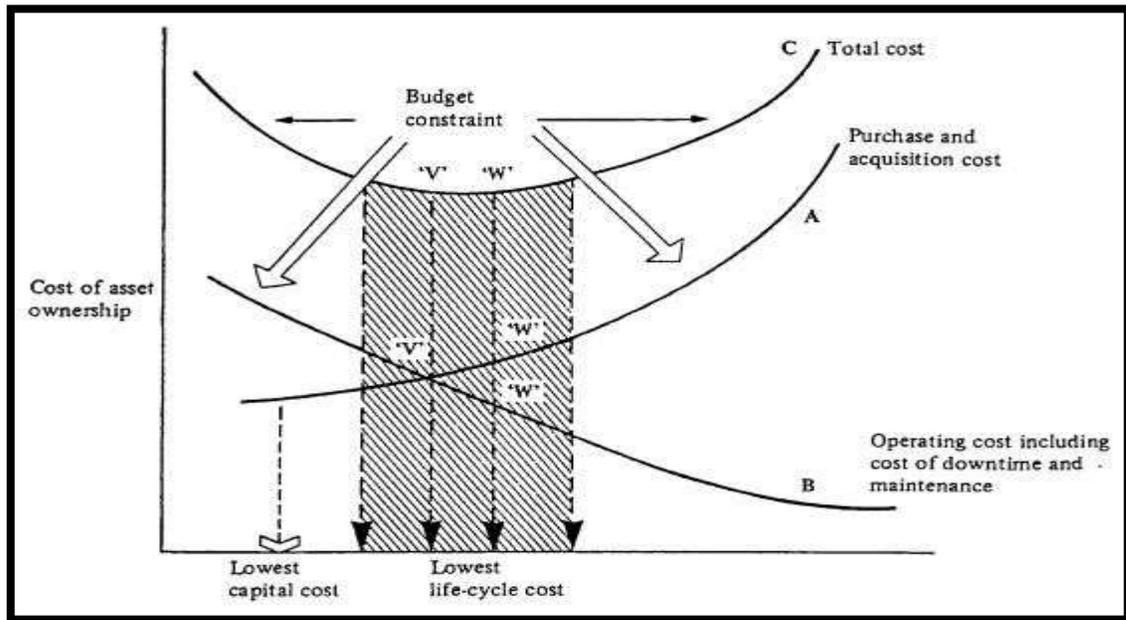


Figure 34: Cost trade-offs in Asset Ownership

Source: (Kirk & Dell'Isola, 1995)

As can be seen in Figure 34, one negative effect that the Tunisian authority, for example, will most likely experience (when LCC is ignored and the focus shifts towards procurement costs), is that their decision, according to the interview, was based on choosing the lowest cost and that can lead to significant total cost at the end of the service life of any infrastructure asset. Making decisions based on LCC analysis could lead to significant money savings in the long run. This would be a valuable outcome in the light of on-going conditions in Libya and Tunisia where the price of oil is decreasing coupled with safety and security situations.

The political situation in Libya currently where billions of dollars are being lost, should be a strong reminder for all sectors (including all industries) that resources (and the political will to exploit them) can be regarded as finite and the belief that Libya is rich is no longer applicable as

the country's major infrastructure assets/services (including refineries and main sources of oil) were severely damaged as a result of the 2011 war. In fact, if such application had been adopted many years ago, the money that could have been saved, as a surplus, may have been of great assistance now, rather than borrowing from other countries in order to rebuild damaged infrastructure assets/services or relying on international donors for loans.

The transportation infrastructure in Libya, for example, is vital for local communities. Libyans need roads to access their workplace, school/university, home and to keep in touch with relatives and friends (cultural and lifestyle aspect). The poor current transportation infrastructure in Libya may result in isolation, low quality or inequality of life as well as unemployment (Chen & Yang, 2009). Since most Libyan cities are becoming larger as the population increases, and in the face of scarce funds and limited budgets, road infrastructure has become progressively more important, especially after the aftermath of the 2011 war where many road networks were severely damaged. This undoubtedly creates a new challenge for public transport.

When a road construction program in Libya and Tunisia, and all countries indeed, is developed strategically, society-wide efficiency and benefits can be accomplished. Hence, it is very important to consider the optimum option (among listed favourable options) to build the roads, not based on the capital cost but rather on the whole life costs of acquiring such an asset or by performing LCCA to decide between listed options (Chen & Yang, 2009). The major issue with capital costs is that they are one-time expenses and do not take into account the cost of any service over its life cycle (Dell'Isola, 1997). Libyan and Tunisian owners and construction managers must increasingly expand their perspective to include operations, maintenance, repair, replacement and disposal costs Cole and Sterner (2000). Figure 35 illustrates a spend profile showing how the costs vary with time.

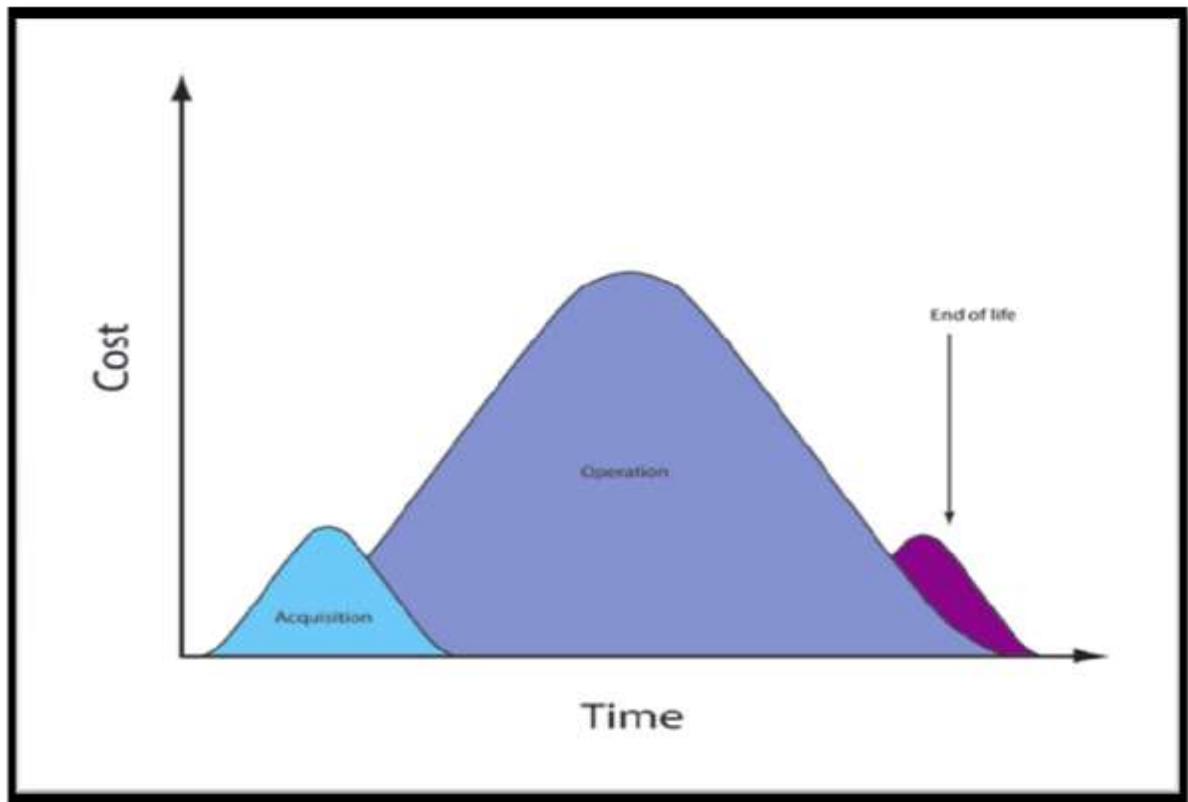


Figure 35: a spend profile showing how the costs vary with time.

Source: <http://www.ogc.gov.uk/assets/images/LifeCycleCostingGraph.gif>

As can be seen from Figure 35, future costs are normally much greater than the initial capital costs. Therefore, undoubtedly it is valuable to take into account future costs as well as present costs when making capital budget decisions as an early identification of these costs enables the decision-maker to balance performance, reliability, maintainability, maintenance support and other goals against life cycle costs (King County LCCA Guide, 2006). LCCA enables achievement of significant cost benefits during the early concept development and design phase of any project. In other words, LCCA is very helpful and beneficial in gathering information and for providing a better understanding of the building /asset in order to determine the best and

worse scenarios, potential cost saving modifications and operational effectiveness and thus choosing the best option available among favourable alternatives (Kirk and Dell'Isola, 1995). Thus, this technique can aid decision-makers in Libya and Tunisia, and perhaps around the world, to assess competing initiatives and identify the most cost effective one in the long-run. Unfortunately, this is not the case in Libya and Tunisia, and perhaps, any other countries where such a technique is not in use.

5.5 PROJECT FINANCE

In Libya, it seems that, as the participants stated, the main source of project funding for both pre and post-conflict/high alert infrastructure projects (building new infrastructure assets/services or maintaining existing infrastructure assets/services) is purely and entirely provided by the state of Libya. The Tunisian case had more sources of funds as the department utilized a dual approach - government funding as well as bank financing. Because government funding was not sufficient, they had to supplement with funding derived from investments as a result of the lack of government funding and the absence of natural resources in Tunisia.

On the one hand, this finding is similar to other countries' main source of funding where it was revealed that the main source of project funds is the government's funds. In Australia for example, it was revealed by the Department of Infrastructure and Regional Development that the major public infrastructure assets/services projects in Australia have been primarily funded by the government, which will continue to be the main source of funding for the majority of Australia's public infrastructure projects in the foreseeable future. As in the case of Libya and Tunisia, governments and the general public have largely treated Australia's infrastructure as 'pure public good' (IFWG, 2012).

Other countries such as the US, Canada, Japan and Germany, however, in contrast to this study, have been found to utilize, besides the government funds, specific taxes or tolls approach

dedicated to the financing of infrastructure construction and maintenance (Acosta, 2014). **However**, these countries are still facing the challenge of a substantial gap between the actual and required spending needed to address urgent projects. For example, with regards to transportation projects in the USA, US legislators had to face the fact that their approach of raising infrastructure funding through fuel tax was an outdated approach. It was estimated that infrastructure investments from all levels of US government were contributing only about one third of the US\$ 190 billion that was needed every year just to keep up with the highway maintenance to stay in line with the increases in trade, population growth and geographic movement of people (Kirk & Mallett, 2013). A generation of roads, bridges, airports, and water and sewer pipes built half a century ago is nearing the end of its useful life. Yet traditional public resources are no longer substantial enough to fund the bill.

Similarly, in Libya and Tunisia, the financing of all public infrastructure assets/services is becoming increasingly complex in the presence of low oil and gas prices, severe fiscal constraints, and coupled with on-going fighting over key oil and gas refineries. In other words, these complexities, in most cases, have arisen because of limitations on public revenue, rising expenditure as well as borrowing. Hence, these issues have made it progressively difficult for government officials, both in Libya and Tunisia, to finance by the traditional instruments of relying on only public finance to reconstruct damaged infrastructure assets and services in post-conflict conditions.

Likewise, other developed and developing countries are trying to search for different ways of financing local needs such as increased taxes, or joint capital participation with private interests. Throughout the world, there are growing challenges in funding public infrastructure projects within many constraints such as budget deficits, bad credit ratings, disturbances in oil and gas prices (in oil rich countries), and the like. Hence, this has placed huge pressure to embark on new sources of project funds besides those from governments. For example, the Australian government established the Infrastructure Finance Working Group (IFWG), with the aim of identifying current barriers, developing new sources of fund options as well as finding ways to

encourage greater private sector investment. The report, the Infrastructure Finance and Funding Reform, published in April 2012, mentioned that the Australian government will need to take action in order to find a sustainable method(s) of funding public infrastructure projects. Most Australian states have suffered rating downgrades in the past and have little or no capacity on their balance sheets for additional borrowings. More importantly, the IFWG stated that states and territories are to be expected to face increased borrowing costs in increasingly more volatile capital markets. Consequently, the report by the IFWG recommended that governments should reform their balance sheets to create the capacity to invest in new infrastructure assets, reforms such as combination of sales of existing State infrastructure assets and extending user pays principles/efficient pricing models across the existing range of assets. The report concluded by strongly recommending that States and Territories should initiate reviews of their respective financial positions. These are important steps to ensure countries' financial positions will be sustainable in the future and able to meet future infrastructure projects' needs (IFWG, 2012).

