

**School of Management**

**Working together, apart: interpersonal communications within  
virtual team engineering projects in the WA resource industry**

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**This thesis is presented for the Degree of Doctor of Philosophy  
of  
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## Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

**Human Ethics** (For projects involving human participants/tissue, etc) The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number #...SOM-29-11

Signature: ..... Date: ...21<sup>st</sup> April 2019 .....



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## **Abstract**

As the world's engineering companies move to the use of virtual teams to deliver their projects, there is a need to better understand the factors that influence how members of these teams communicate and interact. Current research tends to be fragmented and evolving. There are studies that apply existing organisational theory to virtual teams while others focus on single facets while overlooking their complexity. This relative lack of development in research theory is reflected in problems encountered in virtual team practice situations. In light of these problems, the aim of this study is to identify factors influencing interpersonal communication among engineering project virtual team members working in the resource sector.

This study adopted an interpretive phenomenological approach in which semi-structured interviews were conducted with 35 individuals from across four different resources projects. The data were analysed using a novel combination of thematic coding and cognitive mapping from which a substantive theory about virtual project team communication was established.

The substantive theory developed in this study makes a contribution to theory in that it is one of the first to capture and integrate the macro, meso and micro environments of project virtual team communications. This multi-level model incorporates the impact of the passage of time, changes of location and varying degrees of entrainment in the project lifecycle. As such the theoretical perspective developed conveys the overall complexity of the communications environment within complex projects and provides a point of departure for future research.

This study also makes contributions to practice by illuminating previously unidentified groups of personnel working on projects whose work requires a significant amount of communication. The research draws attention to the importance of ensuring professional relationships between the project personnel (which in turn lead to an environment of trust); the need for particular styles and forms of leadership of complex projects unique to project virtual teams and the key factor of personal characteristics of team members, specifically the team members attitudes toward virtual teams.

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# 1. Introduction

## **1.1. Research subject**

This research investigates how personnel working in large engineering project virtual teams communicate and interact to deliver their required project outcomes. It explores the way in which the project organisations these personnel work within influence how they communicate, and how they themselves work within, and outside of, the organisational structures. The research explores how different personnel working in these teams value and will pursue working relationships that extend beyond the pure work boundaries, sharing personal insights and views alongside their working discussions and how these personnel recognise the role of trust in their working relationships. Additionally, this research considers the way many of these personnel frequently work outside of their core hours to undertake the communications necessary and how they select the media most useful for their communications.

The use of virtual teams in engineering projects in the resources sector has been a growing trend for the past two decades. This trend has been driven and supported by a number of factors including, increasing reliability and reach of internet technologies, scale of modern projects, particularly in the Australian resources sector where modern projects range from the billions to tens of billions of dollars and, a desire by those delivering the projects to find the most appropriate skills at the best cost across a global marketplace. However, despite this growing trend there has been little corresponding academic research undertaken in this area to fully understand how these teams form and how they communicate. The majority of published academic work has been in attempting to understand the nature of a virtual team and testing existing theories in controlled environments such as among university students. Multiple searches of the literature by the researcher have revealed only a very small number of publications which have examined virtual teams in engineering projects. This has left industry to learn for themselves through trial and error, with the resulting learnings and knowledge held within corporate structures and individuals.

The resource projects boom in Western Australia from 2006 to 2013 provided a rich environment to undertake research to better understand this emerging trend. The scale and number of projects performed concurrently, which exceeded \$400 billion in total committed capital in the Western Australian resources sector, meant that even small projects used virtual teams to access the skills they needed. It was in this environment that the data collection of this research was undertaken.

The findings of this research help to explain how virtual teams in project environments operate and differ from virtual teams in operational businesses, add to the collective body of knowledge in both management and project management and provide a basis for subsequent testing and research in the field.

## **1.2. Research setting**

This research was undertaken in Western Australia during and following the second peak of the resources development boom of the first years of the 21<sup>st</sup> century. This boom began

around 2006 and finished in around 2013, with a lull in activity in late 2007 early 2008 resulting from the global financial crisis. The boom was largely driven by demand for Western Australian natural resources centred on China's economic development and demand for commodities such as iron ore and LNG. The projects whose personnel participated in this research were all designing plant for either the mining or oil and gas industries, with every project being led from Western Australia. The organisations undertaking these projects all had their main project office in Perth, the capital of Western Australia, with second offices forming the virtual team in either Adelaide, Sydney, Singapore as well as a combination of Dubai and Sydney.

The research began in 2011, with data collection through in-person one-on-one interviews conducted between February of 2012 and the final interview in August 2013. During this period the boom in iron ore development ended as the price for the commodity collapsed, resulting in the cancellation of a number of potential additional developments and the contraction of scope of several ongoing projects. The oil and gas development boom continued for a short while longer until the oil price also dropped, however, many of the oil and gas projects were already fully committed and continued to completion in the coming years. As a result of the end of the development boom many of the projects that employed the personnel who participated in this research were closed, with the teams disbanded and personnel either reassigned within their companies or seeking work elsewhere.

### **1.3. Practical problem being researched**

There is a growing worldwide trend to adopt a virtual teams approach to the delivery of large engineering projects, with many organisations exploring the opportunities accessing global teams presents. However, while the use of these teams grows, there remains a gap in the academic knowledge and practical experience of how to deploy these teams consistently and reliably to produce predictable and successful project outcomes. With the large capital value of the projects being undertaken, identifying ways to improve the effectiveness of these project virtual teams has the potential to deliver substantial commercial and human resources benefits. The resources boom in Western Australia presented an opportunity to undertake research exploring how members of these virtual teams communicate and interact with the objective of beginning to fill the knowledge gap and offer insights back to industry that could be used to improve their work. While the research was undertaken with a specific focus on Western projects, the nature of these virtual teams means that many of the findings are expected to be highly transferable to other locations as well as engineering work outside of the resources sector.

From the latter part of the first decade of the 21<sup>st</sup> Century through to the end of the early part of the second (around 2006 to 2013), the Western Australian economy experienced unprecedented growth, driven by one of the largest resource projects booms of the modern era. The scale of the boom has been estimated to have moved the GDP contribution of the mining sector from its notional two percent in the years before the commencement of the boom

in 2005 to peak at over eight percent of the national economy in 2012/13 before beginning to tail off as the height of the boom passed (Downes, Hanslow and Tulip, 2014, p.8).

This boom placed an intense pressure on resource companies and the engineering services providers who undertake projects on their behalf, which led to substantial growth in the use of outsourced engineering services to secure sufficient personnel to deliver the work. To access these pools of personnel, all major projects adopted virtual team delivery models. This model utilised hundreds of employees in many different national and international offices in an effort to complete projects on time.

Unfortunately, many of these projects suffered substantial schedule slippage and budget over runs, jeopardising the economic success of the projects, as can be seen with projects including Chevron's Gorgon development which was \$20 billion over its original budget and the Wheatstone development which exceeded its original budget by around \$5 billion (Smith, 2016) along with a number of other recently completed projects where the final costs are yet to be publicly revealed. While there are many causes for these slippages and overruns, such as the result of a compounding of multiple similar projects being undertaken concurrently in a relatively constrained labour marketplace, and a global demand for similar skills, this research shows that some of the problems experienced resulted from the use of virtual teams by personnel who lacked experience in their use either as leaders of the teams or as team members. It has been suggested by Zakaria, Amelinckx and Wilemon (2004, p.18) that "up to 50% of virtual teams would fail to meet either strategic or operational objectives due to the inability to manage the distributed workforce implementation risks". While the causes of these failings are many and varied they are partially attributable to the immature understanding across industry of how best to organise and run virtual teams.

Tannenbaum, Mathieu, Salas and Cohen (2012) identified that both practice and academia were lagging behind the evolution and development of teams. Today's teams, they state, operate in a more fluid, dynamic and complex environment, changing more frequently, operating with looser boundaries and are more likely to be geographically dispersed. As teams are evolving, so must research and the models used to conceptualise the teams it strives to understand. Tannenbaum et al. (2012, p.21) go on to suggest that researchers must move beyond traditional cause-effect models toward a more co-evolutionary systems approach, where the reciprocal influences of variables can be better modelled and understood.

It was against this background that this research was initiated; to develop a better understanding of how members of project virtual teams communicate at an interpersonal level. This will ensure the phenomena can be better understood by academia and furnish industry with a more repeatable model for the establishment, leadership and use of future virtual teams.

## **1.4. Research methodology and methods**

This research adopted an interpretive phenomenological approach to develop an understanding of how personnel working in these project virtual teams experience the

challenges of maintaining effective communications in their daily work. Phenomenology was selected for this research as it is focussed on understanding the lived experience of those engaged in delivering these complex multi-centre virtual team projects and phenomenology provides the framework to solicit and interpret their experiences. It took the novel methodological process of combining thematic coding with cognitive mapping to analyse data gathered from 35 one-on-one interviews with project managers and professionals across a number of projects. The participants were drawn from four separate engineering companies delivering projects into the resources sector operating at the time of the data collection. The companies included a major, global engineering design organisation, two technology solutions providers and a specialist civil and structural consultancy. All projects were delivering their outcomes into the Western Australian resources sector using a project virtual team approach. Of the four projects, all had their base office in Perth with their other offices located variously in Adelaide, Sydney, Singapore and Dubai.

Additional to the four projects, a further group of project professionals who were not attached to a specific project at the time of their participation in the research were also interviewed. This independent cohort all had recent experience in virtual teams and their insights provided a reflective contrast to the immediacy of views of those working in projects when interviewed. Interview participants also varied in seniority within their project teams. Some held very senior roles such as project manager, and some held mid-level leadership roles and others were in technical delivery roles. Consequently, it was possible, through breaking the participants down into their demographic groups, to identify seven discrete cohorts of participants to compare and contrast, namely; senior personnel in the Perth home and remote offices, mid-level personnel in the Perth and remote offices, junior personnel in the Perth and remote offices and independent participants. Each of these cohorts had differing views on the themes surfaced through the research, including; how relationships and trust form and influence communications; the role of different communications media; how personnel in specific roles within the project team influence the outcomes; and how the distances, time zones and cultures separating offices influence the way in which team members communicate. All of these views contributed to the overall richness and value of the findings.

The results of the analysis were used to develop a conceptual model of the overall environment influencing interpersonal communications in project virtual teams. This model identifies and places in context the multiple influencing factors in which individuals perform their duties, enabling future researchers to continue to explore the interactions between factors to continue to build the academic understanding of this emerging project management trend and to enable organisations and personnel to better understand and plan their current and future virtual team projects. The model also recognises the change over time of the interaction and inter-relationship of many of the factors identified, with some remaining fixed while others will change and evolve rapidly as the project progresses. This chronological evolution of

project virtual teams is something which is not broadly considered in much of the existing research yet may be a critical component in understanding the nature of these teams.

While the model reflects the specific findings from this research looking at engineering projects in the Western Australian resources sector, it is believed to be transferable to similar projects executed in other locations and may well be transferable to other sectors with suitable testing.

## **1.5. Research significance**

The Australian engineering profession often encounters difficulties sourcing sufficient quantities of suitably skilled and experienced personnel for projects. This was evidenced in the large numbers of vacancies recorded during peak activity periods highlighted by the Engineers Australia vacancy trends (Stewart, 2017, p.6) which showed that during the two peaks of the resources boom, engineering vacancies grew rapidly to multiples of two to three times the rest of the labour market for both total Australian vacancies and professional vacancies.

This skills shortage frequently results in projects being executed with teams including inexperienced and occasionally under skilled members which jeopardises the outcomes of the projects in terms of schedule, cost, quality and plant performance issues, and safety risks to operators and the broader community. This skills shortage, when combined with the increasing labour costs of undertaking engineering in locations such as Western Australia, has fuelled an increasing move to adopt delivery models involving teams of personnel working in geographically dispersed locations.

The virtual teams' approach to project delivery is relatively new, having emerged in the 1990s and identified in some of the original work by researchers including that of Townsend, DeMarie and Hendrickson (1996), Hameri (1997) and Lipnack and Stamps (1999). It was at this stage that the engineering profession also began to utilise these new team structures, though little direct research has been undertaken in the engineering project environment. As with many new ideas it is being adopted and applied differently by different organisations as they endeavour to get the best from their new team structures. Communications is a key aspect of any project, even more so when participants are separated by time zones and distance. As indicated by Hamersly and Land (2015, p.2), there is "a significant lack of literature on virtual project team integration". With neither consistent organisational structures nor consistent communication patterns in these emerging teams, there is a pressing need for a solidly researched and evaluated understanding of the factors which contribute to effective interpersonal communication within project virtual teams. This research may result in the development of a deeper understanding of how project virtual teams work, and the enablers and barriers to effective interpersonal communications. This research will allow future researchers to repeat the work in similar settings to test for validity and to build on the outcomes through their own research, continuing to identify and fill gaps in knowledge.

Additionally, the findings need to address the needs and expectations of all levels of practitioners working in engineering project virtual teams, taking into consideration the divergent organisational, cultural, regional and personal values present.

There is a growing body of research covering many aspects of virtual teams, in fields such as multinational enterprises (Malhotra, Majchrzak, Carman and Lott, 2001), Information Technology (IT) (Dineen, 2005), construction management (Ochieng and Price, 2010) and the management of small organisations (Matlay and Westhead, 2005). This existing research has identified a number of factors influencing communications within virtual teams in these environments, however, this same research has indicated significant gaps in understanding. These gaps are specifically associated with communications, temporal dissonance, cultural diversity, team tenure and task complexity. These same knowledge gaps are also identified in the small body of literature specifically addressing communications in virtual project environments as requiring further study. It is these gaps in knowledge that this research aims to address.

Mihhailova (2007) proposed that the growing adoption of virtual teams has been largely facilitated by the continuing development of communications technology such as increasing internet access and speed, email and cost-effective video conferencing. The adoption of the use of virtual teams in business has seen a great deal of interest from practitioners and academics alike, and while considerable research has been performed into the effectiveness of virtual teams in fields such as multinational enterprises (Vance, 2006, Al-Ani, Horspool and Bligh, 2011, Kauppila, Rajala and Jyrama, 2011), business management and leadership (Kolb, Prussia and Francoeur, 2009) and IT (Rhoads, 2010, Algesheimer, Dholakia and Gurau, 2011), to date there is limited research specific to the application of the approach to engineering projects. This gap exists despite the scale, proliferation and complexity of these projects and the commensurate efficiencies that could be obtained from developing a comprehensive understanding of how they function.

This research contributes to building a broader understanding of how virtual teams operate in project environments as distinct to how virtual teams function in an operational setting where the majority of existing research has focussed. This research also closes gaps in understanding how distributed team members interact in a project environment and offers a new understanding as well as a fresh set of tools, techniques and methodologies for project and business managers involved in these undertakings to use.

While this research focuses on engineering project virtual teams delivering projects into Western Australia, the insights, models, tools and techniques identified and developed should be readily transferable to project teams from other fields, working in similar circumstances delivering projects in other parts of the world. Subsequent research will then be able to build on this work to explore how theories developed through this research can be applied within different industrial sectors and organisational contexts, and to examine the relationship of the developed theories to evolving communication theories.

Much of the virtual teams research has highlighted the difficulties in their establishment and management, (Patti, Gilbert and Hartman, 1997, Van den Bulte and Moenaert, 1998, Pawar and Sharifi, 2000, Lee-Kelley, 2006), with Toor and Ogunlana (2008) observing that as virtual teams become commonplace, there is a growing requirement for managers and participants to develop competencies in cross cultural leadership, communication and motivation to effectively perform their roles

Henderson (2004) proposed that the effectiveness of any project is directly related to the communication competencies of its project managers, which supported the view of Hameri (1997), who asserted that one of the main functions in management and coordination of projects is communication, and a major objective of communication is the coordination of the project teams and their members. Fox (2009) identified that project participants need to have shared understandings to achieve project objectives. However, achieving these objectives must be facilitated through the effective communication of common or team goals from the project managers to the teams and individuals. This communication of common goals is varied in its effectiveness in many project virtual teams, potentially as a result of the organisations and individuals therein being at different levels of skills development and maturity required to reap the most consistent benefits from this emergent approach.

Executing projects across cultural differences and time zones has an impact on the methods and effectiveness of messages and team relationships (Lee-Kelley and Sankey, 2008) and, as discussed by Adler and Gundersen (2008), the intercultural motivational impacts of these messages must be understood and managed at all levels within the project team for work to be successfully delivered with optimum alignment between the various teams involved.

Connaughton and Shuffler (2007) identified a number of issues within the field of virtual teams needing further study. These include the degree of virtuality, degree of distribution of the teams, the length of tenure of team members, the team members' history of working together and the complexity of the assigned tasks. Their findings have been reinforced by subsequent research which suggested that future research should examine; the relationship between team tenure and team performance (Bell, Villado, Lukasik, Belau and Briggs, 2011), how time awareness and temporal dissonance may effect team performance (Horwitz and Horwitz, 2007, Mohammed and Nadkarni, 2011) and, how effective communication can be used to maintain coordination and motivation of geographically dispersed teams (Henderson, 2008). Ochieng and Price (2009) also observed that there is an urgent need for future research to investigate guidelines or strategies for effective collectivism and communication in multicultural project teams.

The resource projects boom in Western Australia brought both challenges to get the virtual teams' delivery method right and the opportunity for this research to examine, from an academic perspective, how the approach is used. This research aims to help close what Schon (1992) refers to as the theory-practice gap by developing theories and practices that can be understood and directly adopted by industry practitioners to give their future projects more consistent outcomes. As Powell, Piccoli and Ives (2004, p.7) point out, "While virtual teams



offer a wide range of potential benefits to organisations, implementations will be at risk if organisations fail to adequately address the many challenges presented”, virtual teams must not be implemented in faith and do not represent an organisational panacea.

## **1.6. Anticipated Outcomes**

When this research commenced, it was anticipated that the outcomes would be a greater understanding of how individuals, working at different levels and in different locations within resources sector engineering project virtual teams, perceive their communication needs and experiences and, whether they see interpersonal communications as a necessary evil, key to their role or somewhere in between.

The existing research into virtual teams available when this research commenced principally focussed on broad definitions of virtual teams and testing the fit of virtual teams into existing academic theories. Much of this was either desktop, classroom based or meta-analysis, with only a small proportion performed in real world, practice environments. Recognising the lack of practice-based research and the broader focus of previous work, this research looked specifically at practice-based experience, to interview members of virtual teams in a number of different projects and at several different levels within the teams. These interviews were conducted across a broad cross section of practitioners to enable a comparison between each of the groups and a composite view of their overall experience of interpersonal communication in these complex virtual teams.

### **1.6.1. Specific anticipated outcomes therefore were;**

**A deeper understanding of the experiences and needs of personnel working in engineering projects virtual teams in the WA resources sector.** As the specific research area of this research, the challenges facing the WA resource engineering sector at the commencement of this investigation were extreme and provided a very rich landscape of data. With the unprecedented expenditure and commensurate challenges facing the industry at the time, the use of virtual teams as a delivery method was both a natural and essential solution. However, it was also widely acknowledged as an unknown and therefore risk laden way to execute projects. With Perth being such a remote centre, it was unknown at the commencement of the research how this isolation may influence the way virtual teams were perceived, deployed and managed. Equally, it was not known if the extremely high levels of activity in the Perth project marketplace would positively or negatively influence how virtual teams were perceived and how personnel in these teams communicated and related to one another.

**Understanding how experiences compare and contrast between personnel in different roles within project virtual teams.** It was anticipated that this research would reveal how personnel working in different locations within a project virtual team would communicate with colleagues in other locations, and how personnel at different seniority levels and different functions within the team would communicate with their virtual colleagues. There

had been little previous research in this area and as such it was important to understand firstly whether there were differences and if so, why and what they were. It was believed that, as with co-located teams, personnel in senior, strategic roles would have different communication requirements and patterns to personnel in technical delivery roles. Equally, it was not understood prior to starting this research how personnel in the hub Perth office of a virtual team perceived their communications when compared to personnel in the spoke or remote offices of the same team.

**Develop recommendations for the education of future virtual team members.** In the fields of engineering, project management and management the knowledge of how virtual teams are operating in practice, how they could be improved and, therefore, how to train and educate future and current members of the workforce to prepare them to participate in and lead these teams is vital. Consequently, one anticipated outcome from this research was to develop findings that could be adapted and adopted by educators to enable them to prepare students for industry as effectively as possible.

**Identify gaps and opportunities for future researchers to continue to explore virtual teams.** As the broader field of project virtual teams is still emerging and being recognised by academics in the fields of management and project management there remains much to be investigated and understood. The gaps are large and opportunities for future research in the field substantial. As this is some of the first research to investigate the use of project virtual teams in engineering projects through direct engagement with industry practitioners, and the first such work in Western Australia, it was anticipated that it would both identify the field as worthy of ongoing research and, establish a landscape on which future researchers could construct their work. Future research in management and project management must continue to be transferable and as such, academia's work must run parallel to industry's needs. Understanding a fundamental shift in the way projects are delivered is a critical trend which deserves extensive ongoing work.

**Develop guidelines for practice to strengthen how industry utilises and exploits virtual teams and gives more predictable project outcomes.** Looking to the future, an ongoing anticipated outcome from this research is to contribute to the development of a set of guidelines to be used in practice. These guidelines would be used initially in engineering companies engaged in delivering resources projects and ultimately translated into the broader virtual team landscape. Such guidelines could be used to enable businesses to standardise their practices around communications in project virtual teams and eventually the overall configuration, leadership and operation of such teams. At the commencement of this research no such guidelines and practices were identified.

## **1.6.2. Contribution of this research**

This research takes a practice driven approach to addressing the theory/practice gap, utilising what Van De Ven and Johnson (2006, p.803) refer to as engaged scholarship; the process in which "researchers and practitioners coproduce knowledge that can advance

theory and practice in a given domain". Understanding how communications between members of project virtual teams impacts their effectiveness is of pressing interest to industry and is poorly understood by the research community. By engaging with industry through extensive interviews and ongoing testing of findings it is believed that the outcomes of this study will be significant to both academia and practice. In doing so it also attempts, for possibly the first time in project virtual teams research, to develop an environmental model of these teams which depicts the full triadic person-process-context of these teams, such that the full complexity of interactions of those involved can be seen and better understood.

The methodology utilised for this research, combining thematic coding with cognitive mapping to analyse interview data collected from industry professionals, allows this research to identify the key themes in the area of interpersonal communication in project virtual teams as well as to place those themes in context relative to each other. To the researcher's knowledge, this approach had not been utilised in any previous research on virtual teams, with previous researchers focussing on individual themes without full consideration for their context. This lack of context in much of the earlier work has resulted in the field lacking a cohesive overall perspective.

Additionally, this research has produced a project virtual teams interpersonal communication environmental model. This model aims to bring together the broader environmental, organisational and individual themes, along with the impact of the passage of time, into one overarching model that illustrates how communication between members of project virtual teams changes over the duration of their project, what the key influencing factors are and how these factors intersect.

This research has also identified a previously under considered member of a project virtual team, those charged by the project with leading the human interface within the project. Much of the previous virtual team research has focussed on the most visible team members, the project managers, and treated the great majority of the rest of the team as one group. What this research shows is that the role of the interface personnel appears to be highly influential on the establishment, maintenance and use of relationships within the teams and the trust that these relationships engender and support. It is only through undertaking such research as this within a practice environment that such critical roles can be identified for deeper future exploration.

## **1.7. Researcher background**

Gaining access to the research participants for this project was greatly facilitated through a combination of the researcher's 30-year career in the engineering profession working on a large number of resource development projects for a global engineering company, and his strong connections to the Australian engineering profession through ongoing membership as a Fellow of Engineers Australia, where he also served as Western Australian Division President during 2015. He also has strong connections to the project management profession,

having completed a masters degree in project management in 2010. This experience and affiliations allowed him to use his professional recognition and credibility to gain access to organisations engaged in projects and through this, to access specific project teams and individuals.

The researcher's professional background gave him both immediate credibility with the participants interviewed for this research, and an understanding of the language used in these teams, helping interviews flow smoothly and helping position the participants roles in the overall business and project landscape.

In undertaking this research, it was important to recognise and understand the researcher's own biases and preconceptions so that they could be allowed for in the data collection and analysis. The major biases to consider were his own cultural and social preconceptions and background, linguistic differences and pre-existing experiences with virtual teams. With any modern team, particularly a virtual team with its multiple locations, there is a broad mix of personnel from different backgrounds. Individuals from different cultural backgrounds may respond differently in a research interview situation. Responses to questions will differ in length, in how they mention and discuss their colleagues, managers and subordinates and in their expectations of how their workplace functions. While these same variations will be present in any population, whether mono-cultural or multicultural, the potential for them to be more pronounced and visible and potentially impact the way the researcher and interview participant interact is greater in a research sample such as used for this research. Similarly, linguistic variability in virtual team environments such as those participating in this research must be considered. Some participants had English as a second or third language and as such, the way in which research questions drawn from the interview instrument must be asked to ensure a consistent understanding and set of responses must be carefully considered.

In considering these two factors of cultural and linguistic biases against the findings from this research, both emerged as challenges for the personnel working in the teams as much as they were challenges to be accounted for within the conscious and unconscious biases of the researcher.

The researcher's previous experience working with virtual teams provided both a benefit and a potential bias. On the positive side, having been part of a number of such teams he found he was able to quickly relate to the individuals who participated, he understood the terminology used and was able to put participants at ease in the interviews since he could explain he too had been in similar situations. On the negative however, the researcher found he had to be extremely careful in the way questions were worded and responses interpreted and managed during the interviews, to avoid filling in gaps in statements from the participants and applying his own views that could influence their responses.