The consequences of not having sufficient funding could be that Libya and Tunisia, and other countries, will most likely face the challenge, as in the case of the USA, of a substantial gap between the actual and required spending needed to keep up with maintenance of the variety of infrastructure assets/services, just to stay in line with the increase in trade, population growth, and geographic movement of people. In Libya, for example, in addition to existing aged status of a variety of assets/services, the destruction of public buildings, hospitals, schools, roads, bridges, airports and water and sewers have compounded the issue. Traditional public resources are no longer substantial enough to fund the bill. This in turn could possibly lead to a failure of the post-conflict reconstruction efforts. Development of efficient, sustainable long-term financing for all kinds of public infrastructure assets and services is essential for the well-being of any country, for the sake of both building new infrastructure and operation and maintenance of existing infrastructure.

The effect of not finding a sustainable and effective funding mechanism for post-conflict reconstruction efforts in Tunisia and Libya could exacerbate the safety and security issues.

Government officials in Libya and Tunisia are in real need of a sustainable funding approach, while at the same time accounting for end-users' requirements and needs.

Many studies have clearly highlighted that people in the aftermath of war tend to be more engaged with the rebuilding process, especially when they were part of the reconstruction process. Ben-Meir (2009) stated that, as in the Iraqi case, people do not destroy (as many have done in the past) reconstruction projects that they determine and manage themselves. Sugiura (2010; 99), further emphasized that 'people considered reconstruction as an opportunity to create a better society, which would help to avoid the problems of the past and respond to future development'. Developing the right funding mechanism could lead to a successful post-conflict reconstruction stage. This in turn may also help the creation of new employment opportunities and thus create a better-off society.

Another possible negative effect, especially in the aftermath of any war/conflict, is health/disease risk related issues due to the lack of funds and thus inability to fix sewerage and hospitals. This, in turn, could possibly lead to quick spread of fatal disease and thus worsen the post-conflict reconstruction efforts. Government officials must spend the available funds wisely, while at the same time developing more sustainable funding mechanisms. Being able to fund the post-conflict reconstruction stage in an effective way will most likely help to optimise the reconstruction efforts and lead to prosperity and thus the wellbeing of the affected communities.

In Libya and Tunisia, the need for infrastructure is immense while resources and capital have become scarce commodities, especially post 2011 conflict/high alert conditions. Due to numerous causes such as low oil prices, oil and gas refinery closures, and on-going civil conflict, the public exchequer cannot meet any of the funds required for infrastructure development. Both countries need to embark on finding new and different forms of project funds to meet their infrastructure needs as well as to refurbish the existing infrastructure assets/services that were damaged because of the 2011 conflict. Libyan and Tunisian cities may benefit from examining alternative funding mechanisms for sustainable, long-term financing of public infrastructure

assets and services. Relying only on governmental funds, as the above review has illustrated, has been proven to be no longer sustainable.

5.6 RISK MANAGEMENT

The construction industry is considered one of the most risky and challenging industries. Hence, risk management procedures become a vital part of the decision making process of many construction organizations (Burchett et al., 1999). Yet, in Libya and Tunisia, almost all participants in both countries confirmed that risk management techniques were not utilised either pre or post-conflict/high alert conditions due to the absence of policy/regulation regarding utilization of risk management techniques, lack of funds for specialized training, and lack of awareness of the potential benefits of such techniques.

On the one hand, the finding of this study is in line with other findings concerning other developing nations that a risk management technique was not in use. For example, Ofori (1993) stated that, because the risk management concept is not in use, the structural problems of the construction industry in developing countries are more serious and complex. The old method of covering the cost of risk by high markup (used by contractors) is no longer effective, especially when the nature of the construction industry is subjected to more uncertainty and risk than many other industries.

On the other hand, unlike this study's finding where the concept of risk management and procedures was not perceived to be important, and thus had not been applied, many organizations and industry sectors, experts and researchers have stressed the importance of risk management as they believe in its strong contribution toward finishing a project in a timely manner, within budget as well as with better quality. It is clear the importance of risk management has become well and widely recognized by the leading project management institutions. Risk management is one of the eight main areas of the Project Management Body of Knowledge (PMBOK) by the

Project Management Institute, which is the largest professional organization devoted to the project management field. Moreover, project risk management is also considered as a process that goes along with the project from planning, execution and control phases up to its completion and closure (Raz & Michael, 2001).

Also, a review of the literature on risk management, over the past decade or so, reveals that there has been a significant rise in awareness and application of risk management. In addition, many project risk management processes have been developed (Boehm, 1991; Fairley, 1994; Higuera, 1994; Kliem and Ludin, 1997; the Project Management Institute, 1996; Chapman and Ward, 1996). For example, the Project Management Institute developed four phases of the project risk management process: identification; quantification; response development and control. The Software Engineering Institute, a leading source of methodologies for managing software development projects, developed five distinct phases for project risk management (identification; analysis; response planning; tracking and control) linked by an ongoing risk communications effort (Higuera, 1994).

Another study by Chapman and Ward (1996) proposed a generic project risk management process containing nine phases: *'define the key aspects of the project; focus on a strategic approach to risk management; identify where risks might arise; structure the information about risk assumptions and relationships; assign ownership of risks and responses; estimate the extent of uncertainty; evaluate the relative magnitude of the various risks; plan responses and manage by monitoring and controlling execution'*.

Many field experts and researchers have proposed risk management procedures and frameworks such as Al-Bahar and Crandall (1990); the U.K. Ministry of Defense; U.S. Department of Transportation (Del Cano & de la Cruz, 2002). Fraser (1978) systematized the process of risk management and established a generally acceptable terminology. Healy (1981)

developed one approach which is suitable for risk management in giant projects. Wideman (1998) proposed a theoretical framework of a construction risk management model. Al-Bahar and Crandall (1990) modified the conceptual model proposed by Wideman, and altered it into a completely defined management model of risks in construction projects. Del Cano and de la Cruz (2002) stated indeed that a risk management plan should be an important and integral part of project management.

The results from this study revealed several significant impacts. For example, the consequence of not using risk management procedures by the Departments of Housing and Utilities in Libya and Tunisia could be time delays, and hence, less project quality. Another possible impact could be ‘nasty surprises’ as risks are being taken on without explicit knowledge. Of course, a project cannot be done realistically without taking risk into consideration (Hlaing et. al, 2008). Figure 36 illustrates how risk can influence the project quality, cost and schedule at different stages of the construction project (influence curve).

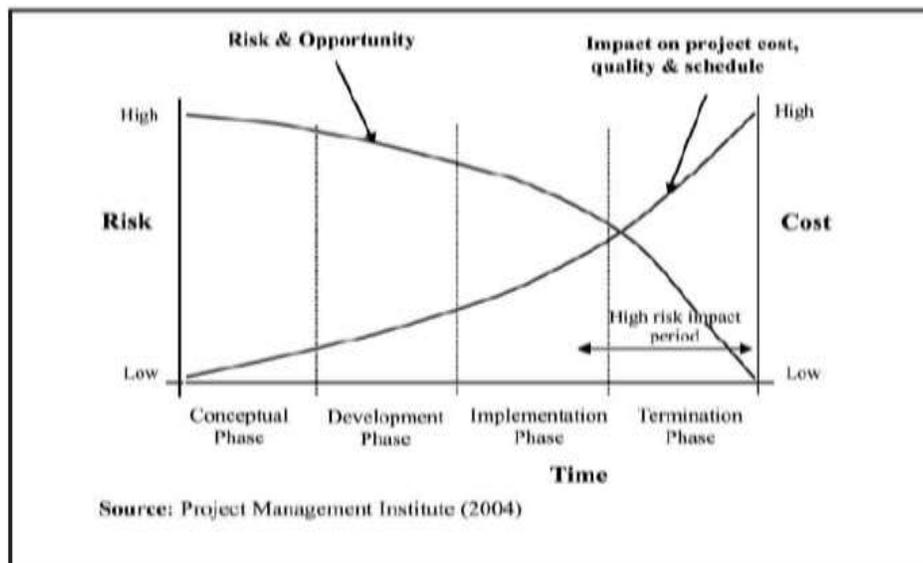


Figure 36: Influence Curve

Source: Project Management Institute (2004)

When projects are delayed, they are either extended or accelerated and, therefore, incur additional cost. Thus, cost overrun could be another probable impact of the absence of a risk management procedure. Therefore, delays in construction projects, in Libya and Tunisia, will most probably lead to cost overrun. This would cause dissatisfaction to all parties involved.

Risks have significant impact on construction projects in terms of their primary objectives. For example, the lack of preventive measures against the risk of environmental hazards or communication risks, in Libya and Tunisia, could lead to delays, significant increases in costs and contractual disputes. Similarly, Howard and Serpell (2012) found that Chilean companies that hire construction services on a recurring basis do not apply risk management practices in projects; this has resulted in negative consequences related to performance of projects.

The absence of a project risk management plan could have negative consequences for the Department of Housing and Utilities, in both Libya and Tunisia, in the post-conflict reconstruction projects due to lack of preventive action against the risks and uncertainty that any project presents. As a consequence, conflicts, poor quality, late completion, poor cost performance and business failures are likely in the absence of risk mitigation strategies. Other possible impacts could be additions, alterations and deductions resulting from project changes. This in turn could lead to disputes due to conflicting interests of the relative parties. For instance, the absence of a risk management procedure could have a devastating effect on contractors and consultants in terms of adversarial relationship development, mistrust, litigation, arbitration and possible cash-flow problems.

Another negative impact could be the risk of accidents. Worldwide, construction workers are three times more likely to be killed and twice as likely to be injured as workers in other occupations. The costs of these accidents are immense to the individual, to the employer and to society. They can amount to an appreciable proportion of the contract price. For example, in the European Union, construction is the sector most at risk of accidents, with more than 1300 people being killed in construction accidents every year (European Agency for Safety and Health at Work, 2004).

Risk and uncertainty can potentially cause detrimental consequences for some construction projects in Libya and Tunisia, especially in the aftermath of 2011 war/conflict. Risk can affect post-conflict reconstruction projects' performance, quality, as well as the budget. Hence, risk management procedures become a vital part of the decision making process of many construction organizations (Burchett et al., 1999). In other words, a risk management procedure, according to Godfrey (1996), helps to recognize, assess and rank risks (making the risks explicit), and thus accordingly, to make informed decisions (mitigation measures) to minimize potential damage (should the worst happen), as well as control the uncertain aspects of construction projects. In addition, risk management helps to identify opportunities to enhance project performance.

The benefits of the risk management process that Libyan and Tunisian authorities could be missing out on include: identifying and analyzing risks, improving construction project management processes and effectively using resources. Risk management helps the key project participants (client, contractor/developer, consultant and supplier) meet their commitments and minimize negative impacts on construction project performance in relation to cost, time and quality objectives.

Hence, the key driver of applying the risk management technique is to examine the relative risks, rank them, and, accordingly, develop the relative mitigation strategies (Hlaing et al., 2008). Marshall et al. (1997) indicated that a central element for project failures is the way in which the knowledge of the organization is managed, indicating that risk management is frequently not a problem of lack of information, but rather a lack of knowledge with which to interpret its meaning.

5.7 CONCLUSION

It is clear from the previous discussion that the consequence of the absence of a long-term comprehensive post-conflict reconstruction approach, alongside a lack of asset-management frameworks, and nominal risk management with scant economic evaluation techniques, are likely to lead to: project overspending and/or cost overruns; project delays; conflicting priorities leading to increased costs and hence delay; and, wastage of valuable building resources. Also, as mentioned previously, a blanket ‘one-size fits all’ scenario for all post-conflict situations does not exist; thus, the North African case-study locations, namely Libya and Tunisia, will most likely require a specifically tailored (yet respectively holistic and comprehensive) approach.

The next chapter provides, importantly, a return to a practical case-study application of the issues at stake for an integrated framework for infrastructure road redevelopment. In other words, the current technical standards and codes for road and pavement construction (in Libya) are reviewed, as a necessary antecedent for any new proposal for an integrated asset-management application.

The section below emphasizes how, up-to-date standards and codes for new-build roads, must be in place *before* policy willingness for life-cycle approaches can be effective.

CHAPTER 6: CASE STUDY: GHARIYAN-MIZDAH ROAD PROJECT

Having reviewed above, the attitudes by the stakeholders to asset-management as a means to achieve improved redevelopment over the long-run, the following section examines technical infrastructure/pavement-construction as a necessary complementary case-study, able to highlight and emphasise the explicit (integrated) links between capital expenditure and life-cycle costing application opportunities for road/infrastructure projects and networks.

This chapter presents the result of a case study, namely, the examination of Gharyan- Mizdah Road Project, beginning below with a brief introduction about the overall status of Libyan roads.

6.1 BACKGROUND ABOUT LIBYAN ROADS NETWORK

In Libya, as with all countries in the world, roads are considered a key infrastructure component, as they connect all cities and a villages as well as neighbouring countries to meet the country's social and economic needs. Thus, the Libyan government has paid great attention to road projects and has established a large network of public roads with a total length of about 34,000 kilometres as of 2012, of which about 15,000 km are main roads; the secondary and agricultural road network is about 18,000 km (refer to Figure 37). To expedite road projects, 'The (Libyan) Road and Bridges Authority' was established, following so-called 'decision no.273 for the year 2010', as a financially independent entity responsible for planning and maintaining roads and bridges, as well as appropriately monitoring and equipping them to ensure traffic safety (The Libyan Transportation Department, 2014).

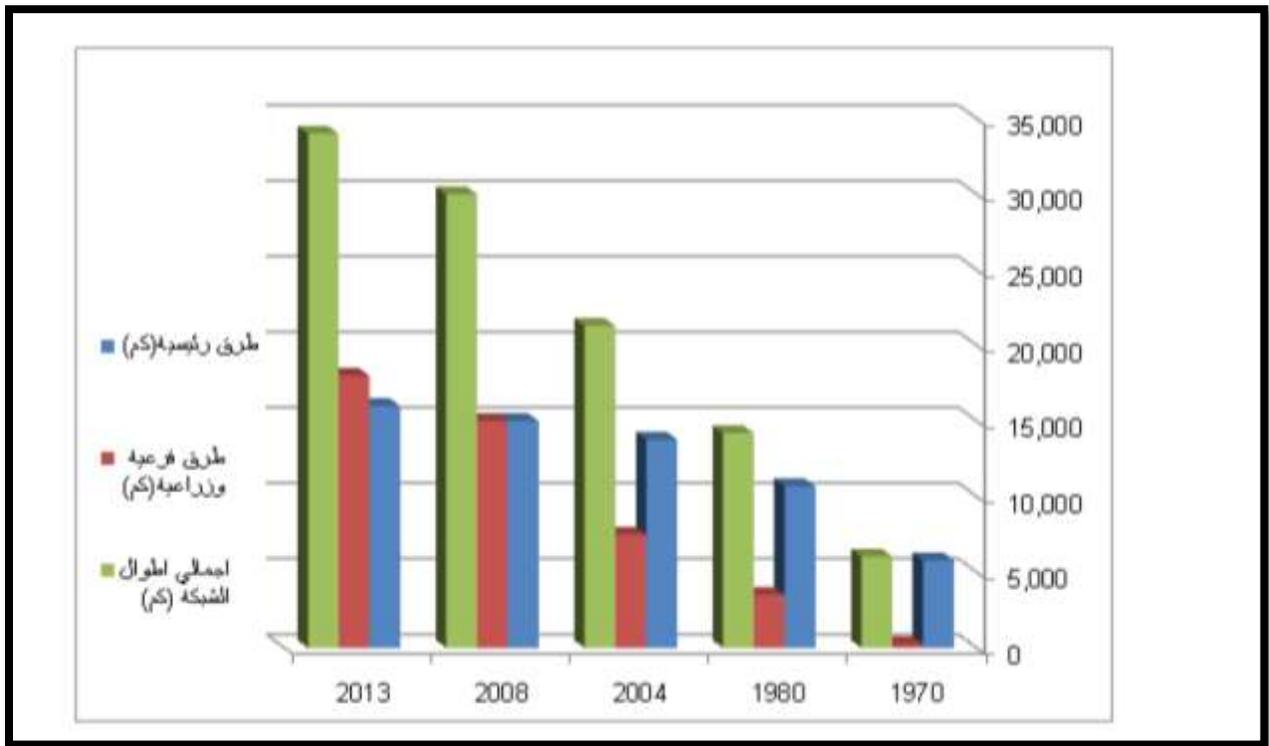


Figure 37: The total paved road network in Libya

Source: The Libyan Transportation Department (2014)

A local Libyan company (under the contract no 1/2010 date 01/03/2010) began executing the ‘Gharyan-Mizdah’ road project in June-2010 (total project length from Km0 to Km67). Unfortunately, due to ongoing conflict in early 2011, the project had to be put on-hold. Three years later, and under the supervision of the Ministry of Roads and Bridges, the company was able to start again on this project and finish the first 7 Km starting from the intersection of Kalipa district to Jendouba Bridge. At time of writing, the work is still ongoing for the rest of the road, and the company has executed a considerable length of the project. Figure 38 shows the Gharyan- Mizdah road project.



Figure 38: Gharyan- Mizdah road

Source: Google Map (2013)

This particular road is considered the gateway to the southern part of Libya and used extensively by heavyweight trucks that deliver all kinds of goods and services to Southern Libya, in addition it is the regular conduit for travellers from the south heading to the capital city of Libya, Tripoli. This road is vital for the country. However, according to the Ministry of Roads and Bridges, the regular users of this particular road are, thus far, highly unsatisfied with this new road network and, accordingly, have lodged many complaints. Complaints, according to the Ministry, identify issues such as: the low quality of road materials that are already beginning to deteriorate, the narrow lanes that are already unsuited to the volume of traffic, and the vehicle damage resulting from extreme changes in the road level across many areas.

The above concerns raises many issues, especially post 2011 conflict, about the Libyan specifications for roads and bridges, as well as the level of scrutiny for projects undertaken post 2011 conflict. The main aim of this case study sought to study the specification used/followed in this particular road project, and compare it against the existing Libyan specifications; ultimately to help identify gaps, weaknesses, (or strengths) in the current Libyan code for roads and bridges, and opportunities to address quality-control measures for such life-cycle (integrated asset framework) redevelopments.

During the time of data collection, this research-project interviewed the two principal design professionals engaged on the project namely: the civil-engineer and the quantity surveyor, as well as the manager (road maintenance division manager) at the main Ministry for Roads and Bridges in Tripoli. In addition, the main Resident-Engineer RE/Supervisor (an experienced expatriate non-Libyan civil engineer) for this Gharyan-Mizdah road project was interviewed alongside the project clerk-of-works.

Interviews sought to then build upon this research-project's technical appraisal and review of the existing 'Libyan specification for roads and bridges' in order to: examine the specification followed by this specific road project; and also, to determine the extent to which the current Libyan code is adequate for roads and bridges, and more importantly might then lend itself to life-cycle maintenance value-management of this and future similar projects.

6.2 DATA RESULTS AND DISCUSSION

The Libyan technical specification for roads and bridges as well as the specification followed in this specific road project were analysed in order to determine the inadequacies or opportunities and to provide further (applicable) information in determining an integrated asset-management framework for redevelopment. The following findings were revealed:

- Somewhat of concern is that the Libyan specification for roads and bridges is found to be an outdated guideline. The Libyan Ministry for Roads and Bridges are still using a technical specifications book that was issued in January 1971. To date, it has never been revised, amended or updated.
 - The *Marshall-Method* currently/typically in-use in Libya is similarly an outdated/traditional method with origins dating to 1940; namely, this method is based on determining the strength of the mixture after compaction and has many disadvantages locally: it is, **first**, somewhat of a trial and error method without a scientific basis, and, **second**, does not take into account the site's traffic, temperature and environmental conditions. Thus the designer, due to the inadequacies of this (Marshall) method lacks the ability to determine the level of performance and expected defects of the mix after use due to the method's inability to account for high temperature.
 - The type of Bitumen typically/commonly used in Libya currently is **Grade 85-100** (requiring a very high mixing temperature of 180-210 degrees), which is not flexible and cannot survive in very high temperatures. Other developed countries are using Grade 25/40 (requiring only 120 degrees). This grade, according to the interviewees, is no longer suitable for Libyan conditions, especially the Gharyan-Mizdah road, as this road is used by heavy trucks and frequent travellers to the capital city, Tripoli.

- The 1971 specification book for roads and bridges (the standard used currently) which is utilised in Libya might have been suitable for that period, as the road users were fewer in number. Accordingly, the overall truck loads were relatively less in capacity. Thus, there was/is only recommendation for 1 layer binder, thickness of 6 centimetres, as well as another wearing layer of thickness 4 centimetres. Currently there are many more heavy trucks (*120 imperial tons, remain the stated datum*) with much greater loading capacities. Thus, two layers can no longer handle the overload/the current capacity of the road users. In summary, the 1971 specification (still in use) is no longer fit-for-purpose. Even a very superficial review can reveal that this specification for roads and bridges needs to be revised/updated not least for new-build specification never mind value-engineering/life-cycle considerations.
- Added to the existing code issues, there is no comparison (by the Ministry of Roads and Bridges) of the actual proposed bills of quantity with the actual executed road. No feedback-loop exists; it can be seen that there are several items that, although included in the bills of quantity, were not executed at all. *Examples* of omissions noted by this research project during extensive site visits include:
 - Bill of Quantities (BQ) Item number 9, fixing of kilometre marks. The latter was not apparent during the researcher's site visit.
 - Furthermore, some of the tasks included in Item number 10 were not executed such as directional arrows, stopping lines, crossing stopping lines, and pedestrians' crossing lines.
 - amounting to a total of approximately 8,269.550 LYD Libyan Dinars omissions form in the Bill of Quantity.
 - BQ Item number 11 also was not executed, the refixing of damaged warning and guiding signboards (4,727.000 LYD).
 - Another item (Item 12), which was not executed was refixing of protection metallic fence (60,580.000 LYD designated in the Bill of Quantity).

- BQ Item number 22, Guard rail, also cannot be seen in its designated place in the already executed road (40,600.000 LYD).
- The total amount of items included in the ‘Bills of Quantities’ and not executed have been assessed, by this research project, as amounting to **114,176.550 LYD**. These amounts have not been accounted-for in the execution of the scope of works.
- To compensate for out-of-date codes and guidelines, the Resident Engineer RE, namely the Civil Engineer and main-supervisor on-site “added” to the road structure an additional ‘third’ layer (consisting 1 wearing course, thickness of 5 centimetres, plus 2 binders of 6 centimetres each);
 - The ‘extra’ layer does not exist in the Libyan technical code for roads and bridges which requires 2 layers (1 layer binder, thickness 6 centimetres, and another layer, wearing colts, thickness 4 centimetres). The Resident Engineer (a non-Libyan national) believed, he said, that his method would contribute more readily to the road being structurally sound and safe, and, in addition, would enable the road to handle the mounting pressure from heavy truck and frequent travellers.
 - According to this experienced ex-patriot RE, the change he made on the road structure was submitted to the Ministry for Roads and Bridges and received approvals accordingly.
- Whilst it can argued that an individual on-site professional’s practical-experience input remains positive, it could also be suggested that such ad-hoc change of road specifications could, without structured national application of codes, lead to adverse situations where other conditions/designs applicable for the Libyan environment are overlooked generally;
 - the expatriate supervisor’s experience/code/design knowledge from overseas must seem to compliment and extend technical standards for Libya. However whilst, on the one hand, in this case the changes made did enhance the road structure, on the other hand, such a step should (only?) be taken or initiated by

the Ministry for Roads and Bridges nationally to avoid any adverse overall effects, as part of regular revisions of the Libyan technical code overall.

Due to the outdated pavement method (documented in local standards), it is highly likely that the overall status of the Libyan road will, over its life-cycle, get even worse. The Marshall method described earlier, does not take into account environmental factors, thus leading to cracks and pavement failures. One possible impact is likely to exacerbate *crocodile cracking*, as can be seen in Figure 39, defined as interconnected cracking with a pattern resembling alligator skin. This kind of cracking is caused due to the inadequate road structure such as small layer thickness (as mentioned earlier), poor drainage, or accumulated damage and is likely to get worse without remedial action (but notably could have been avoided by appropriate design-specification at the outset).



Figure 39: Crocodile Cracking

Source: Transportation Department Website (2013)

Another further effect might be the increase in **linear/longitudinal cracking** caused by pavement that is fatigued from heavy traffic, an unstable base, and poor construction.



Figure 40: Linear Cracking

Source: Transportation Department Website (2013)

The outdated Marshall-method code for pavement currently in-use similarly has knock-on effects for life-cycle potholes and reflective cracking.

According to the Libyan code, the treatment of the crocodile cracks, for example, is by removing the first layer and repaving this again. Linear cracks, they can be solved by using crack filling and by paving another layer, however, this process has proven locally to be inadequate and does not completely rectify these cracks; soon after, the cracks start to be apparent. This is mainly because of poor drainage, accumulated damage or age hardening. The presence of groundwater is normally the main cause in Libya. The solution should be, according to the British Standard 8204-1: 2002, by removing all pavement bases (*in effect removal of the whole road structure*) and rebuilding, which in the case of this particular new-build case-study road is a concerning diagnosis.