## 1.8. Definitions

Research into a domain such as project engineering and the resources sector will naturally involve the use of a number of specific industry terms and acronyms. The following is a list of such terms that appear in this research to provide clarity.

**Drafty** - Several interview participants used the term 'drafty' during their interviews. This is a colloquial term for draftsman or designer, paraprofessionals who produce the engineering drawings used during the design process. In many instances, large cohorts of international personnel are engaged in this part of project delivery, making their role important in the overall success of a project.

**EPC and EPCM** - EPC and EPCM are resource industry project terms for the forms of contract typically entered into for major developments. EPC is an acronym for Engineering, Procurement and Construction and is a form of lump sum contract whereby a final price for the delivered facility is agreed at the onset of the project and the contractor then carries much of the risk for delivery. EPCM is an acronym for Engineering, Procurement, Construction and Management, a form of contract where the contractors work for and on behalf of the client and are reimbursed, typically on a monthly basis, for labour expended and costs committed. In this form of contract the majority of the risk is held by the client, who also retains substantial control over the execution of the project. During the WA resource project boom, the majority of projects awarded were of the EPCM form as the contractors were not willing to carry delivery risk for the outcomes of the projects.

**Kick off meeting** – Meeting or series of meetings held at the initiation of a project to bring together key personnel and obtain alignment and agreement on the project schedule and objectives.

**Leads** - Some interview participants refer to personnel with the role of 'lead' or 'leads', which are the lead engineers and lead designers. It is the role of these personnel to manage the delivery of their technical area of responsibility. In many virtual teams, the lead engineers and lead designers (see drafty above) responsibilities will cross the virtual team boundaries to cover the delivery of their equipment regardless of the physical location of the personnel undertaking the work.

**Resources** - An industry term assigned to Human Resources and used by some interview participants. When the word "resources" appears in interview transcripts it is often referring to personnel working within the project rather than the natural resources the project is accessing.

**Virtual Teams** - Virtual teams are variously defined as "workgroups that transcend the boundaries of space and time" (Bell and Kozlowski, 2002, p.29), or "groups of geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organisational task" (Townsend, DeMarie and Hendrickson, 1998, p.17). In this research the term project virtual team is used to separate the focus area of this work from the broader virtual team context.

**Workshare** - Used by some interview participants as an alternate term for virtual teams. While workshare is the act of distributing work within a virtual team, the term has come to be synonymous with virtual teams in some companies.

## **1.9. Aims and objectives**

The aims of this research are to identify the factors influencing interpersonal communications among engineering project virtual team members working in the resources sector, and to understand the team members resulting commitment to the projects in which they are engaged. These are pursued through expanding on existing research into virtual teams conducted in information technology, construction management, multinational corporations and other associated fields, where issues including degrees of virtuality, temporal and geographic distribution, team tenure and cultural diversity have been identified as factors influencing team performance. Therefore, the specific objectives are to:

- Examine critically current relevant theories in terms of their significance in the context of virtual team based engineering project delivery.
- Identify and assess different communication approaches with reference to how they impact on engineering project virtual team members.
- Generate a substantive theory about interpersonal communications within engineering project virtual teams.
- Determine characteristics of interpersonal communication that are evident in engineering project virtual teams.
- To further understand the complexities of interpersonal communications between members of virtual teams engaged in delivering engineering projects into the Western Australian resources sector, and,
- To map out the complex interactions and better understand how the various factors that influence successful communications relate to one another in the context of project virtual teams.

## **1.10. Research Questions**

In pursuing these objectives, the following major research question is addressed;

- How do interpersonal communications between virtual teams affect the performance of team members in delivery of engineering projects into Western Australia's resources industry?

In addressing this question, the following associated questions are addressed;

- What are the attributes of a successful communicator and coordinator in engineering projects where the virtual team approach is used?

- How do beliefs and expectations of a project's virtual team members vary at different levels and roles within the project and between the project's teams?
- In what ways do current theoretical perspectives adequately explain the relationships between interpersonal communication and the factors that make members of a distributed virtual team feel engaged and committed to the project?
- How can interpersonal communication in engineering project teams be improved?

## 1.11. Outline of Thesis

The structure of the following chapters of this thesis are as follows:

**Literature review** – a comprehensive review of the extant literature in the field of virtual teams, considering the definitions and recognised types of such teams. This will be followed by a review of the literature covering the dominant themes identified through this research of the formation of trust in virtual teams, communication in virtual teams, leadership of virtual teams, diversity in virtual teams and the role technology plays in these teams. The literature review chapter finally considers available models which can be used to interpret and understand the ways in which virtual teams operate.

**Methodology** – describes the choice of methodology used for this research and then describes in detail how the research was undertaken, including the selection, recruitment and interview of participants, how the collected data was treated and analysed using both coding and cognitive mapping techniques, the management of ethical considerations within the research along with ensuring the trustworthiness and credibility of the process and results.

**Findings** – introduces in context then presents the findings from the research by group of participants through the use of annotated quotes from the research participants. Findings from each group follow the same sequence of themes to present the reader with a concise and clearly structured view of the findings. Through this structured, cohort-by-cohort approach, this chapter demonstrates the thematic analysis of the data, where the most prevalent themes to emerge from the coding of each cohort are discussed within the context of their cohort. For each cohort, the thematic discussion is followed by the presentation of the cognitive map generated for each cohort from the coded data, along with a discussion of the overall structure and complexity of each map, the critical central clusters and any virtuous circles that emerged.

**Analysis, Interpretation and Synthesis of Findings** – This chapter presents a project virtual team communications environment model developed from the findings. The model identifies how different themes emerging from the data combine to provide a new, comprehensive picture of how interpersonal communications in project virtual teams function and how individuals within the teams are influenced by their environment. Subsequently, individual findings from both the coding and cognitive mapping are brought together to support further analysis through comparing and contrasting different cohorts, by seniority and location of their teams.

This chapter closes with a series of recommendations on how these virtual team communications can be improved.

**Discussion** – reviews the findings and analysis from this research against the existing virtual teams’ literature and describes how this research both reaffirms some earlier findings, expands knowledge in some areas and identifies a number of as yet under considered areas in need of further exploration.

**Conclusion, Contributions and Recommendations** – presents a series of conclusions and recommendations stemming from this research within the context of its limitations of scale and scope. It proposes ways in which the research findings can be used to further academic understanding of how project virtual teams communicate to support ongoing research in the fields of project management, engineering management and the understanding of complex projects. This chapter presents a future research agenda that can be pursued to continue to grow this understanding, most critically that future research should be performed with industry to fully examine the overall context of the use of virtual teams in industry.

## 1.12. Conclusion

Enhancing the academic understanding of how project based virtual teams in the resources sector communicate and interact will address a large gap in the overall knowledge of virtual team use. These teams are becoming increasingly prevalent in the project delivery landscape and will play a growing role in the success or failure of future projects. The following research closes some of these gaps in knowledge, identifies a number of as yet poorly explored but previously identified areas as well as new areas for further examination.

The following chapter presents a comprehensive review of the extant literature in the field of virtual teams. It identifies several definitions of virtual teams which have been adopted and the structures to which they refer. The chapter also covers the literature related to the dominant themes identified through this research of relationships, trust, leadership and the role of technology as a communications enabler. The literature review chapter also examines the current models that have been developed to attempt to explain some facets of virtual teams.



## 2. Literature Review

*You have no choice but to operate in a world shaped by globalisation and the information revolution. There are two options: Adapt or die.... You need to plan the way a fire department plans. It cannot anticipate fires, so it has to shape a flexible organisation that is capable of responding to unpredictable events.*

- Andrew S. Grove, Intel Corporation

## **2.1. Introduction**

This chapter outlines the current level of research and knowledge in virtual teams, providing a review of the broad virtual team literature and, specifically an examination of literature considering interpersonal communications in project virtual teams. It identifies the current level of knowledge of the form, structure, leadership and use of virtual teams, and their specific application in projects, then subsequently examines the literature to understand; what is known about attributes of successful communicators in such teams; what is known about how personnel, at different levels within virtual teams, perceive and perform communication tasks, and; how these combine to influence the way personnel may feel engaged with the project they are working within.

With the use of virtual teams still a relatively new but growing phenomena, and project virtual teams representing only a subset of the overall use of virtual teams, the research in the field remains limited. The following review of the literature covers the relevant areas of virtual teams' research as comprehensively as possible. This approach effectively illustrates the many knowledge gaps remaining before academia can consider virtual teams to be comprehensively understood.

While there have been a number of studies conducted into virtual teams over the past thirty years, they primarily focussed on organisational virtual teams without regard for specific project teams or their related issues. Researchers have examined the use of technology within virtual teams (Burke, Aytes, Chidambaram and Johnson, 1999, Qureshi, Liu and Vogel, 2006, Zhao, Rosson, Matthews and Moran, 2011), virtual teams within educational establishments, largely simulated for the purposes of research (Piccoli, Powell and Ives, 2000, Hardin, Fuller and Davison, 2007, Ayoko, Konrad and Boyle, 2012), and, most relevant to this research, virtual teams in projects (Henderson, 2008, Lee-Kelley and Sankey, 2008). The very small number in engineering projects and engineering organisations researched include examples such as the work of Ochieng and Price (2010). Though, again, much of the research has focussed on discrete factors such as cultural and temporal influences, and the technology utilised by the team. Little research has specifically focussed on the use of virtual teams in major engineering projects within the resources sector and none to date with a specific focus on the Western Australian resources sector.

Between 2004 to 2014, the Western Australian resources sector was characterised by the massive scale of projects being undertaken. For example, in March 2012 the Western

Australian department of mines and petroleum listed 24 projects out of a total of 35 which were either underway or in the planning stage valued in excess of \$1 billion, four of which were valued in excess of \$10 billion (Department\_of\_Mines\_and\_Petroleum, 2012). Some \$400 billion was spent on new and expanded facilities across the iron ore, oil and gas, gold and other natural resource industries. The sector is also characterised by the scale and remoteness of the landscape, with virtually every major project being situated at substantial physical distance from population centres. The small Western Australian engineering and construction workforce and high local labour costs also contributed to the challenges of undertaking these projects. These issues have increasingly driven organisations to adopt virtual team strategies to enable them to deploy sufficient skilled personnel onto their projects to complete them in a timely manner. Discussions with industry practitioners prior to commencing this research suggested that the issues faced within these teams were substantial, placing the productivity of their projects in serious jeopardy.

## **2.2. Broad Virtual Teams Research**

To begin exploring virtual teams and project virtual teams it is first necessary to explore the origins of the phenomena, from its early beginnings with researchers working to define and differentiate a virtual team from a more traditional, co-located one. After a number of earlier editions that made no mention of virtual teams, the 2017 update of the Project Management Institute's Project Management Body of Knowledge (PMBOK) recognised the need to address the phenomena, observing that the globalisation of projects promote the need for virtual teams, working on the same project, but not co-located, with these teams made feasible by modern communication technology such as email, audio and video conferencing, and web-based meetings. They go on to observe that such teams offer unique advantages, such as using special expertise even when the expert is not in the same geographic area. However, they also comment that the challenges of managing virtual teams fall primarily in the communication domain, including managing feelings of isolation, knowledge sharing and experience between team members, as well as difficulties monitoring project productivity and progress (PMI, 2017) However, while acknowledging the existence and some of the challenges of these teams they offer few solutions for their support or deployment.

The following sections of this chapter examine the current state of the virtual teams literature as it applies to projects in general and, where available, engineering projects. It firstly examines the broad initial literature considering definitions of virtual teams and their typology followed by reviewing the major themes emergent from both the literature and the research captured in this thesis of; the role of trust in virtual teams and how relationships between team members may contribute to this trust; communication between members of virtual teams and how time zone differences may impact this communication; leadership in and of virtual teams and project virtual teams and the different models proposed and examined in the literature; the role of diversity in virtual teams including team member diversity, national culture diversity and heterogenous and homogenous diversity and; the role of technology and communications

media in virtual teams. Following this a number of models to describe the interactions between team members in virtual teams are explored and the model used in the analysis of this research is introduced.

In contrast to much of the existing and ongoing research in the field of project management which has a strong focus on systems and practices which are largely linear and behave in clear and predictable ways, understanding the interaction of members of project virtual teams to better understand how they communicate and interact incorporates a large socio-psychological aspect where it is necessary to consider the beliefs of the individuals and how their roles and interactions influence their subsequent actions and behaviours. In addition to these socio-psychological traits, while the majority of project management research is dominated by linear, causal, clearly defined deterministic perspectives (Padalkar and Gopinath, 2016), the findings from this research are characterised by a largely non-linear environment where relationships between themes and factors are cognitive with inferred directionality.

### 2.2.1. Virtual Teams in the Literature

Virtual teams first began to appear in the human resources and IT based literature in the mid to late 1990s. Organisations were beginning to recognise the potential to operate globally through the use of the emerging internet, using electronically mediated communications to link groups of personnel rather than requiring personnel to relocate at substantial expense to both the business and the individual (Townsend et al., 1996). However, as Bergiel, Bergiel and Balsmeier (2008) observed, virtual teaming was not often planned methodically, but developed to capitalise on the opportunity presented by the emerging communications technologies. One of the first and, possibly the most enduring definitions of a virtual team was subsequently provided by Townsend et al. (1998, p.18) who described them as “groups of geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organisational task”.

Some researchers, such as Lee-Kelley and Sankey (2008) have recognised that virtual teams may also be temporary in nature, with the use of the term temporary being one frequently associated with project teams rather than operational teams. While the definition established by Townsend et al. (1998) has remained the dominant definition of virtual teams in the intervening 20 years, it is broad, leaving virtual teams open to research from many directions.

Three different forms of virtual organisations were outlined by Riemer and Vehring (2012):

1. An **internal virtual organisation**, where all relationships are within the one organisation, with offices and personnel distributed across multiple centres,
2. A **network virtual organisation**, where multiple organisations pool their competencies to swiftly exploit opportunities or undertake a project, and
3. An **outsourcing virtual organisation**, where one focal business outsources much of its value creation to a number of separate suppliers.

Each of these structures have different motivations and characteristics, yet all can be considered as some form of virtual team.

Bergiel et al. (2008) summarise the principal reasons organisations pursue the use of virtual teams as; reducing travel time and cost, recruiting talented employees from a global rather than local skill pool, leveraging the heterogeneity inherent in the majority of virtual teams to engender enhanced originality and creativity, providing equal opportunities in the workplace by removing access obstacles that would otherwise inhibit full participation by some personnel and, discouraging age and race discrimination through conducting business on-line rather than face-to-face.

However, Bergiel et al. (2008) also point out a number of downsides and barriers to successfully operating a virtual team such as; a lack of technological expertise in some employees, a general lack of knowledge among employees about high-level technological application used to enhance virtual teaming, that a virtual team may not be the best structure for every task and business, and that some personnel may not be psychologically suited to working as part of a virtual team.

A research agenda to build an empirical understanding of virtual teams was first proposed by Furst, Blackburn and Rosen (1999), who suggested there were two reasons for the absence of such research at the time. They believed that firstly, the relative newness of virtual teams, leading to an initial descriptive phase of academic work and secondly, that managers and academics alike had not yet recognised that working in a virtual environment may require different approaches to working in a traditional, co-located environment (Furst et al., 1999). They further suggested that some researchers may not have explored virtual teams as deeply as they perhaps should, believing that conventional theories would readily translate to the virtual environment. In addition, Furst et al. (1999) proposed a range of areas for future investigation to allow a deeper understanding of virtual teams. These recommendations were built on the group effectiveness model proposed by Hackman (1983) and include;

- Building a deeper understanding of the organisational context of virtual teams, including evaluation and compensation systems, training and development, information systems and corporate culture,
- Building a better understanding of how group design is undertaken in virtual teams, and how this differs from similar activities in co-located teams. Specifically examining the characteristics of organisational tasks undertaken by virtual teams, how hierarchy is established in a virtual environment and what technological requirements are required to complete assigned tasks
- Building a greater understanding of the synergies established within virtual working environments, with consideration of how team members are socialised in comparison to those co-located environments, how team goals may guide member behaviour and how consensus is achieved.

Recognising that, at the time, little empirical research had been performed to understand the dynamics of virtual teams, Furst et al. (1999) were of the belief that there was a need for substantial directed work to be undertaken, stating that “We now need to know more about making the human collectivity, the teams, more virtuous” (Furst et al., 1999, p.267).

Later that year Lipnack and Stamps (1999) built on the emerging research to recognise the concept of virtual teams as a new way of organising a business, one that was enabled by electronically mediated communications, releasing personnel from the historical requirements of attending a common place of work. They believed that while virtual working environments, which they refer to as networked organisations, were part of the new, evolving way of working, they would not replace previous practices, practices which were dominated by co-located work. These virtual working environments would instead become an additional way for businesses to deliver their outcomes. They stressed that “the key is to select the best form of organisation for a particular kind of work” (Lipnack and Stamps, 1999, p.14) rather than use the same form of organisational structure regardless of its suitability to the task at hand.

The work of Furst et al. (1999), and of Lipnack and Stamps (1999), was followed by that of Martins, Gilson and Maynard (2004) who reviewed the then state of research into virtual teams, referring to it as pre-paradigmatic, needing to be advanced to form a more meaningful basis for future academic enquiry and practical application. They found that around 60% of professionals self-reported as working in some form of virtual team. They believed this reflected the rapid advances of enabling technologies used to bring virtual team members together.

The challenge of understanding and managing the social and managerial issues associated with virtual teams was first considered by Piccoli et al. (2000). They observed that organisations need to use information technology to rapidly engage the skills of relative strangers in a virtual organisational structure, a structure that may form only for a short period then disband once its allocated task has been completed. To this end, their research considered how traditional managerial methods transfer to a virtual team, and whether coordination and communication fully mediate the relationship between control of the team and its output. They found that self-directed virtual teams were more likely to be successful and produce better outcomes than those subject to high levels of direct control. In their later work, Piccoli, Powell and Ives (2004) tested the impact managerial controls have on the effectiveness of virtual teams, observing that the highest levels of team member satisfaction were found in teams with effective communication and coordination. This reaffirmed their earlier findings that members of self-directed teams exhibited greater levels of satisfaction and that the types of control structure put in place made little difference to the outcomes of the teams.

In refining the definition of a virtual team, Martins et al. (2004) proposed the use of an Input > Process > Output model to establish how a virtual team functions. They identified a series of moderators appropriate for virtual teams of; task type, time, social context, support and coaching, leadership structure and organisational culture (Martins et al., 2004). They also

identified a number of variables in their virtual team model they believed required further research. These included the role of diversity including age, race, organisational tenure and personality, the impact of dispersed organisational affiliations resulting in conflicting loyalty, how the size of a virtual team may impact its effectiveness, along with unresolved questions around the definition and execution of leadership in virtual teams. In their review of the literature to date, Martins et al. (2004) also identified that much of the research had examined the differences between virtual teams and their co-located equivalents. Their recommendation was that future research should work toward examining the effectiveness of virtual teams and their functioning. Martins et al. (2004) also recommended that, as the great majority of empirical research to date had been conducted in laboratory settings (in their work they reviewed 93 separate empirical studies of which only 13 used 'real teams' with the balance made up of 66 lab studies and 14 case studies), it was critical that future research investigate real world situations. In making this recommendation Martins et al. (2004) recognised that obtaining such data is not always easy, but that the transferability and real world relevance of the research was highly important.

Many virtual teams are perceived as experiencing challenges due to dislocation and a reduction in social interaction between members when compared to traditional teams, resulting in lower levels of performance. Geister, Konradt and Hertel (2006) attributed some of this to the timely and meaningful provision of feedback to team members. In their research, they tested the VIST model (Hertel, 2002) to understand how it applied to feedback in virtual teams. The VIST model is named for an acronym of Valence, Instrumentality, Self-efficacy and Trust, where Valence is the subjective importance of team goals for team members, Instrumentality is the perceived indispensability of individual contributions, Self-efficacy is the perceived capability to fulfil tasks required in a team and Trust is regarded as a willingness to rely on an event, process, individual or group in whom one has confidence. This model was developed to measure the degree of impact of each factor on the efficacy of a virtual team. Geister et al. (2006) found that, while individual members of virtual teams have different feedback requirements and expectations to maintain expected levels of motivation, with some needing regular, frequent phone calls while others may be happy with bi-monthly conversations, making it necessary to find the right balance for each individual team member. Overall, providing feedback was perceived as being useful in maintaining motivation in virtual teams.

Luse, McElroy, Townsend and DeMarie (2013) explored the relationship between personality and a preference for working in a virtual team. They suggested that while personnel may be selected for a virtual team based on their technical skills, selection for a co-located team is heavily influenced by personal characteristics. Their findings suggest that an individual's openness to new experiences will positively influence their desire to participate in a virtual team and, that those considered extraverts may also have a preference toward working within a virtual team, as they are considered more likely to form trust in virtual environments when compared to those considered to be more introvert.

Knowledge sharing in and by virtual teams was considered by Kauppila et al. (2011) who suggested that virtual teams may be one solution for multinational organisations to share their corporate knowledge. They found that through the use of web portals and sharing platforms, some members of virtual teams were able to share their knowledge globally within the organisation, making otherwise hard to identify and access skills and knowledge readily available to the broader workforce. How knowledge is shared within a virtual team environment, particularly knowledge that may be 'hidden' in remote offices was part of the research by Baba, Gluesing, Ratner and Wagner (2004). They explored whether a global virtual team could be a good vehicle for knowledge sharing and sought factors that influence the sharing of knowledge in such a team. They found that, where significant cognitive differences persisted, it was not possible to build a knowledge sharing environment, and that the persistence of differences led to affective conflict. They also found that divergent perspectives of business and social culture found within the two nationalities represented in their case study (American and French) contributed to a breakdown in the ability of the parties to openly share, ultimately creating new barriers to sharing.

Drawing on the work of Lewis (2000) exploring paradox's in the workplace, Dubé and Robey (2009, p.8) identified and explored five virtual team paradoxes through interviews with a number of members of virtual teams, the paradoxes they explored were; that virtual teams require physical presence; that flexibility of virtual teamwork is aided by structure; that interdependent work in virtual teams is accomplished by members' independent contributions; that task-oriented virtual teamwork succeeds through social interactions, and; that mistrust is instrumental to establishing trust among virtual team members. They found that while most of these paradoxes are real, there are ways members of virtual teams navigate them. Physical presence was addressed through face-to-face meetings and the use of technology such as video conferencing, flexibility and structure can be addressed through careful planning of roles and responsibilities, and interdependent work by independents is addressed through structure and collaboration.

### **2.2.2. Types of Virtual Teams**

Recognising the growing trend toward the use of virtual teams and the lack of understanding of how they function, Bell and Kozlowski (2002) undertook a review to identify differences between virtual and co-located teams and consider different typologies of virtual teams. Much of the previous discussion of virtual teams had considered virtual teams as a generic, homogenous form of team. However, Bell and Kozlowski identified that there are a great number of different forms of virtual team. This view was reiterated by Gibson and Gibbs (2006) who, in their work examining how degrees of virtuality affect the ability of a team to be innovative, observed that while much of the early research into virtual teams assumed that a team was either wholly virtual or wholly co-located, the reality is far more complex, with teams having degrees of virtuality. Three basic forms of team were subsequently considered by Staples and Webster (2007):



- Traditional teams, where all members are co-located,
- Hybrid teams, where some members are co-located, and others are distant and,
- Distributed teams, where all team members are located separately from each other.

Of these, both hybrid and distributed teams can be considered virtual since both models include at least some personnel working at a distance.

Qureshi et al. (2006) proposed that among the various characteristics that define different forms of virtual team are; team size; geographic dispersion; team members tenure and shared experiences; the complexity, uncertainty, difficulty and ambiguity of tasks being undertaken by the team; the choices of communication technologies made by and available to team members; project management strategies employed by and for the team, and the ways in which the team communicates, shares information and maintains co-ordination.

From their work it can be seen that there are many different forms a team can take and still be considered virtual.

Duarte and Snyder (2001) recognised seven different forms of virtual teams; networked teams, parallel teams, project or product development teams, work or production teams, service teams, management teams and action teams. Each type of team is formed, defined and structured dependent on its role (Duarte and Snyder, 2001, pp.5). They went on to suggest that each of these teams require a different form of leadership and management and brings its own unique challenges and opportunities. Despite only being formed for short periods, the performance of virtual project teams was considered by Powell et al. (2004) as having a profound impact on the performance of an organisation, and while they offer a wide range of benefits to their businesses, without sufficient consideration of the many challenges presented, there are also a large number of risks.

In comparing temporary and ongoing virtual teams, Saunders and Ahuja (2006) differentiated between two types of virtual team based on their perceived task lifespan, with temporary teams formed to accomplish a single defined task while ongoing teams undertake multiple, often repetitive tasks to accomplish their overall goal. They categorised teams which would be regarded in conventional, co-located team literature as either being functional or managerial as ongoing, while they considered project and ad-hoc teams as temporary. In this they considered teams who know they will have an ongoing collaborative relationship as ongoing, while teams with no specific indicator of a future of working together as temporary.