The effect of these cracks will most likely incur economic losses in the form of over spending on regular corrective maintenance. Another possible impact might be human losses from regular accidents due to adverse road conditions. The roads and transport today in Libya have become part of the daily struggle to most Libyans, and hence, to the national economy. According to statistics

in 2012 the proportion of accidents involving death in Libya has increased to a rate of 8.4 per day (Altair, 2013). This rate is high, indicating a need for urgent determination of the causes to create solutions accordingly.

Given the technical issues at hand, the next section presents a set of recommendations towards a way forward to address the issue of inappropriate pavement (re)development and the application of outmoded codes for roads and bridges and, subsequently respective integration into an overarching asset-management framework.

6.3 RECOMMENDATIONS

The indications from this case study are that there are inadequacies with the technical code/specifications for roads and bridges, as well as an outdated pavement method of construction. In addition the case study highlighted the lack of revision to the legal specifications for roads and bridges since 1971. Therefore, it is recommended that:

✓ **The Ministry is recommended to change to superior paving mix systems**

As mentioned earlier, the Marshall-method used in Libya is an outdated approach that started in the 1940s. This approach does not take into account the traffic loading, nor temperature and environmental conditions. From an engineering specification point of view, the Ministry for Roads and Bridges is best advised to go towards engineering best practice as well as an adaptation of comparable international standards in the field of design, implementation and installation techniques. Notably, since the top wearing-course asphalt-layer constitutes the final/important part of the road structure loading, the (Libyan) Ministry for Roads and Bridges must strive to take advantage of new technologies that improve the performance of asphalt pavements by adding amendments and the use of modern instruments for the design and equipment. Sound balanced design of the asphalt determines the extent of

its ability to resist loads and operating changes, as well as temperature and environmental conditions.

New technologies for superior performing asphalt pavement technology help solve many asphalt mixture problems worldwide, with an approach that depends on the selection of appropriate materials to mix asphalt for high-performance to take account of temperature and environmental conditions. By way of example, the use of propriety systems such as *SuperPave System* is increasing. In the USA, for example, nearly every state is making some commitment to implement part of SuperPave technology for hot mix pavement such that the best use of asphalt paving technology optimises asphalt mixture resistance to permanent deformation, fatigue cracking and low temperature cracking (Murphy, 1998). Such (SuperPave) pavement systems are designed to account for traffic loading and environmental conditions with appropriate asphalt binder evaluation and mixture analysis towards:

- Best selection of component materials;
- Volumetric proportioning of aggregate and binder (selection of optimum asphalt binder content);
- Evaluation of the compacted mixture.
 1. with mix design method consists of 7 basic steps: Aggregate selection; Asphalt binder selection; Sample preparation (including compaction); Performance Tests; Density and voids calculations; Optimum asphalt binder content selection; and, Moisture susceptibility evaluation.

Figure 41 illustrates the major difference between the current utilized pavement method by the Libyan Ministry for Roads and Bridges, and the new SuperPave technology.



Figure 41: SuperPave compactor sample (left) VS. Marshall Compactor sample (right)

Source: Pavement Interactive (2011)

✓ **It is further recommended that The Ministry develop new traffic laws**

The revision of traffic laws is very important. Most countries around the world regularly update/revise their traffic laws (Altair, 2013). For example, Morocco, Jordan and Lebanon amended around 90% of their old laws, as do European states as diverse as Great-Britain and Romania. The development of transport and road laws and the establishment of weight stations at the entrances to borders, ports and factories, is a crucial first step as such tasks are not controlled by the relevant Libyan authorities. A very explicit example of a truck that uses the Libyan roads daily is a (Fiat) truck with a single axis load of 8.2 tons (where imperial units are common for Libyan applications), with, in the top, a container of 30 tons, with 15 tons of cement cargo (Altair, 2013). These increased pay-loads and volumes require knock-on updating/revising of the traffic (safety) laws, as in the case of Libya, the laws have not been amended, updated or revised since

1971. To further ensure road safety, imposing restrictions on vehicle importation of no older than 10 years of age would similarly assist environmental concerns.

✓ **Ministry review procurement & contract conditions is recommended**

Besides the existing conditions for procurement and award of contracts, review of the general conditions of contract conditions is suggested, such that the Ministry, in this period of essential redevelopment following the war: place all prospective tenderers on a ‘priority’ list based on their history (of successful completion); identify which company is likely to finish the project on time with the desired quality; request that companies, prior to invitation to tender, have known supply-chains, quarries and plant able to address precise specifications; and that, the pavement specifiers acknowledge the latest proprietary fi-for-purpose asphalt add-mixtures.

✓ **The Ministry initiate partnerships with the private sector**

To accelerate the maintenance and expansion of the road network, a partnership between the state and the private sector is needed (in Libya, following the Tunis model) to ensure quality specifications, design, implementation and accuracy are met.

✓ **More effective project supervision be implemented**

As shown by case-study above, a greater focus has to be paid to project execution, project supervision and not least the (BQ review) feedback loop upon completion. This will help to ensure that all details included in the contract are executed in a timely and professional way. Again following the Tunis model, site supervisors from the local authority/Department of Roads and Bridges should be more actively involved in staged monitoring of the project at each principal Critical-Path activity (as it refers to submitted the work breakdown structure of projects as part of a standard form of contract compliance) and report accordingly to the Department.

✓ **Develop structured merit-based planning department training programs**

Training is a very important and integral part of any project development as it helps to identify and thus enhance specific goals; for instance it can help in understanding a process and operating a certain machine or system. In other words, training presents a prime opportunity to expand the knowledge base of all employees as they redevelop infrastructure. In brief, training can help:

- address employee weaknesses;
- improve workers' performance, and thus consistency in duty performance;
- Ensure worker satisfaction;
- Increase productivity;
- Improve quality of services and products (Art of the start 2014).

6.4 CONCLUSION

In conclusion, the case study has shown that the Libyan codes for roads and bridges, as well as the main road-pavement techniques have not changed since 1971. As a result, damage has occurred in the form of regular corrective technical maintenance and high levels of accidents; this case-study sought to examine the effectiveness of currently used specifications/codes for roads and bridges as well as the utilised pavement technology methods, and found both lacking.

Recommendations were provided to enhance/update the existing codes for roads and bridges to include newer state of the art pavement tools and techniques.

Building upon these technical mitigation measures to address current material specification and standards gaps and failings, the next chapter describes the development of the *proposed integrated asset-management framework* that seeks to consolidate user-needs, technology-advancement, best procurement approaches and life-cycle considerations.

Recommendations that stem for this research work are provided below.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

This chapter presents the conclusions of this research project that evaluated the post-conflict redevelopment phases in the North African countries of Libya and Tunisia. Specifically, the purpose of this study was to determine the implications of managing post 2011 conflict in Libya and Tunisia, and to demonstrate how the Libyan and Tunisian authorities can (continue to) respond effectively to adverse conditions, especially in the aftermath of the 2011 man-made conflict.

The study showed that there had been many limitations in the post-conflict approaches used in these countries, not least a national willingness/acceptance that academic review and subsequent independent-researcher recommendations may be positive. It is interesting to note that the initial research project sought to also encompass Egypt, but due to multiple visa refusals stemming from the stated nature of the proposed visit-purpose, the Egyptian case-study had to be abandoned.

The research outcome model, which is the asset-management framework (AMF), provides a comprehensive development of knowledge about improved asset-management in post (man-made) conflict societies. In addition, Recommendations for future research are offered. The findings stated in this chapter indicate that future research reviews need to explore the distinctiveness of asset-management components, and identify and plan comprehensive responses to manage projects in countries recovering from any adverse conditions, post man-made conflict in particular.

7.2 OVERVIEW OF THE STUDY

Conflicts and wars cause major damage to many physical infrastructures, and the growing severe consequences of conflicts, especially man-made conflicts, have, thus, made post-conflict management a significant area of concern. Successful post-conflict reconstruction requires the efforts as well as capabilities of a national government to adopt and apply effective management techniques in order to make the most appropriate cost-effective and efficient decisions, within

budget constraints. Accordingly, this study aimed at developing an Integrative Asset-management Framework(s) for Infrastructure Facilities in adverse (post-conflict/high-alert) conditions using Libya and the surrounding region as a representative location; this framework(s) forms the basis of workable and flexible sets of comprehensive procedures able to be amended with regard to specifications, design, standards, human resources and legislation (when appropriate) as well as accommodating the cost of whole life values.

Specifically this study's objectives were:

➤ **With regards to post-conflict reconstruction:**

- a) To examine the utilised post 2011 conflict reconstruction approach(es);
- b) To identify the affected community's requirements and needs post-conflict/high alert conditions in Libya (Tripoli, Bengasi, Misurata, Sirte and Sabha). The aim of this step was to understand the current affected communities' requirements and needs and then compare them against the governmental approach which had already taken place in post-conflict/high alert Libya.
- c) To determine if the Libyan communities were paying any tax for building new/- maintaining existing infrastructure assets/services and if they were willing to pay tax to finance the maintenance/- building of new infrastructure assets/services.

➤ **With regards to asset-management techniques:**

- a) To examine the major current asset-management frameworks utilized in developed and alternatively newly developing regions;
- b) To determine the current asset-management techniques utilized by the Housing and Utilities departments in (high-alert) zones of interest such as Libya (five cities), and Tunisia;
- c) To identify factors, if any, preventing or slowing the adoption of AM techniques.

- **With regards to economic evaluation techniques:**
 - a. To determine the current economic evaluation techniques utilized by nations in environments of flux, specifically Libyan (five main cities), and Tunisian main Housing and Utilities departments;
 - b. To determine the barriers, if any, preventing or slowing the adoption of the most efficient and effective techniques in these countries.

- **With regards to human resources:**
 - a. To examine training program content, frequency and length pre and post-conflict conditions;
 - b. To evaluate the upper management involvement in the adoption of asset-management techniques in the two countries of this study.

- **With regards to standards/specifications:**
 - a. To examine the standards, specifications, design and regulations that have been set by the Main Transportation Department in Libya, with regards to roads in general, Gharyan-Mizdah road case study specifically;
 - b. To identify how the case-study departments deal (t) with required change.

The above objectives, it was hoped and subsequently confirmed to, lend themselves to the development of a flexible change management structure able to be amended with regard to design, standards and legislation in adverse situations and then to be incorporated into the proposed integrative asset-management framework.

7.3 OVERVIEW OF THE RESEARCH DESIGN

Four years after the so-called ‘*Arab-Spring*’ (Simpson, 2014) which is termed to represent relatively recent conflict across the Middle-Eastern/North-African region, timing was an important element of this research-work. This study recognized that in this period, Libya and Tunisia were

in the midst of complete transition after enduring post war destruction, as well as changes in the overall economy in general.

This research utilized a case study approach – survey questionnaire, interviews, document analysis. The Department of Housing and Utilities in Libya (including five cities, namely, Tripoli, Benghazi, Misurata, Sabha and Sirte) as well as the main departments in Tunisia were chosen as they had been in charge of the post-conflict/high alert reconstruction stage. In order to be reflective of the complexities of the post 2011 conflict reconstruction planning, the sample group included project managers, engineers, and the affected communities. They represented different divisions within the Department of Housing and Utilities and the main Transportation Department.

The instruments for collection of primary data comprised one extensively distributed questionnaire, document analysis and individual interviews. The first set of questions (questionnaire) given to the affected communities in the 5 Libyan cities, mentioned earlier, identified the level of their inclusion in the post 2011 conflict as well as their post-conflict requirements and needs. As for the document analysis, documents were collected and analyzed from the main Transportation department in Tripoli as well as a detailed case study about the execution of one specific road construction, namely Mizdah-Gharyan road project. This step helped identify challenges/concerns in the utilized Libyan codes for roads and bridges. The second section, the individual interviews, involving civil engineers, COEs, project managers working for the Department of Housing and utilities both in Libya (5 cities), and the main Department in Tunisia, identified the current challenges/concerns about the applied post-conflict reconstruction approach.

A total of **621 participants** were involved in the study process, as follows: pilot test (5), semi-structured interviews (40), questionnaire survey (570), and for the document analysis interviews (6).