In their work, Bell and Kozlowski (2002) went beyond considering a virtual team as being equivalent to a co-located team, differentiated only by the fact that team members are not physically proximal. They looked for the different forms a virtual team can take, stating that “we believe there are deeper distinctions that can be revealed through an exploration of the dimensions that distinguish different types of virtual teams” (Bell and Kozlowski, 2002, pp.21). Drawing on the work of Sundstrom, de Meuse and Futrell (1990), Bell and Kozlowski (2002) outlined how virtual teams are distributed in spacial distance and communicate through technological mediation, while conventional teams are spatially proximal and communicate

primarily face-to-face. These two differentiators were then identified as contributing to the challenges faced by the leaders of virtual teams, in that the coordination functions traditionally performed face-to-face now needed to be accomplished by substitutes and by distributing functions within the team. Bell and Kozlowski (2002) also noted that as tasks become more complex, the necessity for more precise forms of communication also increases, placing additional pressure on the communications between members of virtual teams.

Within the continuum of forms of virtual teams, there are those where personnel are either working individually as part of their virtual team, or who have freedom within their roles to work completely separate from their colleagues. For some personnel, however, there remains a strong desire to have a co-located office experience. Rockmann and Pratt (2015) investigated the motivations and preferences of personnel working in an organisation where they were free to choose their work location. Among their findings was that, "it was clear that the version of the onsite office where co-workers socialise and brainstorm no longer existed" (Rockmann and Pratt, 2015, p.155) and, for some personnel, this environment was something they missed. The absence of any co-location meant that it was now difficult to have spontaneous, dynamic, interactive discussions. Additionally, Rockmann and Pratt (2015) found that, for some, the social isolation associated with most personnel working from home became a self-fulfilling prophecy. As more personnel were home based the attraction and expectation of social interaction in the office diminished, leading to more personnel working from home.

The broad spectrum of forms of virtual teams outlined above therefore makes it extremely difficult both for practice and academia to develop effective, generalised guidelines and best practices that cover all forms of these teams. As Staples and Webster (2007) observed, each virtual team is a unique instance, and while some research and practice findings may be transferable, many will not, indeed, some may even be destructive if applied without due consideration.

As can be seen from the work discussed above the field of project virtual teams is still an emerging one with many substantial identified gaps in need of closing. It is also evident from the above that much of the existing work takes the form of either a meta-analysis or study in a simulated environment using university students as the research participants. This existing research has, however, identified many of the areas relevant to furthering the understanding of how these teams' function and team members communicate. These areas are discussed further below.

### **2.3. Trust in Virtual Teams**

Trust and the relationships that lead to the development of trust were strongly identified as key factors influencing the effectiveness of a project virtual team (DeRosa, Hantula, Kock and D'Arcy, 2004). Forming and maintaining this all-important trust in a project virtual team has its own specific challenges. As such it is necessary to understand how trustworthiness, the "interactive process that affects, monitors, and guides members' actions and attitudes in their

interactions with one another, and that ultimately determines the level of trust that exists between them” (Kasper-Fuehrer and Ashkanasy, 2001, 238-9) is demonstrated and communicated in these temporary virtual undertakings.

### **2.3.1. Relationships**

Saunders and Ahuja (2006) observed that prior contact and working relationships precede and enhance the development of trust, with the cognitive component of trust building through observing how virtual team colleagues perform and deliver their assigned tasks. This observation leads to faith that colleagues will continue to complete work as agreed, increasing the team members’ overall level of satisfaction and building a shared understanding that the team will continue to adhere to developing norms. Peters and Manz (2007) observed that collaboration, the purposeful process resulting from a desire to solve a problem or create something, requires that team members must have an open mind and, both listen to and trust their teammates. They argue that, as collaborative virtual teams have become more commonplace the coordination of these teams has come to depend increasingly on trust rather than formal authority, believing that without trust, individual team members would be unwilling to accept the risk that a team member will act in the interests of the team rather than their own. Building collaborative relationships through face-to-face interaction early in the formation of a virtual team is once again suggested by Bergiel et al. (2008) as an effective way to start to establish trust.

### **2.3.2. Trust**

Research by Gillam and Oppenheim (2006) found that trust is vital to prevent geographical and organisational distances from becoming psychological ones. The subsequent work of Breuer, Hüffmeier and Hertel (2016) which reviewed 52 earlier studies found a positive overall relationship between team trust and team effectiveness. O’Leary, Orlikowski and Yates (2000) suggested that this need for trust results from the inability of virtual team members to actively and physically monitor their virtual colleagues work, leading to a reliance on trust that the work is being performed. Successfully building and maintaining trust results in alignment of work, quick and easy exchange of information, improved task collaboration, increased job satisfaction and utilisation of personnel. However, Gillam and Oppenheim (2006) further suggested that not every virtual team member will build and maintain trust in the same way, instead, each individual will do so based on their own cultural and personal preferences and norms. They also identify several different ways communication can facilitate trust; through early communication that conveys enthusiasm and initiates social dialogue; through coping with task and technical uncertainty without attempting to apportion blame for issues faced; through maintaining predictable communication in an organised, timely, accurate and concise manner and; through establishing balanced, pragmatic leadership and a task focussed environment while remaining calm under pressure.

Both Cummings and Bromiley (1996) and Bergiel et al. (2008) suggested that trust is established within a group when an individual believes the group makes appropriate efforts to

behave in accordance with both explicit and implicit commitments, behave with honesty in any negotiations around how interactions will be undertaken, and resist taking unfair advantage of their colleagues even when opportunities occur. While Cummings and Bromiley (1996) principally focussed on co-located teams, they considered that many beliefs were readily transferable to understanding the formation of trust within virtual teams.

The specific need to understand how trust is established, built and maintained in virtual teams was first discussed by Jarvenpaa and Leidner (1999, p.792) who observed that “trust is pivotal in a global virtual team to reduce the high levels of uncertainty endemic to the global and technologically based environment”. They proposed that such trust in virtual teams would need to address issues related to shared social norms, repeated interactions and shared experiences, and would be built through understanding cross cultural communications. Greenberg, Greenberg and Antonucci (2007) outline the two different ways in which trust is developed;

- **Cognitive trust**, the result of an evaluation of evidence of performance, reliability and competence and,
- **Affective trust**, the result of the building of social bonds in which a genuine care for the wellbeing of the other party is recognised.

It is also suggested by Peters and Manz (2007) that an additional form of trust, **organisational** or **institutional trust**, where individuals build confidence in one another based on their compliance to the norms and rules of the organisation should be considered.

In considering the requirement for swift trust, Jarvenpaa and Leidner (1999, p.794) ask “from where is trust imported and how is it to be maintained via electronically mediated communication”. Much of the research on trust in virtual teams, including that of Jarvenpaa and Leidner (1999) and Greenberg et al. (2007), indicates that trust begins to form from first contact and, while a certain level of trust may be imported, the principal determinants for the formation of high levels of trust derive from task focussed correspondence, timely responsiveness and clarity of communications. The limitations of the work of Jarvenpaa and Leidner (1999), however, are similar to much of the work undertaken by others when investigating virtual teams. The research was performed using university students in what Martins et al. (2004) refers to as lab study groups, formed artificially and, where rewards for performance were grade based. While this and other similar simulated environment work, while valuable, may need to be tested in practice based teams to understand its full relevance since within these practice based teams, the formation of the team is determined by the business and any rewards may well be much less tangible, less timely and team rather than individual related.

The three facets identified by Lipnack and Stamps (1999) as underlying their work are Purpose, People and Links, with trust highlighted as the number one influence on how people build and maintain their links. They state that “seemingly irrelevant, unrelated-to-work conversations build trust that will make their working relationships more effective” (Lipnack

and Stamps, 1999, p.19). The need to put in place a working environment that engenders a high degree of trust between personnel in virtual teams was further discussed by Duncan and Panteli (2001), who proposed that the two principal factors needed are;

- Collaborative systems to enable interactivity and information sharing among participants, and
- A redesign of the role of the facilitator or remote manager to better incorporate the requisite skills and abilities needed to support team building of the virtual team and their ongoing collaboration.

The establishment of interpersonal and intraorganisational trust and commitment was also identified in the work of Lee-Kelley, Crossman and Cannings (2004). They considered trust an important component of the formation of virtual teams. Indeed, they indicated that without trust and commitment being established, the virtual team would be unable to perform to their required levels. However, Lee-Kelley et al. (2004) also found that as their research participants were expected to 'hit the ground running' there was little opportunity or consensus for how trust should be encouraged in their virtual teams. Lee-Kelley et al. (2004) supported the position of Handy (1995), that building trust in virtual teams required physical contact, and that once formed, teams can operate effectively with little to no additional face-to-face meetings, though such meetings were highly important at the start of the relationship.

Saunders and Ahuja (2006) suggested that different types of virtual teams (temporary and ongoing) have different needs and processes for developing trust. They observed that temporary virtual teams, brought together for a single task, may not need to develop trust since they will only collaborate for a short period on their objective, while ongoing virtual teams will have both a need, and find ways to develop trust within their group, due to the anticipated duration of their collaboration. However, in their work, Saunders and Ahuja (2006) do not identify at what point a virtual team ceases to be considered as temporary, an important question since in many resources projects, temporary teams may be formed to work together for several years, a duration which could make the distinction between an ongoing and a temporary team difficult.

In exploring paradoxes in virtual teams Dubé and Robey (2009) suggested that mistrust is instrumental in establishing trust among new members of virtual teams. They state that "members of teams were only trusted after proving themselves trustworthy through meeting performance expectations. Trustworthiness was judged mainly through monitoring early performance" (Dubé and Robey, 2009, p.20), and that trust in virtual teams is built on culture, profession, position and experience.

A series of steps for the building of trust between members of a virtual team was suggested by Greenberg et al. (2007). They propose actions by both members and managers as they move from team establishment through to accomplishment of their assigned task. They describe why it can be hard to maintain trust in a virtual team, ascribing difficulties to the challenges of diverse locations and technology enabled communications, where the difficulties

of sustaining highly nuanced conversations using electronic platforms, can lead to misunderstanding and misinterpretations. Similar findings were surfaced by Lee-Kelley and Sankey (2008) in research they undertook between European and Asian offices of a finance business, where they identified a number of instances where emails demonstrated a clear level of mistrust between personnel.

In exploring the role of trust and functional diversity on virtual project team performance, Peters and Karren (2009) found that as trust among team members increased so did their perception of overall team performance. In addition Peters and Karren (2009) proposed that, in a virtual setting where traditional forms of control are not possible, team members rely on trust as the primary determinant of whether they believe the team will be successful, and that the perception and belief in future success greatly affects the efforts and contribution of the team members.

The majority of virtual team trust research undertaken to date has been within the confines of ongoing virtual teams rather than project environments and simulated teams such as the use of university students as participants. Consequently, while trust is established as a major contributor to effective virtual team and project virtual team communication, little actual testing has been documented in practice environments.

## **2.4. Communication in Virtual Teams**

The use of electronic media to undertake the great majority of communications between members of virtual teams is one of the defining characteristics of a virtual team. The advent of accessible, reliable internet enabled communications tools was one of the principal enablers to the development of the approach. While there has been a meaningful level of research into the broad approaches to communication in virtual teams, it remains an area needing ongoing work so that communication patterns and preferences in different environments, including where team members are separated by time zones, can be fully comprehended.

Communication and social interaction has been identified by a number of researchers including Lee-Kelley et al. (2004), Gillam and Oppenheim (2006), Qureshi et al. (2006) and Saunders and Ahuja (2006) as a large part of team building, maintenance of personal and working relationships and to play a central role in virtual team performance. Indeed, Qureshi et al. (2006) noted that effective communication is vital for virtual teams that cannot meet face-to-face. Yet, for virtual teams, there are many limiting factors preventing traditional forms of interaction between colleagues who are not co-located. Through the restricted, or in some instances unavailable opportunities for face-to-face interaction imposed by their geographic separation, members of many virtual teams have limited ways of undertaking what Stough, Eom and Buckenmyer (2000) refer to as the visual rituals of team development. Similarly, the interaction between a manager or leader and their team members is also severely restricted, with the leader of a virtual team required to simultaneously manage personnel in a number of different locations.

Lee-Kelley et al. (2004) found that every team participating in their research reported that face-to-face contact was critical to the success of the project, and that there was a distinct belief that longer, but less frequent face-to-face meetings were better when dealing with relationship and task issues, with the longer time together allowing for negotiation and acceptance of team goals and outcomes. Lee-Kelley et al. (2004) also found that teams who undertook a face-to-face meeting to establish project norms and requirements generally delivered better project outcomes than teams that did not manage a face-to-face meeting early in the project. Specifically, in relating their work to that of Tuckman (1965), Lee-Kelley et al. (2004) believed that holding face-to-face meetings during the 'forming' and 'storming' phases of a team's lifecycle allowed members to build relationships and resolve the conflicts and interpersonal polarisations that characterise these two stages.

In their research, DeLuca and Valacich (2006) considered the need for different communication media to accomplish specific outcomes. That to accomplish a task, the media choices must allow for two principal processes to be pursued; the conveying of information and the processing of the information toward convergence at a shared meaning. They asserted that data is typically transmitted through the use of low synchronicity or asynchronous tools such as email, while high synchronicity, or synchronous tools such as telephone, video and face-to-face are better suited for the convergence process. It is also their belief that teams with an established history of collaboration require a different mix of tools and platforms to one with no shared history. The work of DeLuca and Valacich (2006), performed on 'real world' technical teams, also found that most participants preferred to exchange complex technical information using asynchronous means such as email, feeling that they were able to think more about both the messages being sent and received. As one participant stated "*I think about it more, write, rewrite, rewrite*" and "*I'm a logical person. I like to see replies and threads – logical and made sense*" (DeLuca and Valacich, 2006, p.333-334). Many participants in this research also reported enjoying the freedom afforded to their calendars of communicating asynchronously, allowing them to work on what they needed when they needed, rather than having to attend face-to-face meetings at prescribed times and dates.

Gillam and Oppenheim (2006) suggested that there were a number of new challenges associated with establishing an effective communication strategy to underpin a virtual team, including; new literacies to cope with continuously evolving and emerging communication technologies; understanding and managing the spread of information to ensure the required information gets to the right recipients, regardless of location, while also ensuring the workforce is not overloaded with unnecessary information; maintaining communications records in a continuously evolving electronic communications world; balancing accountability with electronic protectionism and a potential to develop a blame culture; ensuring overall inclusivity within the virtual team so those in peripheral locations are not omitted from communications; managing the overall accumulation of knowledge within the organisation to avoid both 'reinventing the wheel' and the 'not invented here syndrome' and; ensuring personnel don't experience social isolation through geographic isolation or reliance on

electronic media for communications. All of which they believe must be considered when planning and developing a virtual team environment.

As part of their research into leadership practices in virtual teams, Malhotra, Majchrzak and Rosen (2007) found that, in the absence of a common set of communications procedures, each location would default to its local practices, resulting in substantial gaps in messaging and a lack of team cohesion. Malhotra et al. (2007) therefore assert that it is necessary to have agreed common procedures in place to ensure commonality of approach to communications.

A lack of timeliness of communications and poor clarity of roles were identified by Lee-Kelley and Sankey (2008) as causes of problems within the virtual teams they investigated, suggesting that it is important to have absolute clarity of roles and responsibilities among team members to avoid delays, overlaps or gaps. Lee-Kelley and Sankey (2008) also observed a high reliance on email communication among their participants, where the volume reflected a combination of keeping others informed and maintaining a record of decisions. They also observed some personnel experiencing email overload, when the volume of email received exceeded their capacity to read and manage them.

A number of tendencies with communication in virtual teams were identified by DeSanctis and Monge (1999) and tabulated by Saunders and Ahuja (2006, p.681). That; over time, communication volume increases but efficacy decreases; that comprehension of messages becomes more difficult; that forming consensus becomes more difficult when communicating over electronic media; that greater levels of member participation and more lateral communication develop; that users will develop particular styles of technology use to suit the environment and; that interpersonal relationships will deepen over time.

In studying the effectiveness of training on the quality of communications within virtual teams, Beranek and Martz (2005) found that, where teams received communications training they exhibited more cohesiveness and satisfaction. Both are factors which had been shown to increase team members' ability to interact in a positive and constructive way and improve the overall performance of the team. Building on this, Hunsaker and Hunsaker (2008) observed that communication within a virtual team can be made more difficult where team members have different cultural perspectives. In these situations, messages will be coded through the cultural lens of the sender and decoded through the cultural lens of the receiver, leading to potential misunderstandings and conflict.

While dispersed teams of personnel may not communicate as regularly and efficiently as co-located teams, research by Reed and Knight (2009) found this did not equate to a higher project outcome risk. Their research did, however, indicate that there was more risk to the success of the project from insufficient transfer of knowledge. Reed and Knight (2009) proposed, therefore, that while electronic communications may support virtual team effectiveness, it did not allow for informal transfer of knowledge and the sharing of both tacit and implicit knowledge as effectively as occurs in co-located teams.



### **2.4.1. Impact of Time Zone Differences**

Time zone differences are a common factor identified as differentiating virtual teams from traditional co-located teams and, as Rutkowski, Saunders, Vogel and van Genuchten (2007) observed, the impact of temporal separation associated with this difference has been identified by many researchers as being one of the fundamental obstacles to effective communications within these teams.

While not every virtual team is separated by time zones, with many operating in a single time zone even if separated by great distance, every team separated by time zones can be considered virtual. Rutkowski et al. (2007) compared task focussed individuals, i.e. preferring to work on one task at a time, with multitaskers, i.e. those comfortable working on multiple tasks concurrently, to determine the individual's natural preference toward synchronous or asynchronous communication tools when working in a distributed team environment. They found those who were more task focussed had a preference toward asynchronous communication tools such as email, while less task focussed individuals exhibited a preference for more synchronous tools such as instant messaging and voice mail.

An asymmetrical appreciation of the advantages and disadvantages of time zone differences was also evident in the research of Lee-Kelley and Sankey (2008). They found that while personnel at some locations leveraged the time zone differences between office locations to the advantage of the business, there was also an unrealistic expectation from personnel in some locations that other offices should be available 24/7 while they themselves kept conventional business hours.

Understanding the number of locations and degree of temporal dispersion in virtual teams were questions investigated by Prasad, DeRosa and Beyerlein (2017). In researching this new area they found that the distance or number of time zones separating teams had little impact however, the number of locations across which the team were dispersed and the relative sizes of the groups at each location did have an impact on the team performance. Prasad et al. (2017) found that virtual teams with large numbers of locations, or where team members experienced isolation where their group was numerically smaller relative to other groups within the team were likely to perform less effectively than virtual teams with small numbers of locations and where the groups at each location were large enough to provide a sense of belonging to the members at that location.

Beyond the physical dimension of time zones, the concept of temporal diversity is also of particular concern when working with multi-cultural virtual teams. Mohammed and Nadkarni (2011) identify a number of different factors associated with temporal diversity to be considered, including time urgency and pacing style. They also suggested that temporal diversity within teams can be a double-edged sword. In their view, the positives of teams with diverse temporal perspectives include balancing team performance around outcomes such as speed and quality, short term and long-term demands, while on the negative side, high

degrees of temporal diversity can also create ambiguity and conflicts around the meaning and demands of schedule and timeliness of work.

Communications between members of project virtual teams, particularly those separated by time zones remains an imprecise and poorly understood area. With many researchers focussing on the use of different media or optimising the flow of data to support 24/7 operations the perspectives of the individuals tasked with performing the communications have received little attention. Particularly, once again, those working in 'real world' project environments are yet to be fully investigated.

## **2.5. Leadership of Virtual Teams**

Alongside trust and communications, the attributes of effective project virtual team leadership are yet to be fully understood, with as yet, limited literature on effective leadership in virtual teams (Maduka, Edwards, Greenwood, Osborne and Babatunde, 2018). Leveraging the available communications media to lead a virtual team in an engineering project is a challenge faced by organisations on a daily basis. Whether the virtual team is separated by only a few kilometres or multiple time zones, identifying and developing the skills required to lead such an undertaking is a critical enabler to gaining the greatest benefits from these teams.

While Bell and Kozlowski (2002) suggested there are two primary functions of leaders of virtual teams, being performance management and team development, Hunsaker and Hunsaker (2008) found that the overall responsibility of a virtual team leader extends to a great many activities. The majority of a leaders' activities must be accomplished at distance and are most complex and challenging when forming a new team, where they need to engage and develop new personnel, often without previous virtual team experience. In their work seeking guidelines for leaders of virtual teams, Beranek, Broder, Bruce A. Reinig, Romano and Sump (2005) make recommendations for virtual team leaders to address the challenges faced through a project lifecycle, including identifying virtual team potential members, establishing and socialising conventions and norms and, creating a sense of self-awareness within the team.

It is suggested by Al-Ani et al. (2011, p.221) that society's understanding of the demands and expectations associated with effective virtual team leadership is still in its first phase of development; a phase where the extant literature is attempting to identify what leadership of virtual teams 'looks like'. Their research identified a number of themes applicable to virtual team leadership; team distribution; technology; leadership roles; leader emergence; communication and; trust. While Al-Ani et al. (2011) expressed a belief in a continual evolution of leadership characteristics around each of these six traits, they also identified that, in the organisation in which they conducted their research, many leadership practices were still tied back to traditional co-located leadership practices.

Virtual team leaders must overcome barriers associated with coordinating across distance and time, culture and language, trust and team cohesion, working with team members who

have little opportunity to identify common ground. These leaders need all the skills of a co-located business or project leader and more (Malhotra et al., 2007). They need to help team members overcome feelings of isolation, build teams and establish norms of communication, motivation and commitment.

Gillam and Oppenheim (2006) identified three principal differences between traditional and virtual teams which impact on the strategies for their management;

1. Virtual teams typically exhibit flatter organisational structures to those in traditional teams. Largely resulting from the geographic dispersion of the team members, resulting in empowered teams rather than traditional pyramid structures.
2. Virtual teams have more active communication requirements. Their survival is dependent on their ability to communicate critical information regardless of time-zone differences or distance and, to ensure this communication is clear, concise and understood.
3. Virtual teams have a higher need for team building and the establishment and maintenance of relationships than traditional teams.

Furthermore, Gillam and Oppenheim (2006) believe that virtual team leadership requires the use of a broad spectrum of skills at different stages in the development of the team. These skills will be dependent on the membership of the team, its level of distribution and the work it is tasked with performing.

Kimball (2001) proposed a 2x2 matrix shown in Table 1 to identify a leadership communications strategy most appropriate to each form of virtual team. In their table, the horizontal axis is defined by the level of team autonomy and the vertical axis by whether the team's work is considered routine or covers emerging technologies and novel design.

|   |  |                         |
|---|--|-------------------------|
|   | What are the communications norms we need? |                         |
|   | When we are working...                     |                         |
|   | <b>Autonomously</b>                        | <b>Interdependently</b> |
| When patterns of work are...<br><b>Emerging</b> | Lookout                                    | Facilitator             |
| <b>Routine</b>                                  | Defender                                   | Manager                 |

Table 1: The leaders' role in virtual team communications (from Kimball, 2001, p.4)

Their matrix then sets out the principal role of the leader for each of the four pairings, such that;

- A leader of an autonomous virtual team working on routine tasks is defined as a “**defender**”, whose job is to act as a buffer between the team and the rest of the organisation,
- A leader of an interdependent team performing routine tasks is defined as a “**manager**” and undertakes classic managerial tasks to coordinate the work of the team,

- A leader of an autonomous team working on new and emerging tasks is defined as a “**lookout**” constantly looking for problems that may disturb the work of the team and,
- A leader of an interdependent team undertaking new and emerging work is referred to as a “**facilitator**”, one who facilitates interactions and smooths the path for the rest of the team.

As organisations move increasingly toward virtual teams, Brown, Royer, Waterhouse and Ridge (2005) believe traditional forms of control, using formalised rules and close supervision, cease to be effective and new approaches, reliant on output rather than input based criteria will need to be implemented. Brown et al. (2005) went on to suggest that many dilemmas faced when using traditional management techniques to control virtual teams arise because the team structure makes it difficult to have ad-hoc meetings, with advanced planning required to ensure facilities such as video conference is available when required. As such, they ask whether the management and control of distributed groups is evolving from one of direct control of labour, to one of control of outputs and, whether organisations are on a path from control to cooperation.

The question of autonomy and decision making in virtual teams was further considered by Bourgault, Drouin and Hamel (2008). They found that the quality of decision making in project virtual teams was positively impacted by project team members with a clear understanding of their levels of autonomy as well as establishing a formalised decision making process. Bourgault et al. (2008, S107) go on to suggest that “the effectiveness of distributed teamwork is strongly impacted by decision quality and team autonomy”.

Through their work, Malhotra et al. (2007) identified six practices for effective leadership of virtual teams; establish and maintain trust through the use of communication technology; ensure the diversity within the team is appreciated and understood; ensure meetings are properly managed between the virtual team locations; leverage technology to monitor the progress of the teams’ tasks; ensure virtual team members are visible throughout both the team and the broader organisation, regardless of their location and; enable individual virtual team members to benefit from their experience. Malhotra et al. (2007) determined that while leaders of both co-located and virtual teams undertake many of the same tasks, for the leaders of the virtual teams, work is made more complex by the lack of physical proximity which means they need to find alternate and, occasionally, novel ways to lead their team. Some of these leadership challenges are; motivating team members in all locations of their projects; understanding whether silence in communications means agreement or inattention; ensuring the skills of the team are being fully utilised and; that team members in some locations are not being neglected or ignored.

Five phases of management tasks, covering preparation, launch, performance management, team development and disbanding of virtual teams were proposed by Hertel, Geister and Konradt (2005). They identified a number of tasks to be performed by whoever was responsible for the management of a virtual team as the team progressed from formation

to disbanding. Some tasks include; selection of personnel, task design and selection of technology during the preparation phase, holding a kick-off meeting, getting acquainted and the development of inter-team goals at launch, motivation, knowledge management and regulation of communication during the performance management phase, identification of needs and delivery of training in the team development phase and recognition of achievements and reintegration of team members into the broader organisation during disbanding. While some are common to all team types, many are unique to virtual teams.