Data collection in the field was a major challenge for this study, and was undertaken over a period of 4 months from December 2013 to March 2014. Most participants in the departments in

both countries were well educated and the questionnaire and interview questions addressed numerous aspects of post-conflict reconstruction practices as well as asset-management development practices. Combining both quantitative and qualitative data collection and analytical approaches was valuable in establishing the asset-management framework (AMF) for the application of post-conflict development projects. Moreover, the case study method, a method proposed by Yin (2003), provided a systematic and robust way to investigate the current approaches in a practical manner and offered the researcher meaningful characteristics of the situation. The methodology assisted in revealing both existing practices as well as the organizations' management processes.

7.4 MAJOR FINDINGS OF THE STUDY

Research findings were used to determine appropriate ways in which post-conflict reconstruction practices and asset-management knowledge areas could be applied and to demonstrate what needed to be considered for the successful outcome of a project, specifically for post-conflict reconstruction situations. The main findings in the study were found to be:

1. *Project Finance:*

- There was lack of other sources of funds besides the governments' such as funds derived from investments and from private banking sector, both financially and technically. The main source of project funding in Libya was, at the time of the study, purely and entirely provided by the state of Libya. Moreover, even though in Tunisia the use of investment strategies was present, the majority of project funding was still provided by the state of Tunisia.
- Despite the clear lack of funds derived from investments, as well as the absence of regulatory agencies (internal monitoring body), there still seemed to be consensus that the government-only funding mechanism was sufficient amongst the four branches in Libya and the main Tunisian branch. This could have been due to a not-for-profit philosophy that was prevalent in both countries, and the small population

of Libya (which is around 6 million) and its oil and gas abundance. This government-only mechanism, however, has been shown to have contributed to the funding anomalies during the current and post 2011 conflict; *whereby, as a result of political allegiance(s) and historical alignment with the former regime's loyalists' cities, there was unfair distribution of, the (sole-government-provide) funds for the post-conflict reconstruction stage.*

2. Contract award:

- Lack of proper contract award mechanisms, lowest bidding followed by relationship/negotiated tendering were the most predominant and decisive factors for awarding contracts in both Libya and Tunisia. Some participants (around 17%) strongly felt that extreme-lobbying (and some mentioned bribery and corruption) were also major influencing factors.
- There was an absence of an internal monitoring body, leading to a noticeable level of extreme lobbying, and subsequent selection resulting from extreme lobbying, taking place in both countries.

3. Economic evaluation techniques, specifically LCC:

- No economic evaluation technique had been utilized in either country; there was no life-cycle costing considered in redevelopment/asset-management.
- Even though most of the participants in both countries had a fair idea about the life-cycle costing (LCC) concepts and procedures, the life-cycle cost analysis (LCCA) technique had not been applied.
- There were no national or international legal or compliance requirements in their departments for the use of LCC procedures in any pre- or post-reconstruction projects.
- This lack of LCC requirement was deemed to stem from:

- an organizational concentration upon capital-cost, that felt no need for the potential savings to be generated through value-engineering, life-cycle cost considerations of alternative materials and specification
 - the belief that Libya is a ‘rich’ country is held as a major factor against adopting LCCA, where small changes to capital cost today towards future savings across a period of 30 years were deemed somewhat irrelevant;
- the absence of regulations/rules as well as the absence of regulatory agencies;
- administrative and legislative instability;
- no research and development division and a lack of awareness of potential benefits that might accrue from such recommendations.
- LCCA has not been incorporated into the local civil engineering degree curricula; so engineers were unsure as to its relevance to them in their work duties.
- Lack of training is a critical factor; the new technology and software, especially in the civil engineering field, is deemed lacking locally.

4. *Human resource management:*

- There was a lack of effective training programs in Libya, especially post-conflict conditions, except for limited courses for the main department in Tripoli. Thus the main branch gave priority to designing activities mainly for themselves related to overview/generalist policy workshops.
 - This lack was because: training programs were perceived as not being important- (thus fewer funds were offered); lack of awareness of the potential benefits; cost saving measure; limited well-chosen/well-planned/strategic training curricula or training program materials.

- Another vital point was that scrutiny of training content as well as fair distribution amongst employees were absent; no feedback was gathered about the delivery of any programs as they were considered to be efficient.
- Despite specialized training being vital to the work of the Housing and Utilities Department such as software programming (related to civil engineering packages such as Revit, Spacegass, Navigator nor generic spreadsheets-for-LCCA), was not provided.
 - The existing training materials provided, according to all participants, were normally not well planned, always random and the length of these courses was very short.
- In Tunisia, the availability of training opportunities was clearly far healthier and more efficient than in Libya (for design package applications). The Tunisian main branch had developed a list of training courses from which employees could choose.
 - However, with regard to, for example, spreadsheet-software training for life-cycle-costing/discount-rate economic evaluation techniques, the Tunisian case was similarly as sparse as the Libyan case.

5. Risk management:

- Absence of risk management techniques/strategies:
 - no clear policy/regulation regarding utilization of risk management techniques;
 - lack of awareness of the potential benefits of such risk-identification/mitigation techniques which were perceived as additional and unnecessary costs;
 - the absence of a Research and Development Division to provide relevant justification and direction to embrace risk-mitigation, and resultantly weak

training institution and a lack of funds for specialized training, especially pre-conflict conditions.

- There was no form of encouragement/support from the department to undertake or utilise any life-cycle cost/ value management saving techniques that sought to compare and contrast alternative specifications and materials options, and subsequent provide a recommendation on the best whole-life spec.

6. Post-conflict/high alert utilized recovery method:

- There was a lack of long-term reconstruction approach. The only method used was a compensation approach based upon short-term capital-cost rebuild. Many issues were raised later such as false claims; much wasted money as a result of claiming the compensation and never rebuilding; extra-over unofficial payments to officials to ensure the processes of compensation-payment receipts; and finally over-compensation. These issues seemed predominant and thus led to the compensation approach being ineffective.
- There was clear absence of involvement of the affected community.
 - The wider community of users and society requirements and needs were never accounted for in the utilised reconstruction approach. User-group involvement was perceived to be not important and thus not relevant.

7. Asset-management technique:

- Lack of understanding of asset-management procedures;
- the non-existence of asset-management techniques,
 - with at best ad-hoc non-specialized asset-management framework(s), and at worst typically a lack of any whole-life maintenance approach
- This lack was due to: lack of awareness of the potential benefits; the absence of national or international legal or compliance issues in respective departments which

required mandatory use of asset-management (whole-life maintenance) procedures in any pre or post reconstruction projects; weak training institutions; absence of research and development divisions.

The findings clearly indicated a vital need to include the affected *community's* requirements and needs as part of a long term and comprehensive post-conflict reconstruction approach in order to promote a better understanding of how projects are undertaken at all levels of the organization, and to describe processes, procedures and tools used for the actual application of projects. Experiences from Iraq, Nigeria, Turkey, Lebanon and other countries have shown that huge losses will be incurred if the community has not been involved. The refusal of resettlement in Nigeria, Turkey and Tunisia are clear examples. Neglecting the affected communities' requirements and needs has led to multiple reprogramming of project priorities in Iraq resulting in Billions of dollars in losses.

Whilst some post-conflict *approaches* resulted in re-development/rebuilding of infrastructure networks in the short term, through concentration on capital-cost to fund a (somewhat unfit-for-purpose) road, these however were very limited, and challenges and concerns followed such that user-groups queried the build-quality (essentially concern over the poor specifications adopted) for the road surfaces. Post-war or conflict management requires undergoing vital stages, similar to public project management: long term planning, organizing, resource mobilizing, training and completing stages.

With the clear absence of the inclusion of the affected communities' requirements and needs, as well as the absence of long term reconstruction planning, coupled with budget constraints, the goal of this study, accordingly, was to develop a long term/comprehensive asset-management framework (AMF) that could be amended with regards to specifications, design and standards.

The AMF suggests that management of a project lifecycle in post-conflict settings should first be customized to local settings in order to assist civil engineers, project managers, practitioners, humanitarian organizations, donors and policy makers to prioritize the project

tasks first, and then what tools and techniques are most appropriate for use when planning projects to rebuild communities, and second, will accommodate the whole life cycle cost values, and be flexible with change management strategy in order to make changes with regards to specifications, design and standards.

The AMF developed here considers end-users requirements and needs, emphasizes the importance of quality, procurement, the accommodation of life cycle costing values (life-cycle cost analysis LCCA tool in particular), a flexible change management strategy and risk management, which are critical factors given the complexity of the projects, especially in post-conflict sittings.

While current asset-management frameworks/models do typically *imply* end-user involvement, direct consultation with the community is *not*, in fact, explicitly factored-in. Thus, it is critical for countries and their civil society organizations emerging from conflict to commit to adopting some basic asset-management (user-needs) strategies. This will ensure effective, transparent, flexible and participatory delivery of services to the population.

The findings suggest that a detailed asset-management framework which includes community involvement is required. The asset-management framework in Figure 42, therefore, is presented in the next section, followed by general recommendations from the study.

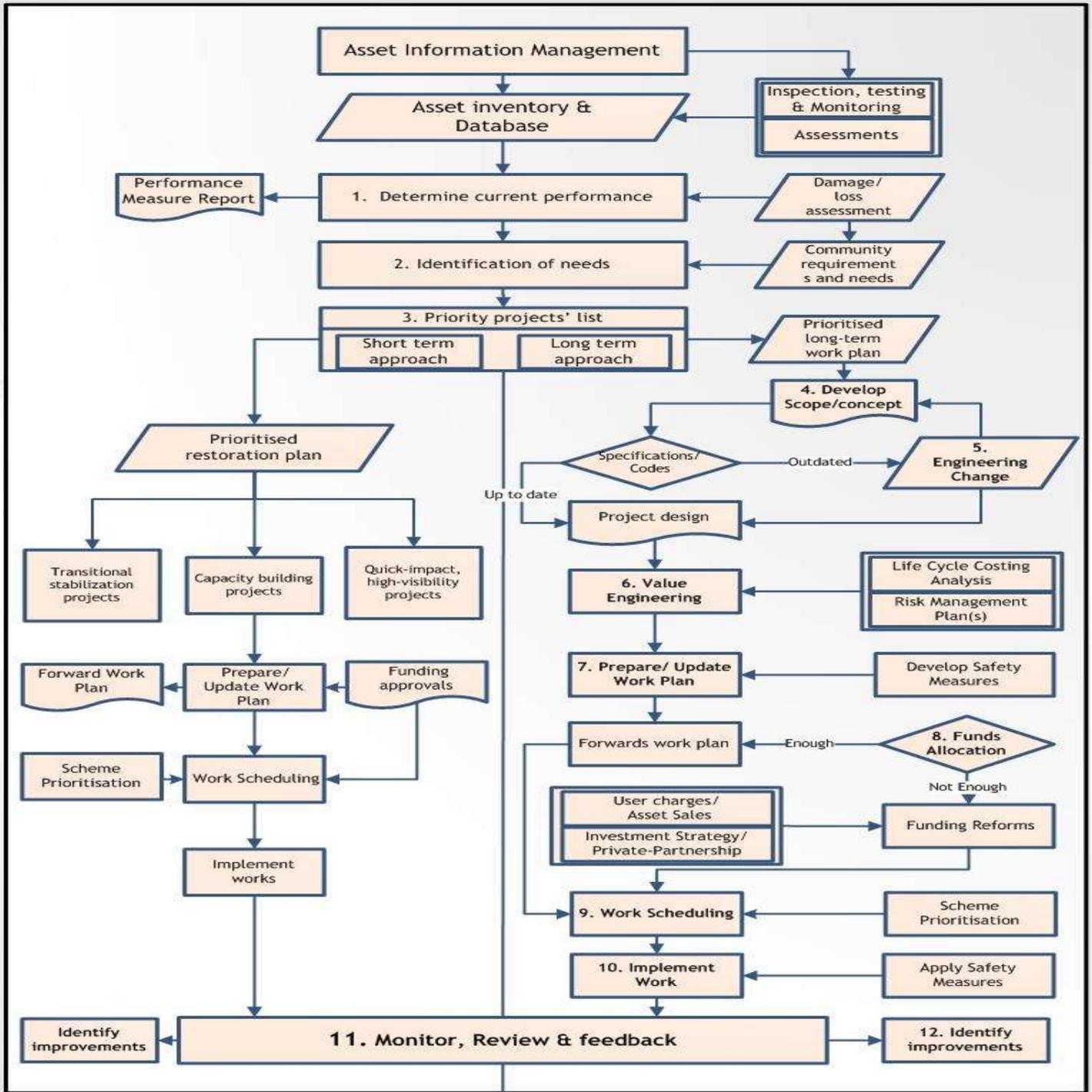


Figure 42: The proposed Asset-Management Framework (AMF).