The management and deployment of personnel into teams from within a project delivery organisation is one that has received ongoing consideration in the research. The majority of project organisations operate under a matrix structure (Melnic and Puiu, 2011) whereby the long-term management of personnel is undertaken by functional line management, with personnel employed and provided career progress by their technical field. These technical personnel are then assigned into projects with their utilisation and management undertaken during the assignment by their project manager. A matrix model offers substantial flexibility for the organisation as it can deploy personnel onto projects as needs arise. Robins (1993) identified that these structures, while common in projects, have two major disadvantages; there is an ongoing struggle for power between the leaders of the project teams and the leaders of the functional teams and; the competition is uneven as the functional leader has a long term ability to influence the career and reward the performance of the individuals while the project leader is denied such abilities. To overcome this problem of two bosses, Melnic and Puiu (2011) recommend that organisations must establish and maintain good human relations and communications protocols to ensure personnel are both controlled in their work while also recognised and provided career opportunities.

In their research into leadership behaviours in virtual and face-to-face communication settings Zimmermann, Wit and Gill (2008) surveyed 420 engineers working globally within Shell. They found that communication was considered more important in a virtual setting than in a co-located one. Setting clear tasks and ensuring a common understanding of the tasks was given the highest ratings in questions associated with tasks. Coordination of work across time zones and ensuring the appropriate technology was available for communications rated highest in questions associated with the task-relationships and, making personnel feel part of the team and demonstrating cultural sensitivity were highest rated in questions of relationships. Overall, Zimmermann et al. (2008) found that as participants 'virtualness' (the percentage of their daily work where they engaged in virtual rather than co-located work) increased, so did their expectation for clarity of role, task and message.

Jenster and Steiler (2011) suggested that many of the 'softer' forms of leadership such as relationship building, caring, compassion and mentoring may be influential in improving team outcomes such as member motivation, commitment and trust. They go on to identify that the visible behaviours of virtual team leaders create instantaneous impressions on their personnel, impacting their motivation, engagement and trust through how they participate in team

activities, how they provide structure and guidance and how they encourage and support their personnel.

The views of researchers such as Handy (1995, p.47) that “good trust based organisations hardly require managers but need a multiplicity of leaders” would indicate that, as the workforce in modern organisations, whether project based or ongoing, becomes more distributed, the way in which these workers are led will need to adapt. These views were further supported by the findings of Flavian, Guinalú and Jordán (2018) that trust in the virtual team leader built by their demonstrated behaviour results in greater organizational efficiency. With the continually evolving demands on leaders in virtual teams of all forms and particularly project virtual teams it is important to consider how the leadership skills needs may change over time. While the concept of teams and their needs changing over time can be traced back to use of the terms forming, storming, norming and performing by Tuckman (1965), Burke, Georganta and Hernandez (2017) point out that there has been little work to understand how these needs change as teams evolve and none in the context of project virtual teams.

### **2.5.1. Virtual Teams Project Management**

There is strong consensus in project management literature that one of the most important attributes for a successful project manager is to be an effective communicator. Henderson (2008) observe that research on virtual teams’ management indicates that communication skills are, if anything, more important in a virtual setting. However, as Leybourne (2007) point out, all too often research into communication in project management has focussed on tools and techniques. There are also broad differences between the beliefs of project managers of virtual teams and their personnel over the attributes they believe most important for successfully delivering projects. In their study of project managers, Hamersly and Land (2015) found that the managers themselves believed that effective management, structure, governance and standards were the most critical attributes to a successful project outcome, while team members look for communications, collaboration and understanding to enable them to perform their work effectively.

In examining critical success factors for project managers of virtual teams, Verburg, Bosch-Sijtsema and Vartiainen (2013) asserted that the most important conditions for successful project execution in a virtual team were; clarity and rules around communication to avoid any project delays resulting from confusion and misunderstandings; the style of the project manager and how they set goals, and; the competencies of the project manager, along with their trust in the team. Within their research, Verburg et al. (2013) identified the way their project manager cohort defined success as both the accomplishment and the reputation of the manager within their organisation.

Leadership and management attributes for those running project virtual teams are difficult to identify through research in anything other than a ‘real world’ practice environment. While such attributes may be possible to infer from some simulated study situations it is only when applied to active projects with all of the daily pressures that accompany them that the true

characteristics of effective leaders can be seen. However, to date there has been as yet a shortage of such studies. For academia and industry alike to fully understand how leadership of these teams differs from the relatively well understood collocated organisation this gap must be addressed.

## **2.6. Diversity in Virtual Teams**

Diversity, whether of a cultural, organisational or professional nature is an ever-present attribute of a virtual team. Team members are distributed across cities, countries and continents, and comprise individuals with a broad range of experiences and backgrounds. All of these different attributes will affect how these individuals will interact when they are placed in the team.

Diversity, in all its forms, has been shown to have an impact on how virtual teams' function. As virtual teams have become increasingly commonplace, diversity has received heightened levels of research. Indeed, it has been suggested by Connaughton and Shuffler (2007) that research needs to consider the increasing complexity and nuanced levels of diversity and multiculturalism found in these teams. The cultural component of diversity not only incorporates broad national cultural differences, it can also include the national and societal culture from which personnel are drawn, the prevailing culture in the country in which each team is based, the national culture of the overall organisation, the internal culture of the organisation and the culture prevalent within the team (Connaughton and Shuffler, 2007). Much of the research into culture in virtual teams has, however, focussed on broad national differences frequently drawing on frameworks such as those developed by Hofstede and Hofstede (2005), Lewis (2006), Trompenaars and Hampden-Turner (2012), and most recently Meyer (2014) for both the language and perspectives used.

Chao and Moon (2005, p.1128) proposed that culture should be considered as "a mosaic, a framework that incorporates demographic, geographic and associative features that influence the individual, a complex system linking cultural tiles in both ordered and chaotic ways". Their tiles include demographic characteristics such as age, ethnicity, gender and race, geographic characteristics such as climate and associative characteristics including family, religion, employer, profession, politics and avocations. The cultural profile of each individual is therefore a complex mix of many factors, making each member of each team unique. It is suggested by Connaughton and Shuffler (2007) that when a virtual team works together a team culture will emerge, but alongside that is likely to be a number of additional cultures and sub-cultures. These sub-cultures occur at the team and sub-team level and could be based on the location of the sub-team. Each different cultural characteristic will, however, impact in its own way on how a virtual team will operate.

### **2.6.1. Team Member Diversity**

When attempting to understand the performance of any kind of team, but most particularly that of a virtual team, it is important to recognise and understand the cultural backgrounds of

its members (Hardin et al., 2007). As Horwitz and Horwitz (2007) described it, the very advantage of a virtual team, the diversity of views of its membership, can also be one of the biggest challenges. Cultural diversity in virtual teams, particularly those in either global organisations, or in culturally diverse countries such as Australia, is almost inevitable. Personnel are drawn from different countries and backgrounds to work together, leading to a melting pot of different cultures. Horwitz (2005) suggested that team diversity can have both a positive and negative impact on a virtual team. Managed properly, they believe a heterogeneous team can establish a significant operational synergy, whereas, mismanaging team diversity can lead to major operational dysfunction resulting from intra-group conflict, miscommunication and a general lack of trust. In their work Horwitz (2005) compared two different theories of team diversity, the similarity attraction paradigm and cognitive resource diversity theory. They noted that the similarity attraction paradigm indicates that homogeneous teams perform better on tasks requiring coordinated activities between team members, while cognitive resource diversity theory proposes that heterogeneous teams are stronger at problem solving and decision-making processes due to their multiple perspectives on issues. As Horwitz (2005) reflected on the work of Cox and Blake, "A core of similarity among group members is desirable... the need for heterogeneity, to promote problem solving and innovation, must be balanced with the need for organisational coherence and unity of action" (Cox and Blake, 1991, p.51) and, while it could be observed that the modern workforce is far more diverse than it was in 1991 when Cox and Blake made this observation, the basic tenet would still hold true.

Qureshi et al. (2006) observed that the globally dispersed nature of many virtual teams complicates the coordination of collective action in many ways; it imposes physical separation on the team members, it brings together personnel with different socio-cultural backgrounds and, through time-zone differences, disrupts interaction between team members. Qureshi et al. (2006) went on to suggest that social adaptation to a common set of norms, while seen as a requirement for effective virtual team interaction, was hard to achieve and, once achieved, hard to sustain due to language and geographic boundaries.

Sharing details of technical skills and expertise of virtual team members through the use of a shared directory or skills matrix was found by Malhotra et al. (2007) to be an effective way to ensure greater levels of collaboration. Indeed, one of their research participants noted "face-to-face teams would learn what they needed to know for good collaboration over dinner and drinks, but the virtual team members will just have to settle for the electronic directory" (Malhotra et al., 2007, p.63).

## **2.6.2. National Culture**

Bergiel et al. (2008) observed that individuals from different national cultures typically vary in their communication styles and group behaviours, with, for instance, different individuals exhibiting different behaviours around how they seek and disclose information. In comparing how the concept of individualism versus collectivism originally proposed by Hofstede (1980)



and later expanded by Hofstede and Hofstede (2005) influenced the performance of virtual teams, Hardin et al. (2007) applied a series of tests to students from universities in Hong Kong and the United States of America, cultures to which Hofstede ascribed substantially different individualist profiles, to determine whether their cultural profile influenced their values of group and virtual team self-efficacy. The findings indicate that members from more individualistic cultures reported similar experiences working in a virtual team to working in a co-located team, in that they exhibited greater confidence in their own abilities than those of the group. However, Hardin et al. (2007) stressed that their findings may not readily transfer to highly culturally heterogeneous virtual team groups, where the influences of the broad mix of cultures forming the group were likely to dilute some of the individualistic characteristics seen in more homogeneous groups.

Culture, particularly when dealing between Europe and Asia where many differences were identified by their research participants, was identified as one area of difference in the work by Lee-Kelley and Sankey (2008). Similarly, Ochieng and Price (2009), when examining the impact of cultural differences between personnel working on multinational civil engineering projects identified eight factors they believed must be considered when planning and implementing a multi-cultural virtual team; leadership style, team selection and composition process, cross-cultural management of team development process, cross-cultural communication, cross-cultural collectivism, cross-cultural trust, cross-cultural management and cross-cultural uncertainty. They went on to identify that conflict, misunderstanding and poor project outcomes can result where these factors are not considered and managed within the team. In later work derived from the same research Ochieng and Price (2010) determined that within multicultural virtual project teams, "both internal and external cross-cultural communication provides the invisible glue which can hold a dislocated multicultural project team together" (Ochieng and Price, 2010, p.11), asserting that effective communication is the key to resolving the misconceptions and misunderstanding that occur when working across cultures.

### **2.6.3. Heterogeneous and Homogenous Teams**

Meta-analysis was undertaken by Horwitz and Horwitz (2007) at the group level to better understand differences between heterogeneous and homogeneous virtual teams. They examined task related diversity such as the skill set of team members, and bio-demographic diversity such as age, gender and ethnicity and found that task related diverse teams produced outputs of both a high quality and quantity. This indicated that a team exhibiting a diverse range of task related characteristics is likely to perform better than one with a limited level or task diversity. However, they found no link between bio-demographic diversity and changes in outcome, indicating that, as far as their work was able to determine, bio-demographic diversity does not influence the quality of a team's output.

The influence of functional (task) diversity was also explored by Peters and Karren (2009) who found a strong positive correlation between task diversity and the perception of team

performance in virtual project teams. This led them to surmise that in a virtual team context, the contribution expected as a result of the diversity of expertise among the members of the team is valued and helps build a sense of trust. Essentially, as Ochieng and Price (2010) observed, heterogeneous virtual teams will bring fresh ideas and new approaches to problem solving, but with this they also bring challenges around understanding and expectations.

#### **2.6.4. Corporate Culture**

Research undertaken by Mukherjee, Hanlon, Kedia and Srivastava (2012) and Mihhailova (2009) explored the attitudes toward satisfaction with virtual work between a national cultural perspective and an occupational or organisational one, finding that for many employees their occupational culture had a greater influence on their satisfaction than did their national culture, observing that “While representatives of different occupational groups point out different virtual work problems, no such conclusions can be drawn for national culture groups” (Mihhailova, 2009, p.91). Further, Mukherjee et al. (2012) proposed that managers of virtual teams consider developing an organisational culture and identification among their personnel to improve their employees’ sense of belonging to the team and therefore improve cohesion and productivity.

### **2.7. Technology in Virtual Teams**

Electronic communications media are the enabler of modern virtual teams. Without ubiquitous access to telephones and internet technology communications between members of teams would be such that any attempts at forming virtual teams would likely prove too slow to offer the responsiveness needed for the phenomena to function. A fresh wave of research has accompanied the advent of each new technological advance.

The language used to describe the choices and use of technology to enable communication in virtual teams leans heavily on the work of Daft and Lengel (1983). They established the concept of media richness, where different technological choices can be ascribed degrees of richness based on the four criteria of speed of feedback, variety of communication channels, personalisation of source and richness of language. Their model proposes that rich media convey more cues and individuals select media whose richness is best suited to the level of ambiguity they can accept for a specific communication (Saunders and Ahuja, 2006).

The development and evolution of communications technology has been a principal virtual team enabler, bringing together distributed personnel to undertake organisational or project tasks. As Beranek and Martz (2005) observed, without technologies such as the internet, these teams would struggle to be effective. From the early research performed on virtual teams, researchers have maintained a heavy focus on the technology enabling teams to communicate.

Examples of work in this area are, Townsend et al. (1998), who explored how desktop video conferencing technology could enable distributed members of a team to communicate and collaborate over the internet. They also discussed how collaborative software and, what was then still the emerging though “enormously popular” internet (Townsend et al., 1998, p.21)

would allow personnel to disseminate information and share documents in near real time. Townsend et al. (1998) also began to identify that one big challenge faced by these virtual teams would be team building in a virtual world, a world where personnel may not meet face-to-face and must rely on electronic media to communicate, stating that “Virtual team members are challenged to recapture the effectiveness of face-to-face interactions using the virtual tools that are available” (Townsend et al., 1998, p.22).

In comparing relationship building in virtual teams through the use of internet mediated technologies versus conventional channels, Pauleen and Yoong (2001) compared face-to-face, telephone and internet (email, synchronous chat and desktop videoconferencing) based communications to determine which gave the best outcomes. They found that while face-to-face meetings produced the greatest level of participant satisfaction, where such meetings were not possible due to issues such as time or cost, that the higher context, richer technologies of video conferencing and telephone provided the next best options. However, in their recent study of the use of computer-mediated video communication in engineering projects in South Africa, Meyer, Bond-Barnard, Steyn and Jordaan (2016) found that video technology was still much less likely to be utilised, with their research participants observing that they believed a reliance on such technology resulted in a reduced focus on the need to build interpersonal relationships.

Johnson, Bettenhausen and Gibbons (2009) tested the affective and attitudinal outcome of the use of technology for communication in virtual teams on a cohort of 150 MBA students. Finding that, where virtual teams used computer mediated communication for 90% or more of their communications, there was a marked decrease in the level of perceived effectiveness within the team when compared to teams with less reliance on computer mediated technology. They suggested that organisations that are wholly dependent on computer mediated technology for communications within their virtual teams will experience negative effects of members’ emotional attachment to their teams, possibly resulting from a lack of social time with team members. They proposed that even a small amount of face-to-face time may counteract this. While Johnson et al. (2009) explored a wide array of computer communication technology in their work, they do not state whether there was a difference in the richness of the technology as far as its impact on affect.

Deploying appropriate communication tools for virtual teams is considered by Aiken, Gu and Wang (2013) to be very important in facilitating communications within a team. Yet, they also observed that with the broad and diverse range of tools available, many businesses, projects and individuals struggle to select the right tools for their business and the appropriate tool for any given communication need. In their research Aiken et al. (2013) found that while perceived knowledge sharing achieved through an appropriate selection of technology has a positive effect on team member satisfaction, it does not influence team effectiveness.

There has also been work exploring how virtual reality tools may contribute to virtual team environments. In their research exploring the effectiveness of the use of 3D virtual meeting technology with traditional face-to-face meetings, Ranade and Greenstein (2010) found that a

3D virtual environment provided a productive and viable alternate meeting environment that could make a realistic substitute for face-to-face meetings, potentially helping businesses mitigate some travel costs associated with operating virtual teams. Similarly, Li, D'Souza and Du (2011) found that these 3D, virtual world, technologies can be used to augment the learning processes in organisations, with organisations utilising rapidly developing technologies powering 3D virtual environments to develop training material allowing their personnel to experience an environment without physical exposure.

It can be seen that the research into technology in virtual teams has primarily focussed on how different media can be applied and whether one media offers advantages over another in a specific exercise. However, as Gaan (2012) observed in one of the rare pieces of research to examine the selection of such technology, collaborative tools are generally selected based on organisational policies which are procedure oriented, making little to no allowance for the development of trust or relationships through the communication they facilitate.

## **2.8. Project virtual team models**

The focus of researchers on facets of virtual teams rather than the whole and on testing potentially transferable theories rather than developing a fresh understanding of how project virtual teams function can be seen in the absence of a comprehensive model of how such teams function.

The researcher could find no single comprehensive model within the literature that reflects the overall environment in which a virtual team operates. Available models include one of virtual team functioning proposed by Martins et al. (2004, p.810) reproduced in Figure 1. This model was primarily intended to highlight areas where research has been undertaken and where research is yet to be completed, and, by its linear structure implies a causal/modifier relationship between actions and functions in these highly dynamic teams.

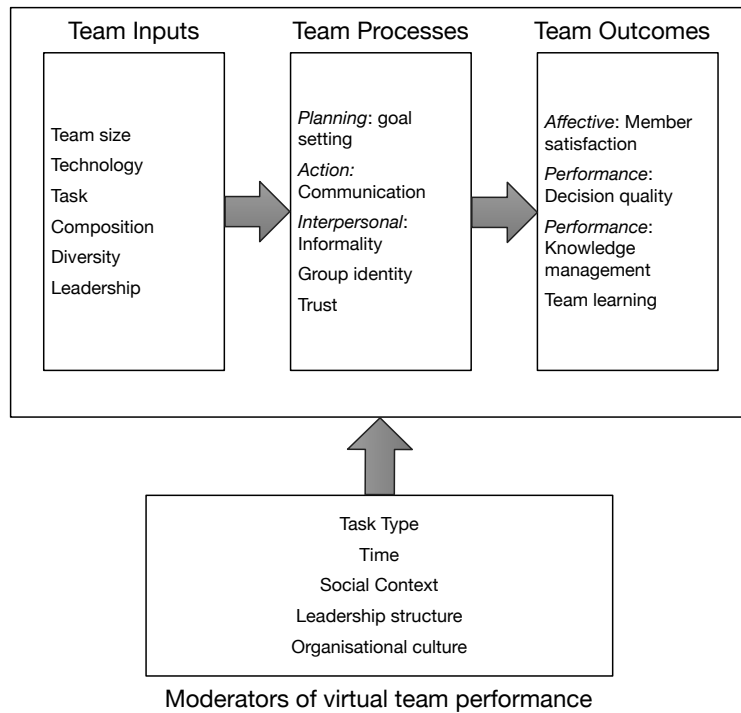


Figure 1: I-P-O model of virtual team functioning from Martins et. al. 2004

Another model, again depicting part of the functionality of a project virtual team is that of Hunsaker and Hunsaker (2008, p.94) reproduced as Figure 2. This model however only captures the management functions pre, during and post a project. It focusses primarily on the management of teams and does not consider any personal interactions within the team.

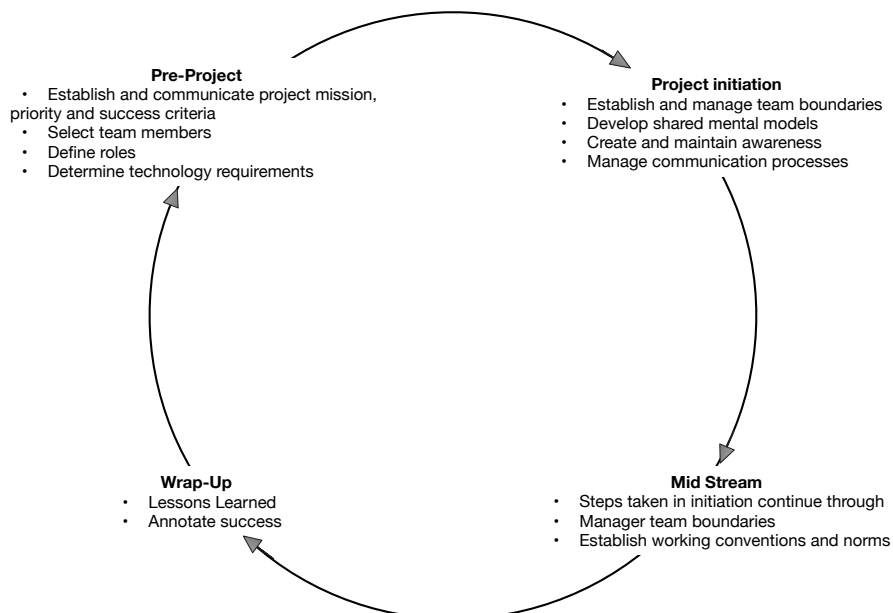
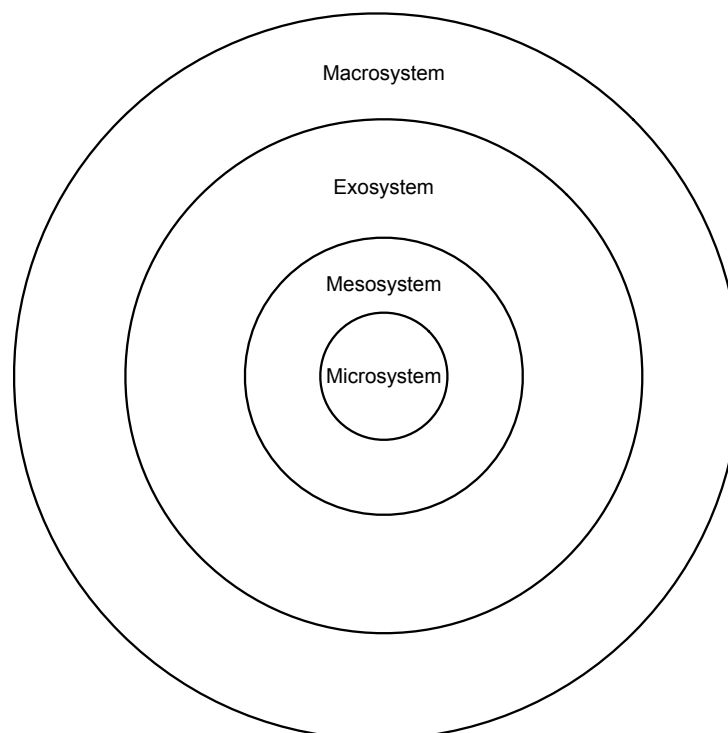


Figure 2: Guidelines for managing virtual teams over the life of a project, from Hunsaker and Hunsaker 2008

Other authors have offered models for the development of trust in global virtual teams (Jarvenpaa and Leidner, 1999), measuring cross-cultural and multi-cultural project

performance (Ochieng and Price, 2009), and identifying the antecedents of virtual collaboration (Peters and Manz, 2007). However, all of the current models reviewed have considered part of a project virtual team rather than the whole. To fully understand project virtual teams they must be considered in their entire context, as dynamic, evolving multilevel organisms where the theoretical understanding “rests, most fundamentally, on the premise that individual, group and organisational characteristics interact and combine to shape individual, group, and organisational outcomes” (Klein and Kozlowski, 2000, p.xvi). Such a model should consider all facets of multilevel theory identified by Klein and Kozlowski (2000, p.12) of what, how, where, when and why.

To better understand overall complexity of social interaction within the ecological system that is a project virtual team it is therefore useful to look outside of the virtual team literature. Ecological systems theory was originally proposed by Bronfenbrenner (1979). Bronfenbrenner initially developed the theory to understand the behaviour of family members in social settings (Bronfenbrenner, 1986) by modelling the ecology of the individual family members into a series of nested or networked systems as depicted in Figure 3, taken from Neal and Neal (2013, p.725). The theory establishes a process-person-context-time mechanism (Tudge, Mokrova, Hatfield and Karnik, 2009) through which relationships occurring within complex social settings such as families, schools, communities and workplaces can be examined.



*Figure 3: Nested Model of Ecological Systems Proposed by Bronfenbrenner (1979) from Neal and Neal (2013)*

Bronfenbrenner's model has subsequently been adapted for use in a significant number of studies such as youth activity engagement and social acceptance, friendship and peer relationships (Gifford-Smith and Brownell, 2003). While the use of Bronfenbrenner's ecological

systems model has largely been within developmental studies (Neal and Neal, 2013), it has also been applied to contexts such as modelling community resilience to natural disasters (Boon, Cottrell, King, Stevenson and Millar, 2012) and workplace wellbeing management (Bone, 2015).

Bronfenbrenner's model consists of a number of systems (Bronfenbrenner, 1994); the inner Microsystem of activities, roles and relationships experienced by the individual in a given setting; the Mesosystem being interrelations between two or more settings in which individuals participate; the Exosystem comprising those settings which affect the individual but in which the individual is not an active participant; the outer Macrosystem comprising lower order systems that define the environment in which the individual exists; and the Chronosystem capturing changes experienced through the passage of time. Capturing the effects of time, the 'when' in such a model is a rare yet important consideration in organisational models (House, Rousseau and Thomas-Hunt, 1995), since as Klein and Kozlowski (2000) observe, many if not most organisational phenomena are influenced and shaped by time. As a structure which places the experiences of the individual within a person-process-context-time model, the overall theoretical construct established by Bronfenbrenner is consequently highly suited to adaption to support the understanding of interaction and interpersonal communication in project virtual teams.

Of the three time-based concepts identified by Klein and Kozlowski (2000), namely; time as a boundary condition; time scale variations across levels and; entrainment: changing linkages over time. It is the third, entrainment which best reflects the way in which time impacts project virtual teams. Ancona and Chong (1997) describe entrainment as the way different levels are linked by the processes of rhythm, pace and synchronicity, with the coupling across different units or levels tightening at times of greater entrainment when higher levels of synchronous or coordinated activity are required.

However, while the micro, meso, exo and macrosystems can be used to depict a static model of a project virtual team, the concept of the chronosystem, while valuable, is limited as it reflects changes occurring only through the passage of time and not changes due to location; the 'where' suggested by Klein and Kozlowski (2000, p.18). Consequently, the concept of a chronosystem must be replaced with one that considers both time and place. Combining the Greek terms khronos (time) and topos (space), the chronotope offers such a concept (Renfrew, 2015, p.112). The concept of the chronotope was originally employed in mathematics and introduced as part of Einstein's theory of relativity (Bemong and Borghart, 2010) before being borrowed and brought into common usage by Mikhail Bakhtin. Bakhtin combined Emmanuel Kant's idea that "time and space are in essence categories through which human beings perceive and structure the surrounding world" (Bemong and Borghart, 2010, p.4) describing it as "the intrinsic connectedness of temporal and spacial relationships" (Bakhtin, 1987, p.84). While Bakhtin used the term in the study of literature, for this research, it is possible to see chronotopes as places in time, as well as conceptual tools to manage and coordinate people from various backgrounds and realities (Aaltonen, 2007) replacing

Bronfenbrenner's 'Chronosystem' with a 'Chronotopicsystem' introduces changes due to both time and space into the model, allowing the consideration of changes over both time and space (location) in such a model for project virtual teams. This then makes the adapted model particularly well suited for the study of project virtual teams where members are separated by distance and where the locations or team members can and do change over time as the project evolves.

## **2.9. Gaps in the current research**

While research to date has addressed a number of areas relevant to virtual teams, there remain many areas yet to be comprehensively examined. The theory/practice gap (Van De Ven and Johnson, 2006) relevant to project based virtual teams in particular is still substantial and reflects all three different models of gap; a knowledge transfer problem with researchers fixated in their quest for theoretical understanding without fully testing and sharing their work with practitioners; a philosophical problem with researchers pursuing general theories that are transferable while practitioners seek contextually grounded solutions to their immediate challenges, and; a knowledge production problem where research fails to position its work in the practice society in which they are embedded (Reed, 2009).

As early as Furst et al. (1999), extensive gaps in academia's knowledge of how virtual teams function, how they are established, communicate and build relationships were identified as worthy of further investigation, yet almost two decades later much of this remains un-researched.

One of the principal weaknesses of current virtual team research is that much of it has been performed on student groups assembled specifically for the research (Furst et al., 1999, Martins et al., 2004, Powell et al., 2004, Saunders and Ahuja, 2006). Examples of this, where researchers place students into simulated virtual team environments to test a particular hypothesis, include Jarvenpaa and Leidner (1999), Piccoli et al. (2000), Piccoli et al. (2004), Beranek and Martz (2005), Beranek et al. (2005), Dineen (2005), Geister et al. (2006), Qureshi et al. (2006), Hardin et al. (2007), Rutkowski et al. (2007), Lin, Standing and Liu (2008), Johnson et al. (2009), Aiken et al. (2013), Luse et al. (2013) and Zaugg, Davies, Parkinson and Magleby (2015). These simulated research environments are useful and provide valuable data but do not capture the challenges and complexities experienced by practitioners as effectively as research performed in real world environments. It is, however, recognised that accessing virtual teams and particularly project virtual teams in the practice environment is often difficult due to their transient nature, a situation reflected in the shortage of such research.

Of the research that has been undertaken in practice environments, much has focussed on discrete areas of the virtual working experience. This includes work such as; comparing the building of virtual relationships between face-to-face and computer mediated environments (Pauleen and Yoong, 2001) which found that the appropriate selection and use of computer



media was important in building relationships between virtual team members; understanding social interaction between virtual team members and how that affects the management of the team (Lee-Kelley et al., 2004), which found that there is a need to understand the relational issues that emerge in a virtual environment; the use of various communication tools and their applicability to different requirements (DeLuca and Valacich, 2006), which found that low synchronous media was effective for conveying information but highly synchronous media was more effective for convergence on shared meaning and reaching consensus; how degrees of virtuality resulting from geographic dispersion, dynamic structure, electronic dependence and national diversity impact a team's ability to innovate (Gibson and Gibbs, 2006), which found that highly virtual teams need psychologically safe environments to communicate and be effective; examinations of the skills needed to be a successful virtual team leader (Malhotra et al., 2007), which identified that organisations should undertake specific programs to develop future virtual team leaders; investigations into communication competencies of project managers leading virtual teams (Henderson, 2008), which found that geographic dispersion typical of virtual teams impacts how project managers code and decode messages, impacting the satisfaction and productivity of team members; examination of the interaction within the software development group of a global banking business, including offices in Asia and Europe (Lee-Kelley and Sankey, 2008), which found that time zone and cultural differences negatively affected communications and team relationships in the virtual teams examined; an examination of leadership behaviours of engineers working globally for Shell global solutions (Zimmermann et al., 2008), which concluded that while relationship oriented leadership was seen as important regardless of the degree of virtualness within a team, task oriented leadership, providing clarity of roles and expectations, increased in importance as teams became more virtual; a case study of the effects of culture within a civil engineering company working between the UK and Kenya (Ochieng and Price, 2009, Ochieng and Price, 2010), which proposed that cross cultural awareness improved communications between members of multicultural virtual teams; along with several other studies involving practitioners working in virtual teams such as Baba et al. (2004), Peters and Karren (2009), Jenster and Steiler (2011), Verburg et al. (2013) and Hamersly and Land (2015)

As can be seen from the above, the overall virtual team research landscape is still fragmented and evolving. Some researchers continue testing the applicability and transferability of traditional co-located organisational theories to virtual teams, while others are attempting to address discrete facets of the overall complexity of virtual teams in isolation from the whole.

Added to this is the matter that much of the research published to date is either in the form of a literature review, a meta-analysis, or research performed on student cohorts, diluting the overall contribution of new research. Even the definition of a virtual team remains so broad as to cover any organisational structure where one or more member may work remote to the balance of the team. This definition covers everything from a co-located workforce with one employee working from home to a globally distributed organisation with large cohorts of

employees in multiple centres. As such, it soon becomes clear that both academia and practice have much work to do before a comprehensive understanding of the ways in which project virtual teams operate can be established.

## **2.10. Conclusion**

There is a solid and growing volume of literature examining the concept of virtual teams and many aspects of these teams that influence how they function. However, much of the existing research is largely undirected and exploratory by nature with large portions of it undertaken on either static teams or on student cohorts. There is however a very small body of research that has been undertaken on project virtual teams and of that, an even smaller subset that has examined how these teams operate in engineering environments of any form.

Virtual teams are being used increasingly in engineering projects and specifically by resources projects. These undertakings have substantial economic impact to national and global economies, as demonstrated by the AUD400Billion of projects performed in Western Australia alone between 2004 and 2014. With the scale of these investments, even small improvements in the efficiency and effectiveness of project execution can significantly improve economic outcomes. With only a small quantity of published work investigating how the growing use of virtual teams in engineering projects can be enhanced, there remain many areas that are as yet not fully understood and opportunities to deliver significant economic benefit to industry through improved team effectiveness yet to be maximised both academically and in practice. With Western Australia being a global centre for the delivery of resources projects using virtual teams it provides a meaningful environment to undertake such research, with findings derived from this research expected to be highly transferable across the global resources sector and potentially into other related fields.

The following methodology chapter describes in detail how this research was conducted. It sets out why a phenomenological approach was taken, how the research participants were identified, recruited and their data collected, how that data was then stored, managed and analysed and how questions of reliability, repeatability, trustworthiness and credibility of the research have been addressed.

## **3. Methodology**

*“The human world, however, is markedly different. As Alfred Schutz pointed out, when we consider other social systems, they have already given names to themselves and decided how they want to live and how the world is interpreted (Schutz, 1970). We may label them if we wish, but we cannot expect them to understand or accept our definitions, unless these definitions correspond to their own. We cannot strip people of their commonness constructs or routine ways of seeing. They come to us as whole systems of patterned meanings and understandings. We can only try to understand, and to do so means starting with the way they think and building from there”*

(Trompenaars and Hampden-Turner, 2012 p.24)

### **3.1. Introduction**

This chapter sets out the methodology used for this research and the reasons for selection; to describe how that methodology was applied in the methods adopted, how they were applied and their outcomes; to provide an understanding of the organisational and individual demographics of the research sample, how they were selected and how they contributed to the research outcomes; to address considerations of ensuring the research was conducted in an ethical manner and; that the research is both trustworthy and replicable.

When planning this research, it was apparent there was limited previous research into interpersonal communication in project virtual teams available to draw upon, especially in the area of major resources projects. The use of virtual teams in the delivery of major projects is an increasingly common undertaking, yet little is known of how the personnel in these teams perceive their interaction. The lack of previous research often leads to a trial and error approach by practitioners and academia, relying on assumptions when training personnel to participate in the teams. It was apparent therefore that firstly, this was an area where there was an opportunity for research to add meaningful knowledge needed by both practice and academia and, secondly that the research methodology would need to be exploratory by nature, since the scarcity of existing material identified by the researcher meant that there was little pre-existing theory upon which to build.

This chapter firstly introduces the chosen methodology, why and how it was selected and how it was applied to the research questions. This is followed by an overview of the data required to undertake the research and how it was to be acquired through the data collection phase of the research. A brief overview of the research method is then presented followed by a detailed description of each phase of data collection, including how the participants were selected and recruited and their demographics, along with a discussion of the interview process followed and the management of bracketing during and after the interviews to ensure the researcher’s personal views did not influence the collection and analysis of the data. The management and analysis of the data is then discussed, along with descriptions of the tools

used to aid the analysis and subsequent interpretation of the data. The chapter then concludes with a discussion of how ethical considerations were handled, the treatment of questions of trustworthiness of the data and analysis including credibility, transferability and dependability, along with the limitations of the research and the role of the researcher.

## **3.2. Methodology**

### **3.2.1. Selection of Epistemology and Ontology**

In determining the appropriate methodological approach for this research, it was first necessary to identify the level of existing knowledge in the field. An initial literature review revealed that, while some research had been conducted into a number of aspects of virtual teams, many gaps remain in the established knowledge. These gaps exist principally in the following areas:

- An understanding of virtual teams in practice environments (much of the available research was conducted in simulated environments such as university classrooms)
- An understanding of the use of virtual teams in engineering project environments
- An understanding of the use of virtual teams in project delivery (most particularly in large, complex, resources projects, the area on which this research focusses)

As such, to answer the question of how interpersonal communications within virtual teams affect the performance of team members in delivery of engineering projects into Western Australia's resources industry, it was apparent that an interpretive, exploratory, constructivist ontological approach was needed. This approach was considered appropriate since the phenomenon being explored was one of social construction, best understood through what Antwi and Hamza (2015, p.218) refer to as "observation and interpretation". The research therefore aimed to establish an understanding of how members of the teams examined experience and perceive the communications with their virtual team members, a process described by Neuman (2014) as experiential observations of how the participants represent their lived reality, the product of their social processes. Therefore, a meaning-oriented methodology, in this case interviews, was adopted. Interviews would focus on the full complexity of the subjects' sense making (Kaplan and Maxwell, 1994) in their virtual team environment, to understand their experiences as members of virtual teams interacting with their colleagues in other locations.

An interpretive phenomenological approach was adopted for this research since, fundamentally, this research is engaged in the study of the phenomena experienced by members of the virtual teams and, that the experiences of the subjects themselves can be considered one where they "exist in a culturally and historically conditioned environment from which they cannot step outside" (Gill, 2014, p.120). Specifically, many facets of Benner's Interpretive Phenomenology have been adopted for this research (Benner, 1985, Benner, 1994). This hermeneutic phenomenological approach is particularly well suited to this research

as it seeks to holistically study the person in the situation rather than attempting to study the individual and the situation separately. This form of interpretive phenomenology utilises thematic analysis to identify common themes from interviews through the extraction of sufficient interview excerpts to present evidence of common themes to the reader. Benner (1985) recommends that sampling continue until saturation, when no new information is emerging from the participants. While the full utilisation of this methodology is well described by Crist and Tanner (2003), the research undertaken in this study diverges from the full process they describe in not identifying individual exemplars from the data collected and instead focusses on thematic analysis.

### **3.3. Overview of required data**

To fulfil the objectives of this research, to begin to understand how practitioners working in virtual teams delivering engineering projects into the Western Australian resources sector perceive, experience and manage interpersonal communications, it was necessary to gather data on their experiences from a phenomenological perspective.

To understand the experiences and perspectives of these practitioners, this research was designed to collect data to uncover the major issues and inhibitors of effective interpersonal communication in virtual teams, how these issues occur and surface, how they are managed and their impact on team functionality. Being research of a phenomenological nature, the data is highly personal, with each participant sharing his or her own views and perspectives.

To collect the research data, a semi structured interview format was selected. Interviewing allows direct interaction with, and focussed questioning of, those directly involved with the phenomenon under investigation, enabling the researcher to probe the participants for specifics and follow lines of questioning to extract the most pertinent and valuable data. Table 2 provides an overview of the principal activities undertaken.

| Phase                   | Activity                                   | Actions  |
|-------------------------|--|--|
| Data Collection         | Identify and recruit participants          | Identify ideal participant group   |
|                         |  | Contact potential participant representatives  |
|                         |  | Agree access with willing organisations and personnel                                  |
|                         | Interviews                                 | Instrument design  |
|                         |  | Pilot test of instrument   |
|                         |  | Full data collection interviews  |
|                         |  | Transcription and de-identification  |
| Development of findings | Coding                                     | Development of codes   |
|                         |  | Development of categories  |
|                         |  | Identification and development of emergent themes                                      |
|                         | Cognitive mapping                          | Produce maps from coded data   |
|                         |  | Determine centrality, clusters and, virtuous and vicious circles in the developed maps |
| Analysis                | Combining of coded data and cognitive maps | Level based analysis between locations   |
|                         |  | Location based analysis between personnel levels                                       |
|                         |  | Analysis of active project participants against independents                           |

Table 2: Overview of the process followed for this research

### 3.4. Research Method Overview

Non-probabilistic, purposive, heterogeneous sampling was used to identify and recruit research participants. This form of sampling was adopted as it allowed the researcher to “collect data to describe and explain the key themes that can be observed” (Saunders, Lewis and Thornhill, 2009, p.239) and, where even though sample sizes may be small, emerging patterns are likely to be of particular interest and relevance to the key themes (Patton, 2002). This approach allowed the researcher to focus on the relatively small population of practitioners engaged in virtual team resource engineering projects, a population with the requisite knowledge and experience of the phenomenon being researched.

Following this sampling approach, where perceptions from multiple participants were sought and used when coding transcripts and developing constructs, is identified by Creswell and Plano Clark (2011) as providing a high level of validation for collected data. Using non-probabilistic, purposive, heterogeneous sampling ensured a high likelihood of representative data from a focussed population (Saunders et al., 2009). Once recruited, participants were interviewed individually at their places of work using a semi-structured approach. All interviews were audio recorded, transcribed then de-identified to ensure participant confidentiality and

anonymity. The interview transcripts were then inductively coded using the three phases outlined by Creswell (2013) of open coding, axial coding and selective coding to group and categorise individual codes into emergent themes and concepts. Coding was performed using the NVivo© software from QSR. Data derived from this coding was then further analysed to construct a series of cognitive maps, a tool suggested by Bryson, Ackermann, Eden and Finn (2004) using Banxia software's Decision Explorer© software. The results of the coding and cognitive mapping analyses were then used together to build an understanding of communication processes within the virtual teams, and to develop emergent theories to address the question of how interpersonal communications between virtual teams affect the motivation of team members in delivery of engineering projects into Western Australia's resources sector. Combining coding and cognitive mapping in this way was a novel construction for the analysis adopted for this research to develop deeper insights from the data.

## **3.5. Data collection**

### **3.5.1. Participant identification and recruitment**

Having established the research methodology, it was necessary to secure suitable participants from whom to collect the required data. To ensure an adequately broad perspective of views, interviewing personnel in a number of different roles in different projects and organisations was deemed the best approach, since this underpins what Dervin (1983, p.7) refers to as "circling reality", which she defines as "the necessity of obtaining a variety of perspectives in order to get a better, more stable view of 'reality' based on a wide spectrum of observations from a wide base of points in time-space" .

Approximately 10 major resource engineering projects were underway in Western Australia using project virtual teams when the data collection for this research was undertaken. The organisations delivering these projects logically formed the overall population to attempt to draw on for this investigation. Since the researcher has a broad, well established network of industry connections, many of whom held senior positions in a number of engineering businesses, he prepared an introductory email, including a brief overview of the research objectives, shown in Appendix B - Information Sheet. The email was sent to his contacts in the target organisations. These emails were followed by telephone calls and personal visits as required. Through these personal contacts and subsequent negotiations, access was obtained to research one project in each of four separate companies. From within each of those four projects the personnel most involved in the virtual team portion of the work were identified, forming the pool of research participants. Other projects being undertaken entirely locally, domestically using wholly interstate teams or in single locations internationally fell outside of the sample boundaries for this research and were excluded.



| <b>Member level</b>                               | <b>Population (estimated)</b>    | <b>Sample size (potential)</b>     |
|---|----------------------------------|------------------------------------|
| <b>Project Manager / Director</b>                 | 8 to 10 (1 per project)          | Entire population (8 to 10)        |
| <b>Project leaders (managers' direct reports)</b> | 80 to 150 (10 to 15 per project) | Approx. 30 based on 3 per project. |
| <b>Project team members</b>                       | 2,000 to 10,000 total            | Approx. 30 based on 3 per project  |

Table 3: Project populations and sample sizes based on 8 to 10 projects underway in WA.

The organisations approached to participate in this research had typical overall project teams of between 200 and 1,000 personnel, giving a total potential population of between 2,000 and 10,000. However, while this population appears substantial, within each project there is typically only one project director or project manager responsible for the total delivery of the project. Each project manager or director then has a management team working for them who each then oversee the delivery of engineering through directing their teams of personnel. Within the project structure, only certain personnel such as the project manager, many of the project manager's direct reports and key other personnel have high levels of interaction with personnel in other locations. Consequently, while the numbers of personnel working on any of these projects may be large, only a small number will be directly engaged in working across the boundaries of their virtual teams. Typical overall populations and potential sample sizes are outlined in Table 3.

The requests for participants also uncovered additional individuals who, while no longer part of any specific project, had recent experience of leading or participating in virtual team project work. These formed an additional cohort referred to as independents in this research.

### **3.5.2. Organisational Demographics**

Each of the four companies that participated in the research had different organisational structures and served different parts of the overall engineering sector. However, all four operated using similar virtual team structures, delivering their work through the use of personnel located both in Perth, where their projects were headquartered, and other locations either domestically or internationally.

The independent participants all had extensive backgrounds as project managers or project engineers. They had all recently held roles on major engineering projects for Australian clients where the architecture of the project was to use a virtual team model.

The four projects referenced in the research were included for the following reasons:

1. The organisation had to be undertaking a Western Australian resource sector project using a virtual team. (There were around 10 of these at the time the data collection was performed).

2. The project had to include a Western Australian based team and a team based elsewhere. Teams where all engineering was executed outside of Western Australia were ineligible. (Of the 10 projects identified in 1 above, two were conducting all of their work in other locations.)
3. The project owners and the managers running the project had to be willing to participate in the research and have personnel who, themselves, were prepared to participate. Of those contacted, four expressed a willingness to participate and had personnel who agreed to be interviewed.

Given the criteria above, the four organisations in which the research was performed would meet what Saunders et al. (2009) describe as being considered to have been selected through both a purposive and convenience sampling method. Chosen deliberately to represent the form of organisation required for the research and convenient due to their willingness to participate and their proximity to the researcher. The form and nature of each of the four projects is discussed below.

#### **3.5.2.1. Project 1**

The organisation undertaking this project was a long-term joint venture operating in Western Australia. Their primary focus, and the focus of the project included in the research, was to deliver major projects to mining clients in the Western Australian iron ore sector. The two partners in the joint venture each had long histories of project delivery and had been working together for a number of years before this research was conducted.

This organisation is referred to as an EPCM contractor, where the form of contract with their client was one of Engineering, Procurement, Construction and Management, i.e. they performed the design and construction of the contracted facility for, and on behalf of, their client.

At the time of the research, this organisation had several active projects running, split between Perth and Adelaide. It was from one of these that the participants were drawn. Those interviewed include project managers, engineers and business leaders in both locations.

#### **3.5.2.2. Project 2**

The company undertaking this project is a global supplier of electrical equipment packages. They supply their equipment into every industry sector at many different levels. In Australia they have an office in each capital city and a number of smaller centres. Their Australian headquarters are in Sydney, with each of their capital city offices carrying local responsibility for securing and delivering local projects through the use of their national and international engineering capability.

They are a supplier in the industrial context in that they supply engineered products and equipment to clients, either directly to the operators of the plants or to engineering companies such as those delivering Project 1 to then supply into their clients' facilities.

At the time of this research, the company was delivering a large volume of equipment to a number of Western Australian resources projects using a virtual team comprised of personnel in Perth and Sydney. It was from the team delivering these projects that the participants were drawn, they included project managers, project engineers, engineers and business managers.

### **3.5.2.3. Project 3**

The organisation delivering this project is a privately owned, international supplier of high technology engineered products and bespoke solutions. They operate in a number of countries and, at the time of this research, had multiple offices in Australia, with their Australian headquarters in Perth. They have several offices in Asian cities, all of which reported either to Australia or the organisation's European owners.

Similar to the company undertaking Project 2 above, this organisation is regarded as a supplier, delivering engineered products and design to their clients who are either the operators as end users, or engineering companies such as the organisation undertaking Project 1.

The project from which participants were drawn for this research was delivering engineered equipment to a Western Australian client, with the execution and ownership of the project work split between Perth and Singapore, along with small levels of logistical support from Europe. Participants were based either in Perth or Singapore and comprised business managers, project managers, project engineers and technical engineers.

### **3.5.2.4. Project 4**

The company undertaking this project is a privately owned civil and structural design consultancy headquartered in Perth. They deliver civil and structural engineering services to clients in the resources sector. The organisation is owned by a group of directors who set company strategy and direction. It has offices in Perth, Sydney and the Middle East and share work between the offices as required.

This organisation is considered to be a consultancy as they typically deliver only engineering design services and specialist design checking services to clients, who are either the builders of the facilities or undertaking design on behalf of other clients.

The project from which participants were drawn was delivering civil and structural design work to a large Western Australia mining resources project, using a virtual team model comprising personnel based in Perth, Sydney and Dubai.

### **3.5.2.5. Independents**

The independent cohort comprised a mixture of project managers and project directors, project engineers and technical engineers. Each member of this cohort had extensive, recent experience working in or leading a virtual team project similar to those described above. Each member of this cohort came from a different project or organisation.

This cohort provided additional triangulation to the research as their views were from a different perspective to those engaged in projects 1 to 4. As reflective individuals, they

provided data which may have contrasted with that of personnel active on projects, who were living their experiences at the time of the interviews.

Collectively, this cohort provided a highly reflective perspective on their personal experiences and observations in the virtual team projects in which they had participated. All members of this cohort were Perth based and had been Perth based during their engagement in the relevant projects.

### **3.5.2.6. Company Comparison**

While each of the companies that provided access to their projects for this research provide services to slightly different parts of the resources sector, they have a great number of similarities. All supply engineering services such as the design of equipment and plant to the operators of the various resource facilities, all are staffed and largely led by engineers and personnel with an engineering background, and all work across geographic and temporal boundaries with their respective virtual teams.

Within each company, the overall business goals are similar; to supply their goods and services at a quality level and price that ensures clients receive a satisfactory outcome for a fair cost while ensuring their business makes a profit. All companies had chosen to adopt a virtual team approach for their work through their own internal decision processes and all had been working that way for several years.

### **3.5.3. Demographics of individual participants**

In all, a total of 35 participants were interviewed for the research. While, as Saunders and Townsend (2016) observed, there is no hard number of participants required for research such as this, it falls within the workplace research norm of 15 to 60 participants they identified. The sample size of this research is larger than the guidance provided by Polkinghorne (1989), who advised a normal sample size of 5 to 25 individuals who have all experienced the phenomenon is appropriate for such an investigation. Participants were interviewed until both theoretical saturation was achieved (Anderson, 2010, Saunders and Townsend, 2016), occurring after approximately 25 interviews, and a sufficiently representative number of interviews were conducted in each of the seven seniority and location categories shown in Table 4 to facilitate comparison. Satisfying the numbers for each of the seniority and location categories required that interviews continued after broad saturation was achieved and yielded some useful additional, reinforcing material.