Recommendations pertaining to the asset-management framework (AMF):

Integrative asset-management framework (AMF)	
A. Organisational Strategic Planning:	
<p>1. Determine current performance</p>	<p>Determining the current infrastructure assets’ performance/condition through the utilisation of inspection, testing, damage/- loss assessments and other available assessment methods in the Department;</p> <p>A performance measurement report is produced in order to inform the management process of any critical asset condition;</p> <p>The recording of a performance measurement report and making appropriate recommendations with respect to damaged infrastructure assets to be fed into the planning process along with community requirements and needs.</p>
<p>2. Identification of needs</p>	<p>The Department of Housing and Utilities collaborate with the community throughout the planning process and obtain support and commitment from all stakeholders</p> <p>Preparing a planning document through community participation process along with damage/loss analysis (or in this case, performance measurement report);</p> <p>All of the above assessments are fed into the asset information management in order to provide accurate and up-to-date information to support planning and operational processes necessary for the effective management of post-conflict reconstruction.</p>

<p>3. Priority projects' list</p>	<p>A priority list of reconstruction projects will emerge to be, then, implemented accordingly after approval processes; noting that whilst benefit/cost ratio techniques may be applicable normally, in areas of highlighted community-need, alternative user-needs weightings must take precedent.</p> <p>Developing clear project goals and objectives. Both a short term plan (to restore necessary stabilization projects), as well as long term reconstruction plans (to ensure that the most effective/efficient option is chosen) must be prepared.</p>
<p>3.1 Short Term planning</p>	<p>Prepare work plan for short term reconstruction including quick reflexes and stabilisation projects such as reconnecting water and drainage networks;</p> <p>Establish short term priority projects' list;</p> <p>Forward the work plan for funding and approvals and then implementing the work plan.</p>
<p>B. Tactical Planning (Option Identification):</p>	
<p>4. Project design 'a'</p>	<p>Prepare project design for each identified list of projects including, but not limited to, the drawings, architectures and so on;</p> <p>Before completing the design stage, the relative specifications and codes must be examined to make sure that they are up-to date and of high standard.</p>
<p>5. Design Engineering Fit-for-use Specification Compliance</p>	<p>If the specifications/codes are outdated (as in the case of the case study-Chapter 6), <i>a flexible change strategy (item number 5. Engineering Change) should be adapted to allow the effective change/update of the state of the art utilised specifications and codes.</i></p>

6. Value Engineering (Best Option Identification)

Life Cycle Cost Analysis seeks to optimize the cost of acquiring, owning and operating physical assets over their usable lives. Thus, the decision to reallocate, maintain or build new projects will depend on the economic evaluation techniques used, particularly life cycle costing analysis:

- a. Determine alternatives available to rebuild the damaged infrastructure;
- b. Identify the total lifecycle costs for each alternative;
- c. Choose the most efficient alternative.

The best balance among cost elements is reached when the total LCC is minimized

Risk analysis be utilised as following:

- a. Evaluate risk early in the project;
- b. Involve other organizations/experts to analyse risk;
- c. Engage the community to identify and minimize the project risk;
- d. Identify the highest priority risk;
- e. Develop risk management plan; develop a contingency plan;
- f. Monitor risk response strategies;
- g. Communicate risk reduction activities;
- h. Use audit reports to monitor progress and;
- i. Evaluate the project outputs on completion.

Lessons learned from the experience to be fed back into the planning and development process for future projects.

<p>7. forward work Plan (Long Term Plan)</p>	<p>Implementing legal safety codes and provision for social insurance are crucial to reconstruction. After any post-war period, there is a high tendency or pressure toward rapid responses and quick reflexes. This pressure could lead to unsafe industrial sites and poorly reconstructed buildings, as well as posing threats for reconstruction workers themselves and companies. Moreover, short term plans such as quick fixes may eventually be much more costly than more comprehensive/long term repairs.</p> <p>Forwarding the work plan including projects’ priority list, option identification using LCC, risk management plan, utilised/- or newly up to date specifications/ codes, safety measures, as well as deigns and drawings;</p>
<p>8. allocation of funds</p>	<p>Determine if the actual budget is adequate; If not, develop budget reforms including user charges, asset sales, investment strategies; private partnership; Provide adequate financial guarantees; Develop cost contingency plan; Develop cost <i>reporting and monitoring protocol</i>; Ensure funds are sufficient to undertake the whole project; Also, ensure funds are distributed fairly amongst all states through decentralising the system.</p>
<p>C. Operational Planning (Implementation):</p>	
<p>9. Work scheduling</p>	<p><u>During the planning:</u></p> <ul style="list-style-type: none"> a. Develop an effective project schedule; b. Develop project schedules network diagram; c. Obtain team ownership and responsibility for their project schedules;

	<p><u>During the execution:</u></p> <ul style="list-style-type: none"> a. Monitor project schedule; b. Respond to schedule changes; c. Review project outcome with schedule
10. Implementing the work plan	<p>Implementing the work plan identified in the previous stage, that is the acquisition/reconstruction plan;</p> <p>Prepare and forward maintenance, operation, and disposal plans</p>
11. Monitor, review and feedback	<p>Lessons learned from the experience to be fed back in the planning and (re)development process for future projects;</p> <p>Identify improvement opportunities.</p>

7.5 OTHER RECOMMENDATIONS FROM THE STUDY

There are several recommendations raised from this study apart from the recommendations pertaining to the asset-management framework:

7.5.1 Support community participation and responsibility

The study clearly indicated a significant need for recommendations to ensure engagement through broader community participation. After any post-conflict period, project risks are extremely complex, especially without community engagements. Community participation can help minimise the risks of any project. Therefore, it is highly recommended that the community become involved in the selection of projects in order to help decrease inconsistent scope and increase acceptance of the project outcomes by all intended beneficiaries.

7.5.2 Engage community in continuity of funding projects

With the scarcity of funds in post-conflict conditions, Libyan and Tunisian authorities should think of other ways to generate funds.

Therefore, it is recommended that the local government reconsider fiscal policy related to the generation and redistribution of revenue locally through taxation and customs' duties and the like to fund identified projects. Relying only on oil and gas profit can no longer be sustainable.

7.5.3 Focus on training

It is recommended that the Department of Housing and Utilities, in collaboration with partner organisations, and possibly international organisations, provide adequate resources for training programs to be regularly conducted; develop the right training content, to include the latest state-of-the-art civil engineering software (as discussed above), management software and any other software which are related to the work of civil engineers at the Department of Housing and Utilities. The employees at this Department could be given the opportunity to choose training content based on what they feel is appropriate to them. Thus, undertaking training programs would be for the purpose of acquiring greater knowledge rather than for just the funding.

The duration of training programs should be extended and they should be regular. Careful monitoring of programs after the training and providing incentives are highly recommended. Consequently, all engineers in the department will be aware of any of the mentioned applications and how they work and their potential benefits and that will motivate them (apart from the incentives) to work effectively in using and utilizing these applications.

7.5.4 Review procurement paths and contract award

It is recommended that contracts be awarded based on (selective-competitive tendering) price competitiveness, quality of the work and company's history, rather than relying solely upon

negotiated contracts with a singular/limited number of tenderers. This would eliminate inconsistencies in awarding of contracts.

Inclusion onto the tender list would require bidders to be able to demonstrate (through their forwarded contract documents at the very least) that they have the required experience to do the job with qualified people, equipment, and quality and within the agreed timeframe.

The Department of housing and utilities should develop a list of all tendering companies along with their history (with past projects) in order to list them in accordance with their cost, time and quality of the executed projects. This would make it easier for the Department to choose more effectively throughout the tendering process. In addition, these criteria would create competition among bidders resulting in huge cost savings as well as competition in providing services with good to high quality with lower prices.

7.5.5 Identifying, assessing and mitigating risks as an essential part of project planning

It is recommended that the Department of Housing and Utilities develop comprehensive plans in order to identify, assess and mitigate potential risks and establish prudent controls. Moreover, it is highly recommended that, before any organization/company is provided with the project-fund, the department ensure there is a requirement to have risk management plan (and risk mitigation strategy) in place as well as to provide a detailed contingency plan on how the project team is going to mitigate risks.

7.5.6 Monitoring of project schedules

After any conflict or disaster, the expectation of the affected communities is quite high, thus, finishing projects on time is vital. It is recommended that, depending on the complexity of the projects, the Department of Housing and Utilities should only make grants and support projects that can be realistically implemented and have an achievable schedule. Moreover, the department should ensure that all necessary controls are incorporated and followed throughout the project.

7.5.7 The need for decentralised system

The various localised branches of the Department of Housing and Utilities have to be fully independent, financially in particular. Then the issue of regional-favouritism can be addressed. Hence, each branch would have the power to assess/ascertain the needs in their municipality and addressed accordingly. One critical effect of such step is that huge time delays for project and funds approvals can be avoided.

7.5.8 Amalgamation of the ‘Department of Housing and Utilities’ with the ‘Department of Implementation Housing and Utilities projects’

It seems that the ‘Department of Housing and Utilities’ and the ‘Department of Implementation Housing and Utilities projects’ are doing exactly the same job with the newly Department having better salaries and many other superior allowances. So, it is highly recommended that both departments be amalgamated and further support and allocation of more resources be given to an overarching Public-Works-Department/General-Works-Company. The main job of this overarching PWD/GWC would be to construct (using localised labour if/where appropriate) non-complex/repetitive specification building-projects for the Departments. This company can be used to create more funds/profits for the Department by undertaking projects for other departments such as health and education; with potentially the possibility of competing in the private sector as an independent tenderer.

7.5.9 SWOT analysis

It is highly recommended that the Department of Housing and Utilities evaluate strengths, weaknesses, opportunities and threats involved in the organisation in charge of post-conflict reconstruction stage:

- In the case of Libya, the absence of a Research and Development division as well as a Training Institution, as well as the centralised system were the major drawbacks to a successful post-conflict reconstruction phase.
- Also, as it was revealed, the specifications for roads and bridges had not been changed since 1971; in addition the current pavement method, the Marshal Method, is an outdated approach.

So, it is recommended that:

- A Research and Development Division be included in the organisation hierarchy and one of its main job tasks is to review, examine and update specifications, codes and standards on a yearly basis. Moreover, technology catch up is another critical task.
- Then, to create a Training Institution, effective and efficient training contents for all employees should be developed. Well-structured training programs should be developed and distributed fairly amongst all employees.

7.6 RESEARCH CONSTRAINTS

This study provides a significant contribution to post-conflict reconstruction and development. However, there were some practical research constraints that need to be acknowledged and addressed. Some of these constraints were:

7.6.1 Fluency in language

As the targeted group for this study were from Arabic speaking nations, both the interview questions and the survey questionnaire surveys were developed in the English language and then translated into Arabic and later the answers were translated into English again. Even though the co-pilot study was utilized, there still may have been times where the full meanings and answers

were not translated correctly in English. During the data collection period, the researcher had to rely on his language ability to translate the responses and may have missed some aspects of the participants' responses.

7.6.2 Limited time frame

Due to time constraints and budget limitations, it was not possible to travel to Libya and Tunisia several times. The researcher spent 4 months between Libya and Tunisia during the one period of data collection. Thus, it was not feasible to include more representatives in each department or get a broader overview of project planning and its execution. The results reported were largely from the perspectives of the project manager or the COEs at the top of the hierarchy in the organization's structure in each city. Interviews with other levels may have provided more valuable information.

7.6.3 Cultural constraints

Due to cultural and security reasons, the researcher was unable to record most interviews. Almost all participants refused voice recording, citing security reasons. The only available option, at the time of study, was extensive and detailed note-taking of the interview answers.

7.6.4 Lack of prior research studies on the topic and instrument used

Most of the studies of the post-war period have focused on history, peace-rebuilding as well as so-called economic-miracles (Jabareen, 2013; Paes, 2005; and Muggah, 2005). Others have focused on the causes as well as the consequences of wars and conflicts (Jones, 2004; Shaw, 2003; Mamdani, 2002; Young, 2002). Hence, there is a limited body of empirical literature available that deals with long term and comprehensive post-conflict reconstruction approaches, the embodying of the asset-management field in particular. Thus, the findings in this study could not be compared to a large extent with other *post-conflict* settings.

Despite these shortcomings, this research study, through the methodologies used, has developed a long-term asset-management framework that accounts for end-users requirements' and needs; the accommodation of whole life cycle values; flexible amendment to specifications/code; and the development of safety and risk management measures to ensure the successful continuity of reconstruction.