Relationships between individual subjects, the projects they were part of, and their geographic locations are illustrated in Figure 4. The left side of the figure illustrates interviews conducted in Perth, with 12 subjects engaged in active projects. The six independent subjects are shown in the top centre of the figure. The right side of the figure illustrates the locations of the balance of participants, located in Adelaide, Sydney, Singapore and Dubai.

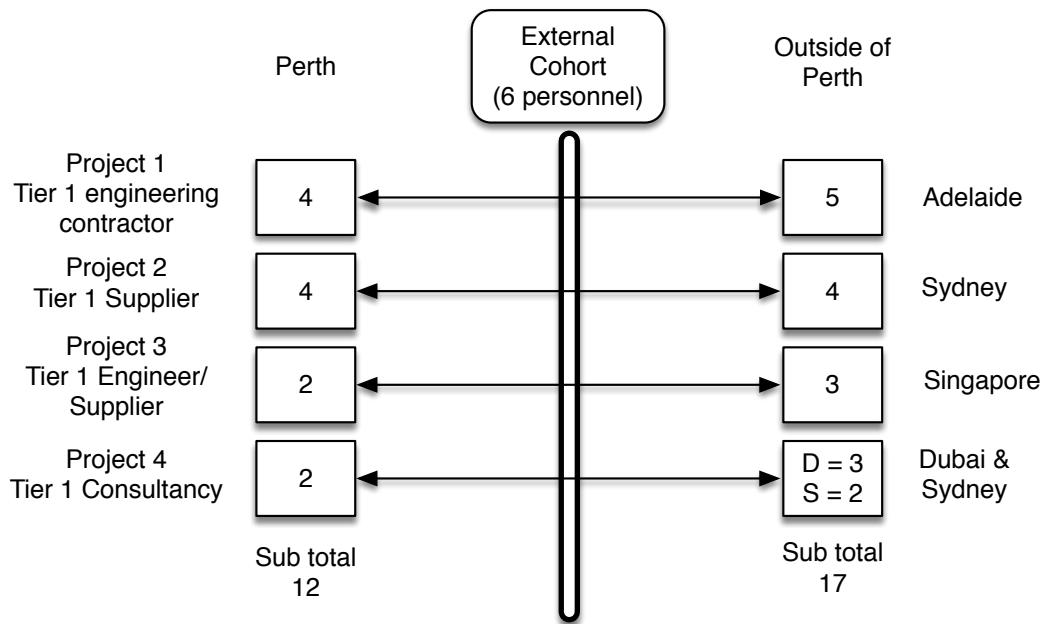


Figure 4: Organisational breakdown of participants and organisations

### 3.5.3.1. Levels and groups of participants

A seniority and location matrix (Table 4) was developed to aid in participant sampling to ensure representative numbers of personnel at each level and location were included in the research. This matrix was developed by defining the separate populations of senior leaders comprising Project Directors and Project Managers, mid-level personnel such as Project Leaders who report directly to each Project Director or Project Manager and junior roles represented by project team members.

|                        | Home<br>(Perth) | Away<br>(external to Perth) |
|------------------------|-----------------|-----------------------------|
| <b>Senior roles</b>    | 4               | 5                           |
| <b>Mid-level roles</b> | 3               | 9                           |
| <b>Junior roles</b>    | 4               | 4                           |
| <b>Independents</b>    | 6               |                             |

Table 4: Seniority and location matrix

While it was anticipated during the planning of this research that there were likely to be notable differences worth investigating between the views of personnel at different seniority levels, it was not known how many such layers of seniority would appear. As the research progressed, it became apparent that there were three clear layers present that could be identified and compared during the analysis of the data. The levels were:

- Senior leaders and managers of the projects and offices in which the projects were performed,

- Mid-level managers and coordinators whose project roles included a substantial volume of inter-office coordination and,
- Junior level personnel tasked with performing the day-to-day engineering work, often with interface requirements to personnel in other virtual team locations.

These three layers then formed the seniority levels that were subsequently investigated.

It was also anticipated during the research design that there could be substantial differences of views and experiences between personnel in the Perth office for the project virtual team and those in the offices elsewhere. Therefore the research was planned to consider these different potential views, separating participants into Perth based “home” and non-Perth based “away” categories. The additional Independents cohort were all Perth based professionals who had recent, relevant and pertinent experience and perspectives of project virtual teams. These independents had all held senior roles within their projects and were treated as a single group for the subsequent analysis.

In all, seven separate cohorts were identified for comparative analysis, as described below and depicted in Table 4 :

- **Home office senior** (4 participants) - Comprised participants based in Perth holding senior leadership positions, either within the team they were a member of and/or within the organisation they were employed by. Typical titles of personnel in this cohort were Business Manager, Project Manager or Project Director.
- **Home office mid-level** (3 participants) - Comprised participants based in Perth holding mid-level roles within their project team. Typical titles of personnel in this cohort were Senior Engineer, Project Engineer or Junior Project Manager.
- **Home office junior** (4 participants) - Comprised participants based in Perth holding junior roles within their project team. Typical titles of personnel in this cohort were Engineer, Junior Project Engineer or Designer
- **Away office senior** (5 participants) - Comprised participants based in offices other than Perth holding senior leadership positions, either within the team they were a member of and/or within the organisation they were employed by. Typical titles of personnel in this cohort were Business Manager, Project Manager or Project Director.
- **Away office mid-level** (9 participants) - Comprised participants based in offices other than Perth holding mid-level roles within their project team. Typical titles of personnel in this cohort were Senior Engineer, Project Engineer or Junior Project Manager.
- **Away office junior** (4 participants) - Comprised participants based in offices other than Perth holding junior roles within their project team. Typical titles of personnel in this cohort were Engineer, Junior Project Engineer or Designer
- **Independents** (6 participants) - Comprised participants not involved with a current project virtual team at the time of the interview, but who held substantial experience in virtual teams and provided a reflective perspective to the research data.

The negotiation and planning of the data collection was then monitored to ensure sufficient numbers of subjects were interviewed for each cell of the population matrix to provide representative data for analysis. As can be seen in Table 4, this process resulted in a high number of participants in the 'mid-level away' category. This was a result of the opportunity to interview these personnel during visits to their offices rather than an intention to have such a relatively large group for this category. The sizes of samples comprised the whole population of Project Managers and Projects Directors in the projects to which access was obtained, since the population of Project Managers and Project Directors was very small and, while homogeneous in project role, was also deemed likely to exhibit substantial variation in experience and perspective given the diversity of their projects. Quota samples were taken from the other two groups, being the project leaders and project team members, who were interviewed until both data saturation and geographic and project diversity was achieved. To test variation of responses between members of different projects, samples of project leaders and project team members within each project were included.

### **3.5.4. Interviews**

#### **3.5.4.1. Instrument design**

The qualitative data collection utilised a semi structured interview format to focus on the views and attitudes of the research participants. Adopting a semi structured approach to the interviews is described by Saunders et al. (2009) as allowing the introduction of additional questions into subsequent interviews as additional themes emerge and, for potential follow up questions to be administered to previous subjects where it is felt emergent themes could be further explored. This approach proved to be valuable during the interview process as some respondents were found to have different specific focuses. It also allowed interviews to be directed toward areas where previous respondents had either provided divergent views or had been relatively unforthcoming. The final version of the interview instrument can be found in Appendix 1, along with the information sheet and informed consent forms presented to each participant prior to their interview which are included as Appendices B and C respectively.

#### **3.5.4.2. Pilot test**

The interview instrument (Appendix 1) was tested for completeness and ability to extract the required relevant data by using it in pilot interviews with several of the researcher's industry colleagues and fellow industry professionals. Suitable industry personnel were sought from the researcher's own organisation for this piloting program. These personnel had relevant project experience, having either previously been involved in similar projects or were engaged in similar projects for other geographic locations. This piloting process met Hannabuss (1996) recommendations, in that it ensured questions were relevant and flowed, and provided an opportunity to incorporate changes into the development of the interview instrument. This pilot program also gave the researcher an opportunity to follow the recommendations of Rowley (2012) and gauge the typical duration of the interview, refine their interview technique and test the recording technology for effectiveness prior to the interviews with the research participants.

No data collected from this pilot phase were utilised in the major research study due to the workplace relationships between the researcher and the pilot test participants.

### **3.5.4.3. Data collection interviews**

#### *3.5.4.3.1. Preparation*

In preparing for the interviews, it was necessary to understand the structure of each participating organisation, to “develop an early familiarity with the culture of participating organisations” Shenton (2004, p.65) so that relevant organisational questions could be raised during interviews, and any differences in structure taken into account during analysis. This was achieved through a combination of desk top research and conversations during the negotiation phase of the interview planning. Through this process the researcher was able to better understand the context of the participants and more readily establish a trusting connection that assisted the participants to share their views openly during the interview. An example of this would be in Project 1. Prior to the interviews at each location it was possible to review the project objectives, understand the project client and their expectations, and also to understand the scale and duration of the project. This preparation meant that during the interviews it was possible to frame questions in the context of their project, rather than as general questions.

Given the nature of the research, and the projects in which it was conducted, it was necessary to interview participants located in a number of different cities and countries to fully understand the impact of communication between geographically dispersed virtual teams. Along with Perth, these locations were Sydney, Adelaide, Dubai and Singapore. All interviews, regardless of the location of the participant, were conducted face-to-face to remove any variation in engagement that could have been introduced through the use of enabling technologies. This was facilitated by the researcher travelling to the project offices of the subjects and, while there, conducting interviews with as many members of the team at that location as possible.

While visiting the project offices, short-term observations were undertaken through meeting with other personnel to build a broader understanding of the projects and some of the environmental issues that may have been faced. These observations served two purposes. Firstly, they allowed the researcher to understand the environment in which the personnel worked. For instance, did they have access to video conference facilities in their work area, did they have private workspaces or open plan, did they have personal webcams on their computers etc. all of which helped establish a baseline for the interview questions. Secondly, these observations contributed to the note taking that was undertaken during the interview process, generating memos which helped retain context and background for later analysis.

#### *3.5.4.3.2. Conducting the interviews*

All interviews were conducted in private rooms or offices with only the participant and interviewer present. Interviews were audio recorded, using digital voice recorders, then transcribed verbatim. The researcher transcribed the first six interviews, with the transcription



of the balance being outsourced to a professional transcription service. All transcriptions were tested for accuracy during the analysis phase by the researcher listening to each audio file while reading its transcription, ensuring that all the observations and statements of the participants were correctly captured in the transcribed files. All transcriptions were then de-identified to remove any references to the subject, their colleagues, employer or client in preparation for the analysis process. The resulting transcripts were then loaded in to Nvivo© for subsequent analysis.

| Name     | Nodes | Referen... | Created On           | Created By | Modified On         | Modified By |
|----------|-------|------------|----------------------|------------|---------------------|-------------|
| IS-AA31A | 57    | 113        | 11 Mar 2012, 11:...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-BB31A | 63    | 216        | 11 Mar 2012, 11:...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-BD11D | 57    | 213        | 5 Dec 2013, 11:5...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-BD21A | 38    | 184        | 30 Sep 2013, 1:4...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-BD31A | 43    | 195        | 6 Jan 2013, 9:41 AM  | FGN        | 19 Jan 2013, 1:5... | FGN         |
| IS-BD41D | 45    | 109        | 20 Jan 2014, 4:3...  | FGN        | 27 Jan 2014, 10:... | FGN         |
| IS-BD42D | 41    | 138        | 27 Jul 2013, 9:12... | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-CB11A | 50    | 143        | 20 May 2012, 3:0...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-DB11A | 54    | 154        | 8 Jul 2012, 12:02... | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-EB31A | 120   | 279        | 5 Aug 2012, 2:39...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-FC31B | 106   | 220        | 20 Aug 2012, 6:3...  | FGN        | 6 Jul 2014, 2:51 PM | FGN         |
| IS-FC32B | 37    | 94         | 6 Jan 2013, 9:41 AM  | FGN        | 26 Jan 2013, 4:1... | FGN         |
| IS-FC33B | 48    | 137        | 6 Jan 2013, 9:41 AM  | FGN        | 28 Jan 2013, 11:... | FGN         |
| IS-FC34B | 46    | 138        | 6 Jan 2013, 9:41 AM  | FGN        | 3 Mar 2013, 4:12... | FGN         |
| IS-FC35B | 52    | 242        | 6 Jan 2013, 9:42 AM  | FGN        | 24 Mar 2013, 1:0... | FGN         |
| IS-GB11C | 49    | 117        | 3 Mar 2013, 11:3...  | FGN        | 15 Jun 2013, 2:2... | FGN         |

Figure 5: Screenshot of several transcripts in NVivo

### 3.5.4.3.3. Saturation and representation

Data saturation began to appear once several participants had been interviewed in each category, this occurred after the first 15 interviews, which fully incorporated two participating organisations. Saturation continued to develop through subsequent interviews as members of additional participating organisations were included. Once 25 interviews had been completed there was substantial saturation in a number of the seniority and location categories, but other categories were still poorly represented in the overall data. To ensure representative and saturated data was captured for all seven categories data collection continued until a total of 35 interviews had been conducted.

Completing 35 interviews resulted in an additional richness of insights in each emerging theme to what would have been possible had data collection concluded earlier. This greater richness of data beyond saturation supported the development of richer thematic coding and cognitive mapping in subsequent stages of the research analysis.

### 3.5.4.3.4. Triangulation of data

Triangulation, referred to by Schwandt (2007, p.18) as “cross-checking of data by use of different sources, methods, and at times, different investigators” was achieved through two different mechanisms. Firstly, through soliciting the views of a wide range of informants, allowing “individual viewpoints and experiences to be verified against others and, ultimately, a rich picture of the attitudes, needs or behaviour of those under scrutiny to be constructed based on the contributions of a range of people” (Shenton, 2004, p.66), achieved by interviewing personnel in similar roles in four different active virtual team projects. These were personnel and projects with no interaction and, while all delivering into the Western Australian resources sector, all were doing so in different ways. This diversity of participants generated four different, independent sets of insights and perspectives of the day-to-day experiences of

personnel directly engaged in virtual teams. The second triangulation mechanism, which broadened the range of informants beyond those directly involved in the projects investigated, was through the independent, reflective cohort. This group of six individuals were interviewed as part of the research and, with each individual in the cohort coming from a different, independent project, all of which had completed at the time of the research, they provided a contrasting set of perspectives to those of the other six cohorts, who were all in active projects.

#### *3.5.4.3.5. Bracketing*

Understanding the role of the researcher in the collection, analysis and interpretation of this research is an important factor in ensuring its trustworthiness. A number of academics including Moustakas (1994), Marshall and Rossman (2010) and Creswell (2013) identified that, in qualitative research, the pre-existing beliefs and perceptions of the researcher must be understood and accounted for throughout the entire research process. As such, it was critical that the researcher recognised their own proximity to the phenomenon being studied, that the researcher understood this and took appropriate measures to ensure that their own views did not influence the research since, as both Ahern (1999) and Gearing (2004) observed, bracketing is necessary to ensure validity and independence of the data collected.

The researcher has worked as an engineer and engineering manager, both within and alongside virtual teams for much of his professional career, he was very conscious from the beginning of this research that he would need to ensure his own experiences, personal views and perspectives were excluded from influencing the research. Having a strong network in the engineering and resource projects industry in Western Australia greatly aided the researcher's ability to gain access to those at the coalface of these projects. The researcher's technical background with a deep personal knowledge and understanding of the typical environment in which those who participated in this research were working was also highly beneficial, providing perspective and an understanding of the terminology and language used by the participants. The risk associated with this network and understanding was that it could have coloured the research process, influencing the way data was collected, analysed and presented. Therefore it was essential that the researcher's own views had as little influence as possible on the research.

To achieve as high a level of bracketing as possible during data collection, the questions as written in the interview instrument (Appendix A), and as asked of the participants, were carefully structured to be as open as possible, allowing participants to bring their own perspectives and beliefs to the process. In many instances, this resulted in participants talking for almost the entire interview with only the occasional clarifying questions being necessary to gain a full understanding of the point being expressed. Occasionally during the data collection process, it was necessary to prompt participants to consider other areas to those they had identified themselves. In these instances open rather than leading or closed questions were employed.

Once the research moved into the analysis phase it was equally important to allow the data to emerge unprompted and not to force it to fit any preconceptions, especially any a priori hypotheses which could have filtered the data prior to, or during the coding process (Glaser, 1978). Having such a large volume of extremely rich data (the 35 interviews yielded some 40 hours of audio recording which transcribed into around 330,000 words) helped in this regard. The sheer volume of data made it hard to manage in any way other than to allow the data to speak entirely for itself. During the coding process a heavy reliance on the statistics generated within the NVivo© database was apparent. Major concepts and themes quickly became apparent through the sheer numbers of codes assigned to them, while the minor concepts appeared only in the long tail of codes. Once the principal themes and concepts emerged from the coding, it was then possible to perform the balance of the analysis taking the emergent data at face value, following the views of theoretical sensitivity expressed by Glaser and Holton (2004) whereby theory is allowed to emerge and are worked out systematically in relation to the data during the course of the research.

## **3.6. Development of Findings**

### **3.6.1. Methods of Data Analysis and Synthesis**

The data collected was analysed using a two-stage process of coding and cognitive mapping. This was followed by comparing and contrasting the combined results of the emergent themes and cognitive maps to identify key findings. The first stage, coding, identified and classified the key pieces of text from the interview transcripts, by collecting them into codes then grouping similar codes into categories, before identifying common themes from the codes and categories into the themes emerging from the data. The second stage, cognitive mapping, extended the understanding and interpretation of those codes into a series of seven maps, one for each of the demographic groupings of research participants. This process allowed the high level of rigour and traceability of the coding process to be combined with the depth of meaning and interrelationship visible through cognitive mapping. The process followed is illustrated in Figure 6. The separate findings from these two inter-related processes were subsequently analysed for overall findings.

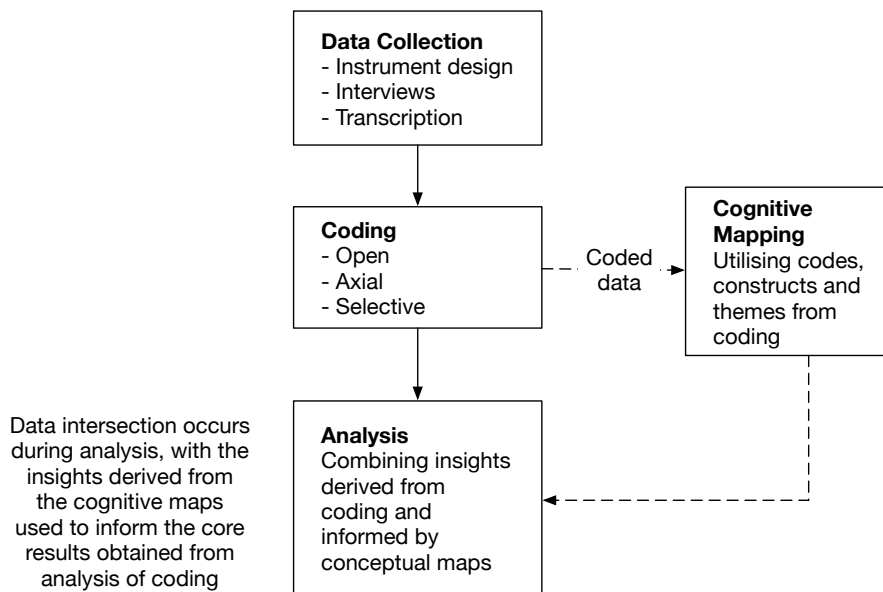


Figure 6: Data collection and analysis process

### 3.6.1.1. Coding then cognitive mapping

The coding process functions on the basis that as each code is developed, it will fit into a single category and, that it will not, as part of its categorisation, be related to codes other than those in the same category. Coding can also lead to the data becoming decontextualized (Glaser and Laudel, 2013), with the development of codes, categories and themes resulting in the story behind the codes, and therefore some of the answers to the research questions, becoming lost in the data. In planning this research it was determined that combining coding and cognitive mapping would develop a more nuanced, interconnected outcome, an analysis that sought to identify both key themes and issues as well as exploring the interrelationships and dependencies in which they exist.

Cognitive maps offer a way of representing a person's assertions regarding a domain (Axelrod, 1976). A cognitive map is described by Armstrong (2005, p.21) as "designed to capture the structure of the *causal* assertions of a person with respect to a particular domain". Armstrong (2005) refers to causal mapping as a subset of cognitive mapping, where a network of causal relationships are developed from data elicited from an individual or group to represent their cognition of a phenomena being investigated. Narayanan (2005, p.2) refers to causal maps as "representing thought as a network of causal relations, representing concepts through nodes and causality through links between nodes". Narayanan (2005, p.13) describes three perspectives in which causal mapping would be used:

- **Objectivist**, where researchers are searching for a 'true' causal representation of some phenomenon. This view is most applicable to the study of physical and technical systems and is less prevalent in social sciences.
- **Expert anchored**, where researchers seek the views and beliefs of experts in the field being explored and establish benchmarks against which others can be judged.

- **Social Constructionist**, where the researcher is primarily interested in capturing the causal maps of subjects they are studying. In this perspective, the researcher is intrinsically interested in the maps and expects them to provide a cognitive explanation for the phenomena being studied.

The social constructionist perspective of causal maps was considered to be the most appropriate for this research. This was predicated on this work focusing on the relatively new phenomena of the use of virtual teams for resource projects; a phenomenon which is neither a physical nor technical system and where there are, as yet, few true experts from whom to solicit information.

Additionally, Narayanan (2005, p.14-15) discussed the four research contexts in which causal mapping is utilised:

- **Discovery** – where the researcher is attempting to unearth new phenomena. In this context, Narayanan (2005) suggested it is likely that two researchers would reach similar outcomes given the same set of data, reducing some of the subjective issues that can occur in data analysis but at the price of the loss of some aspects of human imagination seen in other approaches.
- **Hypothesis testing** – where the researcher uses causal mapping techniques through statistical inference using large samples.
- **Evocative** – where a general theoretical framework exists but where operationalisation of these general theories to a specific domain has yet to be accomplished. This context requires the availability of domain experts.
- **Intervention** – the use of causal maps to assist management of organisations to make decisions or to reflect on reasoning processes.

The relationships of these four contexts to the state of theory, and applicability of the technique and the source of data are shown in Table 5 (taken from Narayanan (2005, p.15)).

|                                 | Discovery                                      | Evocative  | Hypothesis testing  | Intervention                                  |
|---------------------------------|--|--|---|---|
| State of theory                 | Undeveloped                                    | General theoretical framework available; no operationalization | Theory and operationalization available                         | Varies from undeveloped to fully developed    |
| Applicability of causal mapping | Deriving concepts and establishing links       | Operationalizing concepts                                      | Obtaining relevant data   | As an input to decision making                |
| Source                          | Participants in the system                     | Experts  | Relevant population sampling drawn by statistical consideration | Primary stakeholders and convenience sampling |
|                                 | Diverse sources to fully capture the phenomena |  |   |   |

Table 5: Causal mapping in four contexts (from Narayanan (2005, p.15))

Causal maps are described by Huff (1990, p.16) as “allowing the map maker to focus on action — for example, how the respondent explains the current situation in terms of previous events, and what changes he or she expects in the future.” They are powerful tools for the identification and interpretation of interrelationships and dependencies, particularly those of a highly complex and organic, many-to-many, many-to-one, or one-to-many nature. Causal maps allow for visual analysis and presentation of how multiple themes and categories interact, understanding the directions of influence and identifying the central themes.

The term cognitive map is therefore used to describe the maps generated from this research. As outlined above, the term ‘causal maps’ is used in a broad range of applications, from physical sciences and practice applications where they are used to depict and analyse events that can be readily replicated through the re-enactment of identical processes, to the development of concepts in embryonic, discovery research. While in this research the techniques set out in the causal mapping literature are used in their production, the maps themselves are considered and referred to as cognitive maps. The cognitive maps show the phenomenological cognitive linkages and relationships described by the research participants, relationships which, while clearly expressed by the participants and correlated by the descriptions of other participants, exist only as lived experiences and not as physical manifestations that can be replicated and tested in laboratory environments.

The hybrid data analysis and synthesis used in the analysis of the collected data resulted in an output that combines the best of both coding and cognitive mapping practices. It brings the rigour, traceability and repeatability of coding in a fully traceable platform such as NVivo© together with the depiction of the high level of complexity of the phenomenon being studied afforded by causal mapping.

### **3.6.2. Coding**

Coding of the de-identified interview transcripts was performed in NVivo© using a combination of initial, descriptive and in vivo techniques to identify a broad first cycle of codes. These first codes were subsequently reviewed and adjusted as each additional transcript was coded to ensure consistency across all of the transcripts.