If the Libyan and Tunisian Housing and Utilities Departments adopted asset-management processes, it is likely they would have a better understanding of asset-management and end-users' requirements and needs; they would be able to improve the level of communication and reporting; they could improve asset performance monitoring; and enhance asset-management through periodic strategic review. Also, asset-management could help to minimize the total ownership and operation costs while delivering customers' desired service levels at an acceptable risk level. It also can provide the most cost-effective results because it allows the use of strategic direction and risk determination to set priorities.

7.7 SUGGESTIONS FOR FUTURE RESEARCH

Worldwide, there are many man-made conflicts, across Africa, Asia, the Middle-East, and beyond. The challenges and complexities of reconstruction/rebuilding in such climates are going to increase.

Although this study has provided a number of contributions to the area of post man-made conflict reconstruction, research in the area of post man-made conflict reconstruction/rebuilding is still in its infancy and, there is still much research to be accomplished in the field in other post-conflict conditions. For example, firstly, future research in this area should strive to better understand how asset-management development, based on responsible practices of planning and development policy areas, is aligned with the community, and the organization.

Second, much of the literature and publications in post-conflict environments focus on other aspects of post-conflict conditions such as peace building, women's rights, education and

disarmament. On the other hand, there is a lack of empirical evidence in the literature about post-conflict reconstruction using long term techniques such as asset-management and other management processes, and this area presents an opportunity for future research.

Thirdly, the current study and analysis of data were focused on North Africa, namely Libya and Tunisia; however, there are many other countries emerging from severe conflict. Hence, this study might be replicated in other post-conflict societies. Furthermore, the research mechanism considered for the current study was based on the purpose of the study. Further development and revision of the mechanism could be undertaken to test and maximize its validity. The revised mechanism could be used as a pilot test in a study in another similar situation, and the adequacy of the instrument tested before embarking on full-scale data collection in the field. In brief, further investigation of similar/different situations and conditions is needed.

7.8 CONCLUDING STATEMENT

Reconstruction is an essential measure for a society in a state of flux as a result of man-made conflict, both in terms of physical assets and the emotional ties to such physical-assets. A long-term approach must become a priority and the guiding goal of reconstruction. Reconstruction helps to rebuild the infrastructure for damaged societies, and this process can succeed only if there is a national commitment to redevelopment of a fit-for-purpose built-environment as well as a commitment to involve the affected community's facilities user-needs within an integrated asset-management framework.

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Appendix A

Mann-Whitney Test (1,2)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Bengasi	110	117.00	12870.00
	Misurata	110	104.00	11440.00
	Total	220		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	5335.000
Wilcoxon W	11440.000
Z	-2.072-
Asymp. Sig. (2-tailed)	.038

a. Grouping Variable: Group

Mann-Whitney Test (1,3)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Bengasi	110	118.45	13030.00
	Sabha	120	112.79	13535.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	6275.000
Wilcoxon W	13535.000
Z	-.843-
Asymp. Sig. (2-tailed)	.399

Mann-Whitney Test (1,4)**Ranks**

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Bengasi	110	126.50	13915.00
	Sirte	110	94.50	10395.00
	Total	220		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	4290.000
Wilcoxon W	10395.000
Z	-6.105-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Mann-Whitney Test (1,5)**Ranks**

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Bengasi	110	118.95	13085.00
	Tripoli	120	112.33	13480.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	6220.000
Wilcoxon W	13480.000
Z	-.991-
Asymp. Sig. (2-tailed)	.322

a. Grouping Variable: Group

Mann-Whitney Test (2,3)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Misurata	110	111.36	12250.00
	Sabha	120	119.29	14315.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	6145.000
Wilcoxon W	12250.000
Z	-1.282-
Asymp. Sig. (2-tailed)	.200

a. Grouping Variable: Group

Mann-Whitney Test (2,4)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Misurata	110	120.00	13200.00
	Sirte	110	101.00	11110.00
	Total	220		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	5005.000
Wilcoxon W	11110.000
Z	-4.550-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Mann-Whitney Test (2,5)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Misurata	110	111.86	12305.00
	Tripoli	120	118.83	14260.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	6200.000
Wilcoxon W	12305.000
Z	-1.136-
Asymp. Sig. (2-tailed)	.256

a. Grouping Variable: Group

Mann-Whitney Test (3,4)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Sabha	120	128.79	15455.00
	Sirte	110	101.00	11110.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	5005.000
Wilcoxon W	11110.000
Z	-5.503-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Mann-Whitney Test (3,5)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Sabha	120	121.00	14520.00
	Tripoli	120	120.00	14400.00
	Total	240		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	7140.000
Wilcoxon W	14400.000
Z	-.151-
Asymp. Sig. (2-tailed)	.880

a. Grouping Variable: Group

Mann-Whitney Test (4,5)

Ranks

	Group	N	Mean Rank	Sum of Ranks
Was there any Damage	Sirte	110	101.50	11165.00
	Tripoli	120	128.33	15400.00
	Total	230		

Test Statistics^a

	Was there any Damage
Mann-Whitney U	5060.000
Wilcoxon W	11165.000
Z	-5.394-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Appendix B

Mann-Whitney Test

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Bengasi	110	152.48	16773.00
	Misurata	110	68.52	7537.00
	Total	220		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	1432.000
Wilcoxon W	7537.000
Z	-10.219-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Bengasi	110	100.65	11071.50
	Sabha	120	129.11	15493.50
	Total	230		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	4966.500
Wilcoxon W	11071.500
Z	-3.510-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Bengasi	110	108.93	11982.50
	Tripoli	120	121.52	14582.50
	Total	230		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	5877.500
Wilcoxon W	11982.500
Z	-1.548-
Asymp. Sig. (2-tailed)	.122

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Misurata	110	63.67	7003.50
	Sabha	120	163.01	19561.50
	Total	230		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	898.500
Wilcoxon W	7003.500
Z	-11.690-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Misurata	110	57.50	6325.00
	Sirte	110	163.50	17985.00
	Total	220		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	220.000
Wilcoxon W	6325.000
Z	-12.827-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Misurata	110	66.78	7346.00
	Tripoli	120	160.16	19219.00
	Total	230		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	1241.000
Wilcoxon W	7346.000
Z	-11.037-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Sabha	120	96.02	11522.50
	Sirte	110	136.75	15042.50
	Total	230		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	4262.500
Wilcoxon W	11522.500
Z	-5.241-
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Ranks

	Group	N	Mean Rank	Sum of Ranks
Satisfaction with post war reconstruction effort	Sabha	120	128.90	15468.00
	Tripoli	120	112.10	13452.00
	Total	240		

Test Statistics^a

	Satisfaction with post war reconstruction effort
Mann-Whitney U	6192.000
Wilcoxon W	13452.000
Z	-2.044-
Asymp. Sig. (2-tailed)	.041

a. Grouping Variable: Group

Appendix C: Questionnaire for the communities

Part I:

1. **What is your Gender?**
 - Male
 - Female
2. **What is your age?**
 - 18-29
 - 30-49
 - 50-64
 - 65 years and over
 - Rather not say
3. **What is the highest level of education you have completed (Please Specify)?**
 - Elementary school only
 - High school graduate
 - College graduate
 - Trade/technical/vocational training
 - Master's degree
 - Doctoral degree
 - Professional degree
4. **The organisation you work for is in which of the following (Please specify)?**
 - Public sector
 - Private sector
 - Non-for-profit
 - Others
5. **What is your employment status?**
6. **How long have you been working for?**
 - 5 -9 years
 - 10-19 years
 - 20-29 years
 - 30-39
 - 40 or more
7. **Where do you currently reside (please provide city/village's name)?**
8. **Which of the following best describes the area you live in?**
 - Urban
 - Suburban
 - Rural

Part II:

9. Was your city/village affected by the civil war/high alert conditions in 2011 to date:

- Yes
- No

9.1. If Yes, how extensive was the damage?

- Minor
- Considerable
- Major

9.2. What were the effects of the damage?

9.3. What were the most damaged infrastructure assets? (PLEASE Rank in order):

Infrastructure Asset	Please Rank
Roads	
Hospitals	
Schools	
Universities	
Electricity networks	
Water facilities	
drainage	
Homes	
Public buildings	
Others. Please specify	

9.4. Is there any specific example where disruption was most detrimental and took longest to reinstate?

10 Which, if any, of the damaged assets have been reconstructed?

10.1 Can you give the most important five+ assets that are essential to allow returning to normality?

10.2 If these assets have not been reconstructed, why do you think that is?

11 How satisfied were you with the Department of Housing and Utilities’ reconstruction efforts post-war/high alert condition with regard to the assets which were reconstructed:

Please tick your response	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
Roads					
Hospitals					
Schools					
Universities					
Electricity networks					
Water facilities					
drainage					
Homes					
Public buildings					
Others. Please specify					

12 How would you rate the state of your city’s infrastructure assets prior and post to the war/high alert conditions? (Please provide 2 answers one for pre and one for post).

Please tick your response	Excellent	Good	Fair	Poor
Roads				
Hospitals				
Schools				
Universities				
Electricity networks				
Water facilities				
drainage				
Homes				
Public buildings				
Others. Please specify				

13 What were the requirements of the community post war/high alert conditions, in your opinion? Please rank these in order of importance?

Infrastructure Asset	Tick for Requirement
Roads	
Hospitals	
Schools	
Universities	
Electricity networks	
Water facilities	
drainage	
Homes	
Public buildings	
Others. Please specify	

14 Do you believe the Department of Housing and Utilities considered your community’s requirement seriously?

- Yes
- No
- Maybe
- Don’t know

16.1 If no, why do you think that was?

15 How would you rate the quality of the reconstruction work with the construction prior and post the conflict/high alert conditions?

Please tick your response	Prior to war/high alert conditions				Post war/high alert conditions			
	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor
Roads								
Hospitals								
Schools								
Universities								
Electricity networks								
Water facilities								
drainage								
Homes								
Public buildings								
Others. Please specify								

16 Do you pay tax with regards to building new or maintaining existing public infrastructure/services?

- Yes
- No
- Do not know

17 If no, are you willing to pay a certain amount of tax for future building new and maintaining existing public infrastructure /services?

- Yes
- No

18 19.1 If yes, what percentage of your income would you be prepared to give?

Appendix D: Interviews

1. General Information

1.1 What is your present job at the department of Housing and Utilities (DHU)?

--

1.2 What is your highest formal educational qualification?

--

1.3 How long have you been working for DHU?

--

1.4 What is your current role? Is there any specific job description on file?

--

2. Project Finance

2.1 What is the main source of project funding in general in your DHU?

--

2.2 What is the main source of project funding for:

New build asset/service post conflict/high alert conditions	Maintaining existing asset/service post conflict/high alert conditions

2.3 What mechanism (plan) is used to allocate the funds for:

New build asset/service both prior and post to conflict/high alert conditions	Maintaining existing asset/service both prior and post to conflict/high alert conditions

2.4 How would you define 'effective' related to the project funding mechanism?

--

2.5 Do you think the funding mechanism (plan) is effective with respect to new build asset/service pre and post conflict/high alert conditions? Why/why not?

Infrastructure Asset	Pre	Post	Why/why not?
Roads			
Hospitals			
Schools			
Universities			
Electricity networks			
Water facilities			
drainage			
Homes			
Public buildings			
Others. Please specify			

2.6 Do you think this funding mechanism is effective with respect to maintaining existing asset/service pre and post conflict/high alert conditions? Why/why not?

Infrastructure Asset	Pre	Post	Why/why not?
Roads			
Hospitals			
Schools			
Universities			
Electricity networks			
Water facilities			
drainage			
Homes			
Public buildings			
Others. Please specify			

2.7 How would you improve the funding mechanism for post conflict/ high alert conditions?

3. Contract Award

3.1 What is the procedure for awarding contracts in your DHU with regards to new build asset/service pre and post conflict/high alert conditions?

Pre	Post

3.2 What are the main factors (criteria) that play a major role in awarding a contract award for new building new/maintaining existing asset/service pre and post conflict/high alert conditions?

Pre	Post

3.3 How would you define 'effective' with regard to award contract mechanism?

--

3.4 Is the current contract award mechanism in the DHU effective? Why/why not?

--

3.5 Does any lobbying take place for contracts for post conflict/high alert reconstruction? How is that done?

--

3.51. In percentage, what is the probability of its occurrence?

Pre	Post

4. Evaluation Techniques, specifically LCC

4.1 What are the economic evaluation techniques the DHU utilises as a part of the decision process towards choosing to design (and subsequently build) one particular facility, when faced with a range multiple needs for different types of facility?