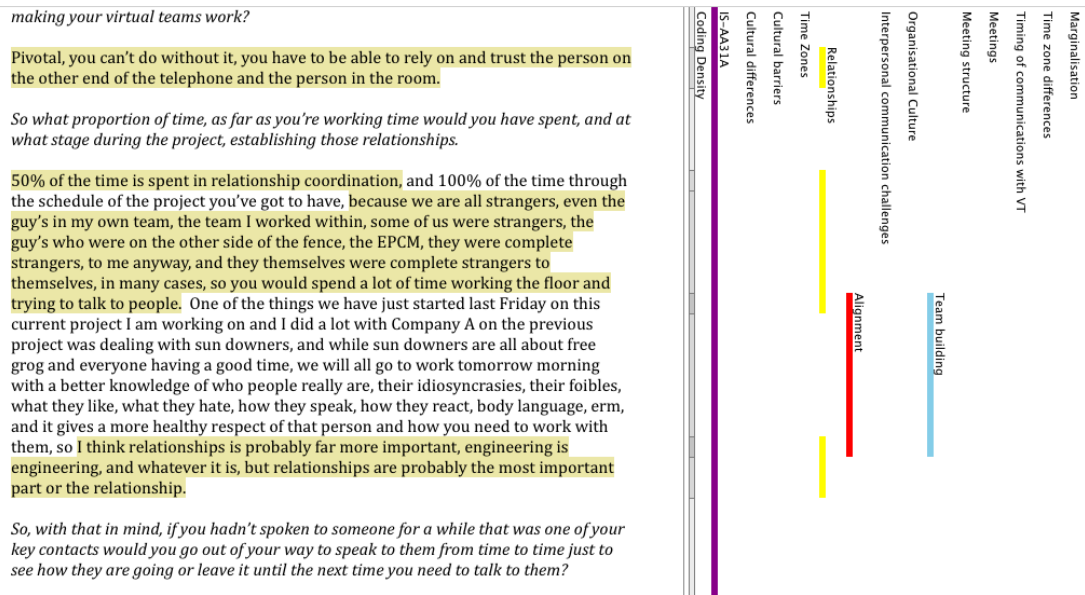


Figure 7: Screenshot of transcript coding in Nvivo©

Initial transcript coding was followed by the identification of categories within the codes, collecting similar groups of codes together by their meanings. During the initial coding process, analytic memos and notes were continually generated and reviewed to capture emergent ideas and concepts from the data.

|   |   |   |                     |     |                     |
|---|---|---|---------------------|-----|---------------------|
| Expertise (technical)                                 | 0 | 0 | 2 Sep 2012, 10:3... | FGN | 2 Sep 2012, 10:3... |
| Local hybrid processes                                | 0 | 0 | 6 Oct 2012, 5:43 PM | FGN | 6 Oct 2012, 5:45 PM |
| Need to understand local customs and Hierarchy        | 0 | 0 | 7 Oct 2012, 7:54 AM | FGN | 7 Oct 2012, 8:04 AM |
| Spending time at other locations                      | 0 | 0 | 7 Oct 2012, 8:16 AM | FGN | 7 Oct 2012, 8:19 AM |
| Visiting remote versus remote visiting hub            | 0 | 0 | 7 Oct 2012, 8:20 AM | FGN | 7 Oct 2012, 8:42 AM |
| Differential incomes                                  | 0 | 0 | 7 Oct 2012, 8:44 AM | FGN | 7 Oct 2012, 8:46 AM |
| Using inputs to expedite resolutions to disagreements | 0 | 0 | 7 Oct 2012, 10:3... | FGN | 7 Oct 2012, 10:4... |
| I think the answer is patience... in a word           | 0 | 0 | 7 Oct 2012, 11:0... | FGN | 7 Oct 2012, 11:1... |
| Body language   | 0 | 0 | 7 Oct 2012, 11:1... | FGN | 7 Oct 2012, 11:1... |
| Informal sources of communication                     | 0 | 0 | 7 Oct 2012, 11:1... | FGN | 7 Oct 2012, 11:1... |
| Body language versus blind assumptions                | 0 | 0 | 7 Oct 2012, 11:4... | FGN | 7 Oct 2012, 12:0... |
| Pressure leading to increased disagreements           | 0 | 0 | 7 Oct 2012, 12:0... | FGN | 7 Oct 2012, 12:0... |
| Importance of personal relationships                  | 0 | 0 | 7 Oct 2012, 12:1... | FGN | 7 Oct 2012, 12:2... |
| Training  | 0 | 0 | 7 Oct 2012, 12:2... | FGN | 28 Apr 2013, 10:... |
| Compromise over scope and quality                     | 0 | 0 | 7 Oct 2012, 12:5... | FGN | 7 Oct 2012, 12:5... |
| Need resources to learn from mistakes                 | 0 | 0 | 7 Oct 2012, 1:02 PM | FGN | 7 Oct 2012, 1:03 PM |
| Tenure  | 0 | 0 | 20 Oct 2012, 2:2... | FGN | 19 Jan 2013, 10:... |
| Email usage   | 0 | 0 | 20 Oct 2012, 2:3... | FGN | 21 Oct 2012, 9:5... |
| Phone usage   | 0 | 0 | 20 Oct 2012, 2:3... | FGN | 20 Jan 2013, 2:2... |
| Different communication media preferences             | 0 | 0 | 20 Oct 2012, 2:4... | FGN | 20 Oct 2012, 2:4... |
| Respect   | 0 | 0 | 21 Oct 2012, 10:... | FGN | 19 Jan 2013, 9:4... |
| Confidence in others                                  | 0 | 0 | 21 Oct 2012, 10:... | FGN | 21 Oct 2012, 10:... |
| Different Agenda's                                    | 0 | 0 | 28 Oct 2012, 12:... | FGN | 28 Oct 2012, 12:... |
| Allocation of people to teams                         | 0 | 0 | 28 Oct 2012, 12:... | FGN | 28 Oct 2012, 12:... |

Figure 8: Screenshot of memos in NVivo©

The identification of these categories was subsequently followed by a third, final cycle to provide a thematic analysis, distilling the first, individual codes into a series of themes. As Saldana (2009) suggested, coding is a recursive, cyclical act, with each cycle further managing, filtering, highlighting and focussing the salient features to generate categories, themes and concepts, grasp meaning and build theory.

|   |    |     |                      |     |                      |
|---|----|-----|----------------------|-----|----------------------|
| Relationships   | 35 | 236 | 7 May 2014, 12:0...  | FGN | 8 Aug 2014, 9:10...  |
| Relationship building                                     | 26 | 96  | 9 Sep 2012, 10:2...  | FGN | 29 Jul 2014, 9:38... |
| Bringing in people from the remote offices for rel...     | 8  | 21  | 7 Oct 2012, 8:25 AM  | FGN | 28 Jun 2014, 2:1...  |
| Secondments to help build relationships                   | 3  | 11  | 9 Sep 2012, 12:2...  | FGN | 7 Dec 2013, 3:32...  |
| Building a remote relationship                            | 7  | 13  | 8 Sep 2012, 11:2...  | FGN | 7 Dec 2013, 3:06...  |
| Ideas for remote relationship building                    | 1  | 1   | 8 Sep 2012, 2:48...  | FGN | 28 Jul 2013, 11:2... |
| Building a remote network                                 | 3  | 4   | 1 Oct 2012, 11:1...  | FGN | 20 Jan 2014, 4:2...  |
| Photographs to share                                      | 2  | 4   | 9 Sep 2012, 12:5...  | FGN | 6 Oct 2013, 11:5...  |
| Importance of personal relationships                      | 14 | 56  | 9 Sep 2012, 1:57...  | FGN | 30 Mar 2014, 2:4...  |
| Personal relationships                                    | 12 | 26  | 11 Mar 2012, 1:0...  | FGN | 21 Mar 2014, 12:...  |
| Maintenance of relationship                               | 7  | 14  | 17 Mar 2012, 3:5...  | FGN | 30 Mar 2014, 2:4...  |
| Historical experience                                     | 5  | 9   | 11 Mar 2012, 12:...  | FGN | 29 Dec 2013, 3:1...  |
| lack of personal relationship                             | 3  | 3   | 1 Oct 2012, 2:34 PM  | FGN | 15 Dec 2013, 11:...  |
| Previous personal experience                              | 3  | 7   | 17 Mar 2012, 3:4...  | FGN | 15 Feb 2014, 2:3...  |
| Remote relationships                                      | 3  | 4   | 2 Sep 2012, 1:24...  | FGN | 6 Oct 2013, 11:4...  |
| Equality  | 2  | 4   | 17 Mar 2012, 3:4...  | FGN | 6 Oct 2013, 11:4...  |
| Mutual support  | 2  | 3   | 1 Oct 2012, 11:2...  | FGN | 6 Oct 2013, 11:4...  |
| Relationship  | 2  | 2   | 2 Sep 2012, 10:0...  | FGN | 7 Dec 2013, 4:18...  |
| Adapting to different relationships                       | 1  | 1   | 9 Sep 2012, 12:4...  | FGN | 6 Oct 2013, 11:4...  |
| Easier to start in person                                 | 1  | 1   | 8 Sep 2012, 3:05...  | FGN | 6 Oct 2013, 11:4...  |
| Focussing on the people will lead to a successful vir...  | 1  | 1   | 24 Mar 2013, 12:...  | FGN | 6 Oct 2013, 11:4...  |
| Helping a long term relationship                          | 1  | 1   | 8 Sep 2012, 11:2...  | FGN | 6 Oct 2013, 11:4...  |
| Losing track of contacts                                  | 1  | 2   | 8 Sep 2012, 2:43...  | FGN | 6 Oct 2013, 11:4...  |
| Over familiarity leads to a lack of professional appro... | 1  | 4   | 17 Mar 2013, 11:...  | FGN | 6 Oct 2013, 11:4...  |
| Rapport from meeting people                               | 1  | 1   | 8 Sep 2012, 10:3...  | FGN | 6 Oct 2013, 11:4...  |
| sourcing the relationship                                 | 1  | 1   | 2 Sep 2012, 1:20...  | FGN | 6 Oct 2013, 11:4...  |
| Communication medium                                      | 34 | 249 | 9 Sep 2012, 9:59...  | FGN | 29 Jul 2014, 9:19... |
| Interpersonal communication challenges                    | 34 | 269 | 31 Jul 2014, 10:0... | FGN | 8 Aug 2014, 9:14...  |
| Challenges of Virtual teams                               | 30 | 159 | 7 Oct 2012, 12:4...  | FGN | 8 Aug 2014, 9:30...  |

Figure 9: Screenshot of an expanded theme in NVivo©

### 3.6.3. Cognitive Mapping

Once coding was complete, a series of cognitive maps were developed, each representing the views and beliefs expressed through the interview data by the members of the seven distinct demographic cohorts. To generate these cognitive maps, causal mapping techniques were utilised with the coded data. This was undertaken within the Decision Explorer© (COPE) software package available from Banxia software, an established platform used for the development, management and analysis of causal maps. The causal mapping technique was considered to be particularly suitable for this phase of the analysis since, as Markoczy and Goldberg (1995) note, it is the process by which the beliefs of an individual or group of individuals about a particular domain are solicited and the interrelationship of those beliefs then diagrammatically expressed. The maps generated are graphical representations that explore the subjects' phenomenological causal beliefs (Sproull, 1981) and, are highly suited to understanding the interactions of personnel working in virtual team environments.

The mapping process followed the demographic distribution of the interview subjects as set out in Table 7 whereby the coded data collected from the interview participants were grouped by their location and level of seniority within the project. This produced seven demographic groups, namely;

- **Senior home** - those holding senior project positions located in the Perth home office of the project.
- **Middle home** - those holding mid-level roles and located in the Perth home office of the project.



- **Junior home** - Those holding junior roles and located in the Perth home office of the project.
- **Senior away** - those holding senior roles and located in any one of the satellite project offices
- **Middle away** - those holding mid-level roles and located in any one of the satellite project offices
- **Junior away** - those holding junior level roles and located in any one of the satellite project offices
- **Independents** - those who were not part of a current virtual team project at the time of interview but who had recent, reflective insights into the working of such projects.

All codes identified within the data from each group were analysed using the causal mapping techniques developed by Axelrod (1976) and similar to those outlined by Laukkanen (1994). Laukkanen (1994, p.234) described causal mapping as a series of causal assertions exemplified by "Phenomenon / entity A leads to / causes / is followed by / influences / etc. / Phenomenon / entity B" or, "B is an outcome of / caused / effected / preceded /influenced / etc. / by A". Each causal relationship being represented by the interconnection of two or more short pieces of text, referred to as nodes, interconnected by unidirectional arrows, with the text at the tail of the arrow taken to be the cause of the statement at the head (Eden, Ackermann and Cropper, 1992). One such map is shown in Figure 10 where nodes are represented by text in boxes.

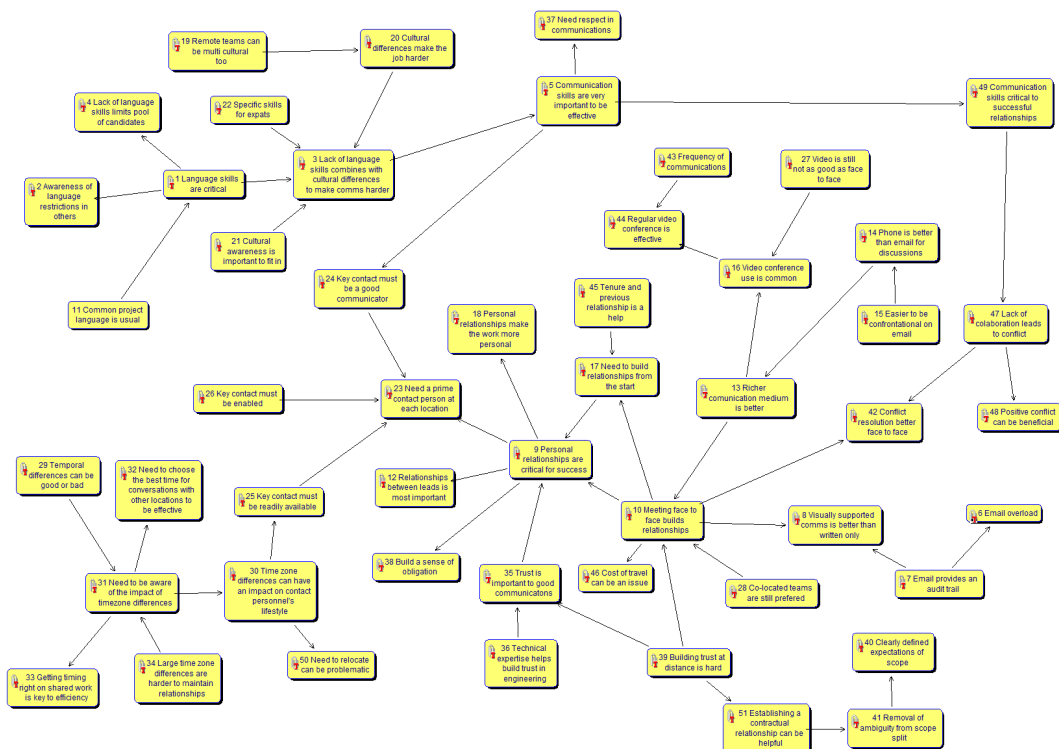


Figure 10: Example completed cognitive map from Decision Explorer©

As each map was generated, each node was supplemented by memos recording the source of the data which led to its inclusion in the map. The text in these memos were direct quotes and references from the originating codes captured in the NVivo© coding process such as that shown in Figure 11.

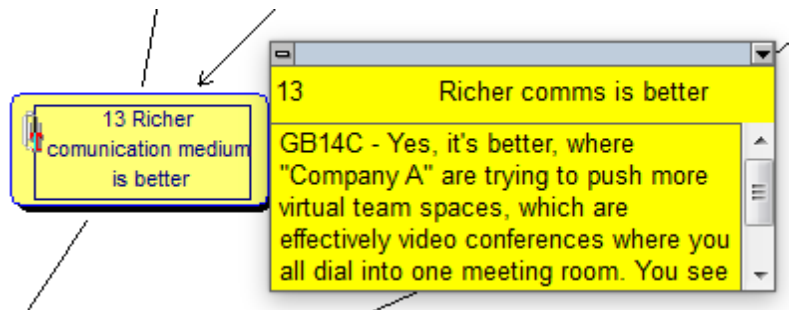


Figure 11: Screenshot exemplar memo and its associated node

Following this process, seven cognitive maps were produced. Each map represents the consolidated views of one of the seven cohorts identified above. The maps represent the causal relationships derived from the coded data collected from the participants in each cohort and represent them such that “when a cognitive map is pictured in graph form it is then relatively easy to see how each of the concepts and causal relationships relate to each other, and to see the overall structure of the whole set of portrayed assertions” (Axelrod, 1976, p.5).

These maps varied in complexity, with between 50 and 100 nodes representing the data from each cohort. In producing the maps, many nodes were found to have multiple links to other nodes, resulting in complex, organic, rhizome like maps. It is suggested by Eden et al. (1992) that a high ratio of links to nodes demonstrates that the maps will have captured a greater level of cognitive complexity.

Each of the maps was analysed individually to identify the core domains within them. These domains are the nodes within the maps with the highest number of connected links, indicating that they are the most cognitively central (Eden et al., 1992). These cognitively central nodes form the core constructs of each map. Core constructs of this nature are considered by Spender (1989) to represent key organisational knowledge of a kind referred to as an “industrial recipe”, having both a significant depth of meaning for organisation members and an intersubjective convenience in organisational conversations (Eden et al., 1992). The analysis also identified any clusters present in the maps along with any virtuous or vicious circles.

### 3.6.3.1. Centrality

Analysis through identification of degrees of centrality is undertaken by searching the completed map for the nodes with the largest numbers of input and output links. These nodes can be considered as being the most cognitively central to the overall construct. These central nodes are highlighted in the analysed maps by the placement of bold ovals around each node.

Cent Scores Calculated...

- 10 Meeting face to face builds relationships  
16 from 30 concepts.
- 9 Personal relationships are critical for success  
14 from 25 concepts.
- 23 Need a prime contact person at each location  
12 from 25 concepts.
- 17 Need to build relationships from the start  
11 from 23 concepts.
- 13 Richer communication medium is better  
11 from 23 concepts.
- 39 Building trust at distance is hard  
10 from 22 concepts.

Figure 12: Screenshot of centrality calculation in Decision Explorer©

### 3.6.3.2. Clusters

Clusters are groupings of tightly interconnected nodes that break a map into a series of inter-related themes. The individual clusters are typified by a series of strong intra-component linkages which are, themselves, connected by weaker inter-component linkages. During the development of maps clusters are formed when numbers of relatively similar nodes are linked to one another until a defined level of dissimilarity has been reached (Eden et al., 1992). Clusters are highlighted on the analysed maps through an outline encircling them.

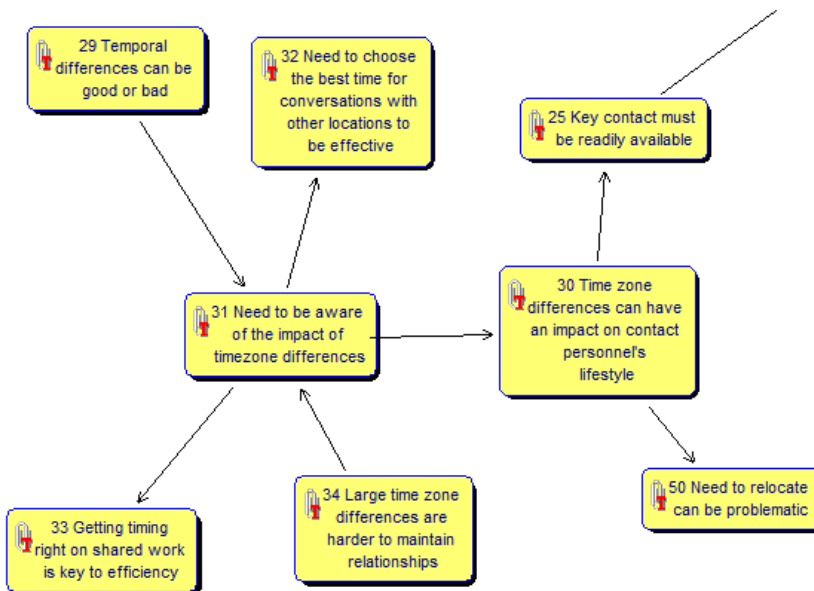


Figure 13: Exemplar cluster from a cognitive map

### 3.6.3.3. Vicious and virtuous circles

Vicious and virtuous circles are formed where the inter-relationship of nodes indicate the forming of a circle. A virtuous occurs where the outcome of each node positively reinforces the successive node, and a vicious circle where the output of nodes negatively reinforces subsequent nodes in a seemingly continuous manner. Such circles are highlighted on the analysed maps by bold arrows following the nodal linkages.

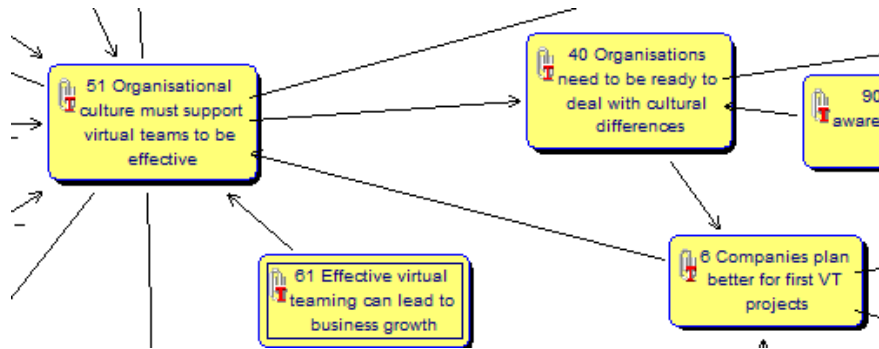


Figure 14: Screenshot of a virtuous circle with nodes 51, 40 and 6 interconnected

## 3.7. Analysis and interpretation

To understand the impact of interpersonal communication within these virtual teams, the findings from the coding and cognitive mapping processes were brought together. Each of the seven cohorts were compared and contrasted to understand how the views, beliefs and perspectives of each group differed from the others. As illustrated in Figure 15, the senior maps of the home and away cohorts were compared for differences and similarities, as were the mid-level maps and those of the junior project members. Similarly, the views of each of the three groups within each location of the virtual team relationship were compared, so the views of the senior, mid-level and junior personnel were compared to identify similarities and differences.

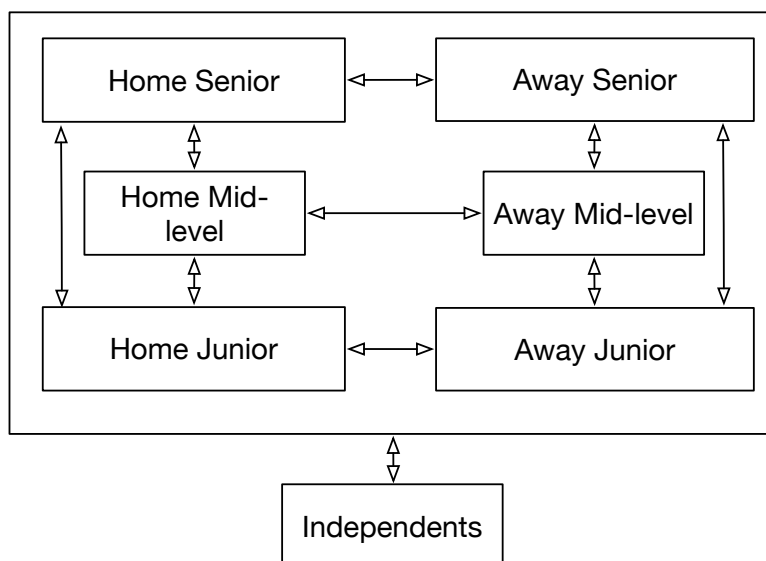


Figure 15: Directions of comparison between groups

### **3.8. Ethical Considerations**

The research was conducted in accordance with the policies of the Curtin University Human Ethics Committee. All participants received a statement regarding the importance of the study while ensuring participants and their organisations that privacy and anonymity would be maintained (See Appendix B - Information Sheet), and that they had the right to withdraw from the study at any time without prejudice. The data provided continues to be treated as confidential and kept in a secure location, both on a secure university server and in locked cabinets, for 7 years as per Curtin University policy. An executive summary of the aggregated research results was offered to participants. Ethical approval for the research was sought and granted using the minimal risk research ethics Form C and renewed as required throughout the research to ensure continuous coverage.

All research data were de-identified to ensure confidentiality and anonymity of both the organisation and individual. All data collection was designed to be as unobtrusive as possible to the individuals and their employing organisations.

This research involved the collection of data from project management and engineering professionals operating in a number of locations and different roles by a researcher employed as an engineering manager at the time of collection. This presented several ethical issues to be considered and addressed. Ethical boundaries were carefully established and managed to satisfy the subject companies, projects and individuals that the researcher, conducting this research on a part time basis, was acting impartially and not as an officer of their employer when surveying potentially competing companies. To avoid any potential ethical issues associated with power relationships within the researcher's own organisation, he did not seek to conduct any formal data collection within that organisation.

Principal ethical considerations in this research are that the rights of the participants were protected at all stages, that the participants were made aware of their rights at the commencement of the interviews, that they were fully aware of their right to withdraw from the research at any stage and that the maintenance of confidentiality and anonymity of all participants, their employers and their employer's clients were protected through the entire research process.

At the commencement of each interview, each participant was provided a copy of the research information sheet (See Appendix B - Information Sheet) clearly stating the aims of the research, the participant's rights and contact details of the researcher and supervisors along with the ethics approval number issued by Curtin University. Each participant was also asked to sign an informed consent sheet which outlined the above information (See Appendix C - Informed Consent Form). On signing, one copy was retained by the participant and the other copy retained by the researcher.

To ensure anonymity of all parties, immediately following the interview the audio recording file of each interview was copied onto a secure computer and assigned a 7-digit alphanumeric code in the format AA-AA<sub>n</sub>nA, where A = a letter and n = a number. These codes uniquely

identify each interview participant. These codes, along with the names and contact details of each participant were recorded on a separate table that was securely stored, separate to the audio files. The audio files were then transcribed to produce textual versions of the interviews, each transcript was de-identified to remove all names and identifying features including the names of the subject, their employer, any colleagues mentioned during interviews and any other identifying features. Only once this de-identification was complete were the transcripts uploaded into the NVivo© database for coding.