4.2 What are the benefits of using such techniques?

4.3 What are the key factors (criteria) used in the evaluation of options in the decision-making process?

4.3.1 Do you think any other factors should be considered in this evaluation process? If so, what are they and why?

4.4 What costs do you consider when evaluating options for pre and post conflict reconstruction projects?

Pre	Post

4.5.1 Do you include the following costs? How would you weight them?

Type of costs	Included	Why/why not	Weight%
Capital Cost			
Land acquisition costs			
Construction costs			
Overhead costs (utilities and the like)			
Cost in use after construction			
Operation costs			

Maintenance and periodic refurbishment costs			
Repair costs)			
Disposal costs			
Others, please, specify			

4.5 Do you take into consideration the whole life cost associated with an asset’s usable life? How would you define Life Cycle Costing (LCC)?

--

4.6 If you use LCC what are the costs you factor in?

--

4.7 What tools / techniques are you utilising for LCCA?

--

4.7.1 Are you utilising any of the following techniques?

Techniques	Partially Utilised	Not Utilised	Fully Utilised	Why/why not
Net Present Value(NPV)				
Discounted Cash flow (DCF)				
Internal rate of return (IRR)				
Cost-benefit analysis (CBA)				
Payback Period (PP)				
Modified Internal rate of return (MIRR)				
PP				
benefit-cost ratio (B/C)				
☒ Others, please, specify				

4.8 How would you define Life Cycle Costing Analysis (LCCA)?

--

4.9 Does your DHU utilise LCCA for any asset/service pre and post conflict/high alert conditions? If so, how?

Pre	Post

4.10 What is your estimation method(s) with regard to projects undertaken pre and post conflict/high alert conditions?

Pre	Post

4.11 Do you use any specialized software or excel sheets for LCCA? If yes, what is it? And is it appropriate for the task, in your opinion?

--

4.12 What (if any) local, national, international LCCA legislation or framework exists that requires compliance by your DHU?

--

4.13 Are there any difficulties with complying with LCCA legislation? If so, what are they?

--

4.14 What are the factors (if any) that affect the application of LCCA in your DHU?

--

4.15 In your opinion, what could be done to improve the effectiveness of the application of LCCA procedures in the DHU?

--

5. Human Resource

5.1 In general, does your DHU provide any training programs for personnel involved in post conflict/high alert reconstruction as well as in normal conditions? If yes, what are they?

Projects undertaken in normal conditions	Post conflict/high alert reconstruction projects

5.1.1 What specific training programs are provided from the following list pre-conflict/high alert conditions?

Training Programs in normal conditions		
Name	Yes/No	Why/Why not?
Reviewing/ assessing the need for a facility/service		
Reviewing/ assessing the need for maintaining an existing facility/service		
The incorporation of the facility into the overall regional development plan		
Estimating the capital cost		
Estimating the cost-in-use of the facility over its useable life to ensure its ongoing life-cycle-fit-for-purpose		
Various evaluation techniques		
Keeping up to date with evaluation techniques software as well as newly developed techniques		
Others, please specify		

5.1.2 What specific Training programs are provided from the following list post-conflict/high alert conditions?

Training Programs post conflict/high alert reconstruction projects		
Name	Yes/No	Why/Why not?
Reviewing/ assessing the need for a facility/service		
Reviewing/ assessing the need for maintaining an existing facility/service		
The incorporation of the facility into the overall regional development plan		
Estimating the capital cost		

Estimating the cost-in-use of the facility over its useable life to ensure its ongoing life-cycle-fit-for-purpose		
Various evaluation techniques		
Keeping up to date with evaluation techniques software as well as newly developed techniques		
Others, please specify		

5.2 How are training programs implemented in your DHU?

--

5.2.1 Have they been adequate for both normal conditions as well as post conflict/high alert situations? Why/why not?

5.3 Does the DHU normally partner with any training institutions or organisations, in the design and delivery of training opportunities?

--

5.3.1 What is the content of these courses? How are they delivered? Is the content of the programs adequate? If not, why not?

<p>5.3.2 How often are training programs conducted? Is this adequate in your opinion? Why/why not?</p>

5.4 Approximately what percentage of employees has received training related to post conflict/high alert situations within the last year?

<ul style="list-style-type: none"> • Internally ____% • Externally ____% • Total ____%

5.5 Approximately what proportion of the DHU's annual costs is spent on training related to pre and post conflict/high alert conditions?

Pre conflict/high alert conditions	Post conflict/high alert conditions

5.5.1 As percentage of the value of one project, can you itemized the cost breakdown of the following costs out of the overall project value?

Items	Percentage%	
	In normal Conditions	Post conflict/high alert conditions
Design costs		
Construction costs		
Training costs		
Overhead costs		

5.6 How do you continually motivate staff to work at their highest level in pre and post conflict/high alert situations?

Pre	Post

5.7 How do you reward employees' work which has reached a high standard?

--

5.8 Do you provide software training to employees who are likely to be involved in post conflict/high alert situations? If yes, how?

Pre	Post

5.9 What do you think is the most effective current motivator that could be used for personnel involved in post conflict/high alert situations?

--

5.10 What are the main challenges in your DHU regarding training & development for post conflict/high alert situations?

--

5.10.1 What are your strategies for overcoming them?

--

5.11 What do you consider to be the three major challenges currently for HR in your DHU and the main challenges over the next couple of years in relation to post conflict/high alert reconstruction?

5.12 What would you need in order to meet these challenges?

5.13 Approximately what percentage of importance do you give to post conflict Research and development?

- _____ %

5.14 How important do you think research and development is to post-conflict re-development?

5.14.1 Do you have a research and development division in your DHU? And specifically for post conflict research?

5.14.2 Why/why not?

6. Risk management

6.1 How do you define risk in your DHU?

6.2 Is a risk framework/plan being used in your DHU with respect to any projects undertaken by your DHU pre and post conflict/high alert conditions? If yes, how?

Pre	Post

6.3 At what stage is the risk management plan(s) prepared?

6.4 Pre the conflict/high alert conditions, who is primarily responsible for risk management in the department with regards to the following criteria?

Risk Identification	Risk Evaluation	Risk Mitigation	Risk Monitoring	Risk Financing

6.5 Post conflict/high alert conditions, who is primarily responsible for risk management in the department with regards to the following criteria?

Risk Identification	Risk Evaluation	Risk Mitigation	Risk Monitoring	Risk Financing

6.6 Generally, how have you identified risk with regards to any given project? What tools and techniques have been used by your DHU for identifying risks pre/post the conflict/high alert conditions?

Pre	Post

6.7 How have the identified risks been evaluated?

Pre	Post

6.8 How have you applied your internal control activities (mitigation)?

Pre	Post

6.9 Has your department reviewed new activities during the planning stage to identify and address risks? Why/why not?

Pre	Post

6.10 How have you reported and communicated the identified risk?

Pre	Post

6.11 How involved is your Board in risk management?

Pre	Post

6.12 Who reviews and monitors risks faced, their treatments and financing?

Pre	Post

6.13 How would you rate your approach to risk management?

Pre	Post

6.14 How important is effective risk management to the achievement of your DHU's objectives?

Pre	Post

6.15 Has training been provided by your DHU on: risk, risk policy, procedures and practices? If yes, how?

Pre	Post

6.16 To what degree has your DHU encouraged and resourced staff to undertake relevant training to improve their skills in risk, risk policy, procedures and practices and mitigations

Pre	Post

6.17 Has your DHU been able to allocate appropriate resources in support of risk management policy and practice? If yes, how?

Pre	Post

6.18 What are the main barriers to the provision of adequate resources in support of risk management?

Pre	Post

6.19 Have your DHU documented risk management policy? If yes, what is it?

Pre	Post

7. Post Conflict Reconstruction

7.1 Do you provide any compensation for the affected community with respect to post conflict/high alert reconstruction? Why/why not?

--

7.2 If compensation is not given, does your department consider rebuilding/repairing? Why/why not?

--

7.3 Where compensation promised was in the form of policy-statements (not in cash form), how did you communicate with the affected community that their facilities/services would be fixed in an agreed timeframe?

--

7.4 Do you think that the compensation approach is effective? Why/ why not?

--

7.5 In your state, what are the main drivers for change for future post conflict/high alert developments?

--

7.6 How vital do you think technology is as part of your planning strategy? Why/why not?

Light blue response area for question 7.6.

7.6.1 How do personnel keep up to date with technology?

Horizontal line separator.

7.8 In the recent conflict/high alert conditions, did you consider your community's requirements and needs? Why/why not?

Light blue response area for question 7.8.

7.8.1 What were their requirements'?

7.8.2 Have they been considered and implemented? Why/why not?

Horizontal line separator.

8. Asset management

8.1 What are the key assets that you manage?

Light blue response area for question 8.1.

8.2 What are your current goals in the management of these assets?

Light blue response area for question 8.2.

8.3 Please define asset management (AM)

Light blue response area for question 8.3.

8.4 What are the benefits of the AM technique?

Light blue response area for question 8.4.

8.5 What are the asset management tools and techniques that your department is utilizing? Why?

Pre	Post

8.5.1 Are you using any of the AM techniques stated in your answer to 8.5 in totality as one framework or separately, each for a particular target? Why?

Pre conflict/high alert conditions				
Technique	Separate Technique for separate goal(s)		One complete framework to achieve overall goal(s)	
	Yes	No	Yes	No
Asset Management tools and techniques				
Why?				
Post conflict/high alert conditions				
	Separate Technique for separate goal(s)		One complete framework to achieve overall goal(s)	
	Yes	No	Yes	No
Asset Management tools and techniques				
Why?				

8.5.2 In any given project, which of the following processes/strategies does your department utilize separately or as one complete framework to achieve a project's overall goals?

Pre conflict/high alert conditions		
Process	Separate Technique for separate goal(s)	One complete framework to achieve overall goal(s)
	Tick	Tick
User' requirements		
Demand analysis		
Development plan		
Condition assessment		
Evaluation techniques		
Life cycle planning		
Short term plans		
Long term plans		
Project funding mechanism		
Risk management		
Human resource management		
Operation management		
Maintenance management		
Asset information management		
Value management		
System Engineering		
Resource and development management		
Technology adaptation and catch up		
Monitoring, reviewing		
Feedback		

Post conflict/high alert conditions		
User' requirements		
Demand analysis		
Development plan		
Condition assessment		
Evaluation techniques		
Life cycle planning		
Short term plans		
Long term plans		
Project funding mechanism		
Risk management		
Human resource management		
Operation management		
Maintenance management		
Asset information management		
Value management		
System Engineering		
Resource and development management		
Technology adaptation and catch up		
Monitoring, reviewing		
Feedback		

8.6 How do you determine the need for a new asset/service in normal conditions as well as post conflict/high alert conditions?

Pre	Post

8.7 How do you determine the need for maintenance of existing asset/service in normal conditions as well as post conflict/high alert conditions?

Pre	Post

8.8 How are decisions carried out with regards to building a new asset/service in normal conditions as well as post conflict/high alert conditions?

Pre	Post

8.9 How are decisions carried out with regards to maintaining existing asset/service in normal conditions as well as post conflict/high alert conditions?

Pre	Post

8.10 Do you think that decisions with regards to the following criteria are effective? Why/why not?

building a new asset/service in normal conditions	building a new asset/service post conflict/high alert conditions
Maintaining existing asset/service in normal conditions	Maintaining existing asset/service post conflict/high alert conditions

8.11 What is your main method for asset/service valuation? How is it reported and saved?

Pre	Post

8.12 Do you think that the current asset/service evaluation method(s) is effective? Why/why not?

--

8.12.1 Suggestions for improvement?

8.13 Do you use any specialized framework for AM in the following conditions? If yes, what is it? How does it work?

Pre conflict/high alert conditions	Post conflict/high alert conditions

8.14 Which of the asset management processes do you regard as being the most effective and efficient in your organisation, with regards to the following criteria?

Pre conflict/high alert conditions	Post conflict/high alert conditions

8.15 On what basis did you select these processes?

--

8.16 What are some of the difficulties you have observed or encountered in the management of infrastructure asset with regards to the following criteria?

Pre conflict/high alert conditions	Post conflict/high alert conditions

8.17 What are the factors (if any) that have affected the adoption of AM techniques or frameworks in your DHU?

--

8.18 In your opinion, what could be done to improve the effectiveness of the application of AM procedures in the DHU?

--

8.19 Considering the recent post conflict/high alert conditions, what difficulties have you encountered with the recent refurbished/rebuilt/built assets/services? Is there any specific example can I look at and examine?

--