Within the NVivo© database, interview subjects were only referred to by their 7-digit alphanumeric identifier (see Figure 5). These same identifiers were then used in the cognitive mapping process and in the body of this thesis to differentiate between interview subjects. To provide additional context in the analysis of the data, generic role descriptions are also used against each subject, such as “Project Manager, away”. These role titles are generic interpretations of the roles of the interview subjects and cannot be used to identify any individual participant.

### **3.9. Trustworthiness**

There are a number of factors for consideration in ensuring qualitative research of this nature is rigorous, valid and trustworthy (Guba, 1981, Shenton, 2004). Lincoln and Guba (1986, p.77) identified four criteria of trustworthiness that apply to qualitative research and which parallel similar tests traditionally applied to quantitative research, being:

- **Credibility** as a parallel to internal validity, exploring the true value of the inquiry.
- **Transferability** as a parallel to external validity in its applicability and ability to be applied more generally than the specific field in which it is conducted.
- **Dependability** as a parallel to reliability and replicability in its ability for successive researchers to apply the same methods and approach and obtain the same or similar results and
- **Confirmability** as a parallel to objectivity that establishes the neutrality of the work undertaken.

Each of these criteria is addressed separately below.

#### **3.9.1. Credibility**

A number of activities were included in the research structure to ensure its credibility. The data collection process ran for an extended period of approximately 15 months, commencing with first contact to obtain access to the first participant through to the completion of the last interview. During this period, the basis of the research was regularly tested through discussions in the negotiations with each organisation and individual, through discussions with industry practitioners and contacts of the researcher and, with academics working in both the fields of management and project management, to ensure the research would be valid. This

process included continual testing and refining of the interview instrument itself in a reflective process after each interview was completed.

Once initial findings from the research began to emerge, opportunities were secured for the researcher to present findings and methodology papers to both the academic community and practice at a number of conferences and seminars. This has included:

- Presenting at the Australia, New Zealand Academy of Management (ANZAM) annual conference in 2012 (Norman, Pick and Dickie, 2012)
- Presenting at the Australian Institute of Project Management (AIPM) annual conference in Perth in 2013, (Norman, Pick and Dickie, 2013), this also resulted in the research being featured in the AIPM magazine April/May 2014 edition (Mezrani, 2014)
- Presenting in the “managing complex projects” stream at the Engineers Australia national convention in Melbourne in 2014 (Norman and Pick, 2014)
- Presenting in a half day complex projects seminar held by Engineers Australia in Perth in 2015
- Presenting the research methodology used in this thesis at the British Academy of Management annual conference, 2016 (Norman, Pick and Dickie, 2016)
- Producing a magazine style article for the International Centre for Complex Project Management (ICCPM) (Norman, 2016)
- Participation as a member of the reference group to the Virtual Work Integrated Learning for Engineering Students (VWIL) research program funded by the Australian Government Office for Learning and Teaching.

This process of peer debriefing, referred to by Guba (1981) as member checking, where the credibility of the data and analysis are tested with the relevant human data source groups, allowed the broader community to question and test the emerging research to ensure it remained credible. Through this period of testing and validating of the research, the validation received demonstrated that the work has real value to both academia and practice.

### **3.9.2. Transferability**

When considering transferability, which Lincoln and Guba (1986, p.77) describe as requiring sufficient narrative about the research context such that others who may wish to apply all or part of the findings elsewhere can determine the degree of fit, it is important to describe the geographic, industrial and organisational contexts in which this research has been performed. Geographically, the research has focussed on Western Australia as the destination of the projects in which the participants were working, i.e. the projects were to be constructed and operate in Western Australia, largely in the state’s north. This location for the research was selected due to the volume of such projects being undertaken at the time and the researcher’s own location and personal network, all of which contributed to his ability to execute the research.

While Western Australia has some specific geographic characteristics and differences that separate it from other locations, such as its remoteness from the rest of the world's resource centres, the destination of the project could be considered as a minor issue toward transferability of the research and its outcomes. Industrially, this research was conducted within the resources engineering community and, as such, will have some professional cultural differences to other industrial groups that would need to be allowed for to undertake similar research in a different sector. From an organisational sense, virtual teams are used to undertake projects in almost every sector in the modern business world, indeed, virtual teams are becoming common place. Consequently, the potential for much of this research to be applicable across a broad range of sectors where virtual teams are used is high.

### **3.9.3. Dependability and Confirmability**

Adopting the proven qualitative investigation approach of coding for the initial phase of this research, combined with the development and analysis of cognitive maps using well documented causal mapping techniques, ensured subsequent researchers should find it relatively straightforward to replicate this research. The Interview Instrument (see Appendix A – Interview Instrument) provides a clear and concise exemplar of the questions asked in the data collection. If this, or a similar instrument were to be applied to a similar demographic, it is strongly believed that similar results would be obtained.

Similarly, as the principal phenomena being investigated are those of the lived experience of individuals involved in these virtual teams, applying the same investigative procedure to another cohort of virtual team participants should produce repeatable and dependable results that are independent of the time period in which the investigation is performed. Such subsequent investigation would potentially provide longitudinal data to compare against the data collected for this research, helping understand how perspectives and attitudes change over time, against a background of evolving enabling technology, corporate and academic understanding of the issues faced.

Additionally, the entire research workflow, from data collection to cognitive map development for each cohort is entirely traceable, providing a high level of traceability as suggested by Lincoln and Guba (1986) as important for such work to be considered dependable. The traceability is as follows;

1. All interviews were audio recorded and securely stored using the alphanumeric identifier outlined above.
2. All audio recordings were transcribed and checked for errors and accuracy before having the de-identification process applied to remove any names, companies, projects etc. that could be used to identify the participant or those individuals, entities and projects they discussed.
3. Following de-identification, each transcript was filed using only the same alphanumeric identifier applied to the audio files.



4. The transcript files were imported into the NVivo© database under those same alphanumeric identifiers, where all of the coding was performed, producing the codes, categories and themes, all of which reside within the NVivo© database.
5. The same codes were used as the cross-reference identifier during the construction of the cognitive maps within Decision Explorer©. Here each node in each cognitive map is supported by one or more corresponding codes copied directly from the NVivo© database and cross referenced using the same alphanumeric code as applied to the audio recordings, transcripts, files in the NVivo© database and then used in the findings, analysis, interpretation and synthesis sections of this thesis.

Through this traceable process it is possible to follow any individual coded piece of text from any point in this thesis, whether the narrative analysis or any of the cognitive maps, back to its original audio recording.

### **3.10. Summary**

The approach to analysis of the data in this research, combining thematic coding and cognitive mapping, is particularly suited to this area of research. Thematic analysis produced a hierarchical, conceptual, code structure similar to the typical organisational structure of a co-located project team, with one overall manager, a number of senior personnel reporting to the manager and then a large workforce undertaking the delivery of the project, all located in one centre. The cognitive maps resemble the structure of a virtual team, a complex, organic and dynamic structure, with often hard to identify leadership, characterised by clusters of personnel engaged in specific and discrete tasks and subtasks and interacting in often messy, fluid and unpredictable communication patterns to complete their work. The two analytic processes are therefore highly analogous to how the teams investigated function, the combination of the formal structure of the organisation combining with the often informal, fluid and dynamic communication patterns the team members use to perform their work.

To attempt to analyse interaction in a virtual team environment within the constraints of a coding and thematic analysis only approach would be to risk losing much of the overall richness of the data and the information and insights it can provide. Similarly, to attempt to perform this analysis using only cognitive maps developed using causal mapping techniques would have resulted in maps that may have been rich in content, but which would have been hard to generate due to the low level of exposure to such techniques in the practice world. This singular mapping approach would also have been hard to demonstrate traceability and repeatability for future researchers to replicate. Consequently, the approach used for the analysis of the data in this research has enabled the development of a set of insights and understandings of interpersonal communications within project virtual teams that would not have been possible with other approaches.

The following chapters take the data captured in the interviews to produce an analysis, conclusions and recommendations for practice applications of these findings and opportunities

for academia to educate the next generations of practitioners and continue to explore this critical, emerging research area.

## 4. Findings

## 4.1. Introduction

This chapter introduces and discusses the research data. It sets out findings drawn from the data collected from participant interviews in a structured sequential manner to facilitate a clear understanding of the findings by cohort, and to place that understanding in perspective within the overall findings. The chapter is structured into a section for each cohort. Within each section, findings are presented as themes and constructs followed by cognitive maps;

- **Findings presented as themes and constructs** – in the first part of each section the findings from the coding of the data analyses are introduced and discussed. The themes are presented in a consistent structure, from the most dominant theme to less dominant themes.
- **Findings presented as cognitive maps** – in the second part of each section, cognitive maps developed using the narrative phrases captured from the coding process are presented and discussed, offering a multi-dimensional, nuanced understanding of not only the themes but how they each interact and influence interpersonal communications in project virtual teams.

Within the following sections the narrative phrases from the data are presented verbatim from the interview transcripts. Each narrative phrase is in italics contained by double speech marks followed by the assigned code, role description and location of the participant who provided it. Quotes were selected as the best exemplars to illustrate the theme. Where dissenting opinions were identified, appropriate quotes are used to demonstrate divergent perspectives.

As the quotes selected are taken verbatim from interview transcripts they include some false starts, industry jargon and occasional use of strong language.

This findings section represents an extensive portion of the body of this thesis. This has been necessitated by the rich nature and volume of data and is essential to building a full understanding of the context and complexity of project virtual teams and how different cohorts within these teams communicate.

### 4.1.1. Context

Data will be discussed as part of the seven cohorts into which research participants were assigned shown in Table 6. These are; three Perth based groups with one each for senior, middle and junior roles within the project teams; three non-Perth based groups of senior, middle and junior roles within the project teams and the seventh, an independent, reflective group comprising personnel with a strong history of involvement in project virtual teams but who were not part of such an endeavour at the point of interview.

|                 | Home<br>(Perth) | Away<br>(external to Perth) |
|-----------------|-----------------|-----------------------------|
| Senior roles    | 4               | 5                           |
| Mid-level roles | 3               | 9                           |
| Junior roles    | 4               | 4                           |
| Independents    | 7               |                             |

Table 6: Participant distribution

These seven cohorts were identified during the data collection phase as offering significantly different perspectives on how interpersonal communication functions within project virtual teams. Of the seven cohorts, the six directly engaged in projects at the time of interview represent the potential demographically different sectors within the teams, in terms of the location and seniority of the interview participants. The seventh, independent, reflective group provided a different perspective as they had had time to reflect on their experiences.

Each of the seven groups is briefly described below;

**Senior Home** - Comprised business managers, directors and associate directors holding responsibility for the performance of the office or were project directors or project managers responsible for leading the project. All participants in this cohort were Perth based.

**Middle Home** - Comprised mid-tier personnel within the participating project teams. Roles included project engineer, interface manager or project manager for a portion of the project. In most instances, these participants reported to a senior representative who was also interviewed. All participants in this cohort were Perth based.

**Junior Home** - Comprised lower tier personnel within the project teams investigated. Roles included engineer, junior project engineer, programmer and designer, working either for personnel categorised in the Middle or Senior Home cohort. All participants were Perth based.

**Senior Away** - Comprised senior leaders in the offices in which they were based. Roles included business managers, directors and associate directors holding responsibility for the performance of the organisation's office or were project directors or project managers responsible for leading a large and complex project. All participants were based outside of Perth with locally based roles.

**Middle Away** - Comprised mid-tier personnel within the project teams investigated. Roles included project engineer, interface manager or project manager for a portion of the project. In most instances, these personnel reported to a senior representative who was also interviewed. All participants were based outside of Perth with local roles and responsibilities within their project.

**Junior Away** - Comprised lower tier personnel within the project teams investigated. Roles included engineer, junior project engineer, programmer and designer, working either for

personnel in the Middle Away or Senior Away cohorts. All participants were based outside of Perth with local roles and responsibilities.

**Independent Reflective** - Comprising principally senior personnel from within the engineering profession who had spent substantial, recent periods working in, and associated with, large virtual teams. They included senior project managers, business directors, senior technical consultants and chief engineers. Unlike the other six cohorts these participants were not working in a project virtual team at the time of the interview, but had been able to reflect on their experiences, what they had learnt and what they would repeat or change for future similar roles.

#### **4.1.2. Subject Locations**

In collecting the data for this research, participants were interviewed at their places of work in a number of different geographic locations. These are segregated into Home (Perth based personnel) and Away (those in locations other than Perth) as well as the seventh, reflective cohort whose experiences were Perth based and who were all interviewed in Perth.

Those identified as Home were interviewed in the Perth home office for their project. Those identified as Away were interviewed in offices located in Adelaide, Sydney, Singapore and Dubai. All interviews were conducted face-to-face using the same interview protocols and tools and in similar environments of a closed office or meeting room with only the subject and the researcher present. All interview rooms were private and provided a comfortable environment to conduct the interview.

All participants from the home and away cohorts were active in virtual team engineering projects at the time of interview, with personnel within each project working collaboratively in a virtual environment with their colleagues. The independent reflective participants were not actively involved in a virtual team project at the time of interview.

##### **4.1.2.1. Demographic Overview of Research Participants**

All research participants were selected because of their involvement in, and experience with, the delivery of engineering projects to the Western Australia resources sector using virtual teams. As outlined above, they were either part of an active project or had recent, relevant experience in such a team.

While the majority of participants were engineers by education and training, two had a business background. Three of the 35 participants were female with the remaining 32 being male. The oldest participant was in their early 60s and the youngest in their early 30s. Participants had a broad mix of countries of origin and ethnicities, including Australians of both European and Asian heritage, Indonesians, Malaysians, Filipinos, Germans, Polish and Zimbabwean. The majority of the cohorts from each project, and in each location, were found to be multi-cultural, regardless of the country or project or the location of the individual. Table 7 illustrates the overall mix of research participants.

| Cohort      | City or Country of participant | Seniority   | Gender | Nationality | Age bracket |
|-------------|--------------------------------|-------------|--------|-------------|-------------|
| Independent | Perth                          | Independent | Male   | Australian  | 50-59       |
| Independent | Perth                          | Independent | Female | British     | 40-49       |
| Independent | Perth                          | Independent | Male   | Australian  | 50-59       |
| Independent | Perth                          | Independent | Male   | Australian  | 50-59       |
| Independent | Perth                          | Independent | Male   | British     | 40-49       |
| Project 1   | Adelaide                       | Middle      | Male   | Australian  | 40-49       |
| Project 1   | Adelaide                       | Junior      | Female | Australian  | 30-39       |
| Project 1   | Adelaide                       | Middle      | Male   | Australian  | 40-49       |
| Project 1   | Adelaide                       | Middle      | Male   | Polish      | 50-59       |
| Project 1   | Adelaide                       | Senior      | Male   | Australian  | 40-49       |
| Project 3   | Perth                          | Middle      | Male   | Australian  | 40-49       |
| Project 3   | Perth                          | Senior      | Male   | Australian  | 50-59       |
| Project 3   | Perth                          | Junior      | Male   | Australian  | 40-49       |
| Project 3   | Perth                          | Senior      | Male   | Australian  | 50-59       |
| Project 3   | Sydney                         | Senior      | Male   | Australian  | 50-59       |
| Project 1   | Perth                          | Middle      | Male   | Australian  | 50-59       |
| Project 3   | Perth                          | Middle      | Male   | British     | 40-49       |
| Project 1   | Perth                          | Senior      | Male   | Australian  | 40-49       |
| Project 1   | Perth                          | Junior      | Male   | Australian  | 50-59       |
| Project 3   | Perth                          | Senior      | Male   | Australian  | 50-59       |
| Project 1   | Perth                          | Middle      | Male   | Australian  | 60-65       |
| Project 4   | Perth                          | Junior      | Male   | Australian  | 30-39       |
| Project 4   | Perth                          | Junior      | Male   | Zimbabwean  | 30-39       |
| Project 3   | Singapore                      | Senior      | Male   | German      | 50-59       |
| Project 3   | Singapore                      | Junior      | Male   | Singaporean | 30-39       |
| Project 3   | Singapore                      | Middle      | Male   | Indonesian  | 40-49       |
| Project 4   | Dubai                          | Senior      | Male   | Australian  | 40-49       |
| Project 4   | Dubai                          | Junior      | Male   | Philippine  | 30-39       |
| Project 4   | Dubai                          | Middle      | Male   | Australian  | 30-39       |
| Independent | Perth                          | Independent | Female | Serbian     | 50-59       |
| Project 4   | Sydney                         | Middle      | Male   | Australian  | 40-49       |
| Project 4   | Sydney                         | Junior      | Male   | Australian  | 40-49       |
| Project 2   | Sydney                         | Middle      | Male   | Australian  | 50-59       |
| Project 2   | Sydney                         | Middle      | Male   | Australian  | 40-49       |
| Project 2   | Sydney                         | Senior      | Male   | Australian  | 40-49       |

Table 7: Demographic overview of research participants

### 4.1.3. Coding

Coding produced a substantial volume of data from each transcript. More than 400 codes with between 1 and 30 individual narrative passages were generated in the initial coding process. During subsequent iterations these initial codes were consolidated to a number of concepts which were further consolidated into themes. Themes ranged from a small number containing large volumes of individual codes through to a “long tail” of codes, including some verbatim codes with as little as a single narrative passage.

The largest themes, listed in Table 8 in order of number of narrative passages within a theme, where there were over 100 narrative passages within the theme were as follows;

- **Interpersonal communication challenges** - a broad theme capturing participants' comments regarding specific challenges faced with interpersonal communication within project virtual teams.
- **Communication media** - capturing participants' comments regarding various forms of communication media and technology, including meeting face-to-face and the use of various tools including email, telephone, video conference and instant messaging.
- **Relationships** - capturing participants' comments regarding personal relationships in project virtual teams and how these relationships may affect team effectiveness.
- **Cultural differences** - capturing participants' comments regarding the impact of culture within interpersonal communication in project virtual teams. Culture in this theme covers general, nationalistic and individual culture.
- **Personnel's suitability for virtual team work** - capturing participants' views of the personal attributes needed to be effective in project virtual teams and conversely, characteristics which may make an individual unsuitable for project virtual teams.
- **Challenges of virtual teams** - capturing participants' views on the principal challenges faced in building and maintaining effective project virtual teams.
- **Reasons for virtual teams** - capturing participants' views on the reasons virtual teams are used.
- **Working with time zones in virtual teams** - capturing participants' views on issues associated with communicating effectively across time zones with team members as well as solutions tried within their projects which may or may not have been successful.
- **Trust in virtual teams** - capturing participants' views on how trust may be formed and maintained through communication within a project virtual team.
- **Alignment of personnel** - capturing participants' views on the effectiveness and performance of various alignment activities in projects virtual teams.
- **Management of scope** - capturing participants' views on how the management of scope within a virtual team project affects its viability and the communications needs of those involved.



- **Organisational culture** - capturing participants' views on how the culture of the executing organisation impacts on the way a project virtual team communicates and functions.

The distribution of these large themes is illustrated in Table 8. This table illustrates the relative relevance and focus of views of the participants on each of the themes, along with the overall numbers of comments against each theme.

|   | Senior Home | Mid home | Junior home | Senior away | Mid away | Junior away | Independent | Total |
|---|-------------|----------|-------------|-------------|----------|-------------|-------------|-------|
| <b>Interpersonal communication challenges</b>   | 29          | 29       | 24          | 33          | 73       | 28          | 53          | 269   |
| <b>Communication media</b>                      | 28          | 18       | 24          | 51          | 62       | 22          | 44          | 249   |
| <b>Relationships</b>                            | 7           | 20       | 34          | 49          | 52       | 20          | 54          | 236   |
| <b>Cultural diversity</b>                       | 30          | 41       | 14          | 28          | 43       | 8           | 38          | 202   |
| <b>Suitability to work in a virtual team</b>    | 38          | 2        | 54          | 25          | 39       | 8           | 23          | 189   |
| <b>Challenges of virtual teams</b>              | 33          | 13       | 15          | 25          | 31       | 15          | 33          | 165   |
| <b>Reasons for virtual teams</b>                | 18          | 6        | 31          | 19          | 39       | 18          | 26          | 157   |
| <b>Working with time zones in virtual teams</b> | 7           | 20       | 20          | 23          | 31       | 24          | 26          | 151   |
| <b>Trust</b>                                    | 17          | 1        | 11          | 30          | 29       | 9           | 26          | 123   |
| <b>Alignment of personnel</b>                   | 10          | 5        | 11          | 5           | 34       | 19          | 33          | 117   |
| <b>Management of scope</b>                      | 16          | 9        | 6           | 20          | 25       | 17          | 19          | 112   |
| <b>Organisational culture</b>                   | 13          | 10       | 9           | 12          | 21       | 4           | 35          | 104   |

Table 8: Numeric breakdown of largest themes

Beyond these twelve major themes were many smaller themes. The smaller themes included specific verbatim quotes or unique perspectives. The smaller themes or discrete narrative passages did not fit a larger theme but were retained in the analysis process to provide additional context and perspective during the conceptual mapping and further analysis and discussion phases.

Each major theme identified in Table 8 was examined for relevance to this research and the two themes of “Reasons for virtual teams” and “Management of scope” were found to focus

on attributes of virtual teams not directly pertinent to this research. Those two themes are consequently not discussed in the findings below. The remaining ten major themes are all directly relevant to understanding interpersonal communications in project virtual teams and are discussed in descending order against each of the cohorts in the following sections of this thesis.

#### **4.1.4. Cognitive mapping**

A cognitive map of each cohort was constructed by analysing the descriptive passages captured in the coding process to find the expressed causal relationships. These relationships followed the format typified by phrasing such as “Phenomenon/entity A leads to/causes/is followed by/influences/etc. Phenomenon/entity B” or, “B is an outcome of/caused/effected/preceded/influenced/etc. by A” (Laukkanen, 1994, p.234). These phrases were used, one-by-one as nodes, to construct the maps, connecting text nodes with arrows and lines representing the directionality from the descriptive text, until a full picture of the collective views of the cohort were captured diagrammatically. While the maps produced capture all of the expressed cognitive relationships described in the data for each participant cohort, the maps portray directionality only and not a linear or hierarchical relationship between any two or more nodes.

Once the map was constructed it was possible to begin to build an understanding of the interactions of the various factors identified by each cohort as influencing effective interpersonal communication in project virtual teams. Through this understanding, it was possible to provide an enhanced level of overall analysis of the discrete themes and how the overall themes, individual constituent codes and descriptive passages described the lived experience of those working within a virtual team.

## **4.2. Senior Perth Participants (Senior Home)**

This ‘Senior Home’ cohort comprised four very senior leaders of the projects included, they are referred to in the data by the identifiers GB32B, GB34B, HC32A and BD21A. The dominant themes identified from this cohort are set out below, along with key narrative passages from each theme to highlight the insights provided by the participants.

### **4.2.1. Thematic coding of findings**

#### **4.2.1.1. Interpersonal Communication Challenges:**

Interpersonal communication challenges identified included the extent of communication training given to personnel and how they choose to communicate. The perception of this cohort was that their organisations did not prepare them sufficiently to communicate in general and, specifically, within the virtual team environment in which they were working:

*“communication is so important in business. And I don't think you know we don't study it enough.” GB32B Project Manager, Perth*

*“big organisations don't necessarily spend the time in training their people on how to manage that communication.” GB32B Project Manager, Perth*

They identified that they believed consultative forms of communication worked best in their environments:

*“it takes a little bit longer. You do it in a more consultative style and hopefully what you do is you bring these people on board” GB34B Business Manager, Perth*

In addition, two participants identified issues with communication becoming adversarial rather than collaborative in a virtual team environment, where individuals rarely meet face-to-face, communicating instead via electronic media:

*“the style of the communication often can be very adversarial rather than collaborative.” GB32B Project Manager, Perth*

The majority of participants noted the difficulty sensing how communications are received and understood when they are delivered in an electronically mediated way as opposed to face-to-face:

*“within that virtual environment, there can be a lot of concise information passed backwards and forwards via the electronic, but it cannot necessarily feel whether the guy believes in what he's doing” GB32B Project Manager, Perth*

It was perceived that some personnel may miss information because they are not physically present at the location of the originator of the message, because of either intentional or accidental marginalisation of the other part of the virtual team:

*“not the wrong communication in the context of the people being misinformed, they are not informed.” GB32B Project Manager, Perth*

#### **4.2.1.2. Communication Media**

The media used for communications was an area where participants presented a number of perspectives, commenting on the overall technology and how specific forms of media can impact on how they communicate. This included the level of reliability and accessibility of the technology chosen:

*“dealing with multiple entities working on the same project from different destinations, you need to make sure that the technology that you're using enables you to be able to work effectively in that regard.” BD21A Director, Perth*

All participants observed how they use different media such as email in their roles. They discussed how, for some, email is the default communication tool regardless of whether they are communicating with co-located colleagues or those in other offices:

*“The emails, the major medium, even within the office or within the state within the office within the same floor, it’s send an email. It’s not get off your bum and go and talk or pick up the phone and go and talk.” GB34B Business Manager, Perth*

*“my view is that email has taken over from, it’s certainly taken over from face-to-face and it’s probably now taken over even from a telephone.” GB43B Business Manager, Perth*

All participants discussed the use of the telephone in conversations between members of their virtual teams. Some stated they found the telephone more effective for specific communication with overseas team members while others were concerned over slips of the tongue during calls:

*“telephone is fine, you can hear people, so what if you don’t get to see their ugly faces, isn’t that a good thing? But it did help a lot.” HC32A Project Manager, Perth*

*“I find that communication with overseas is a lot better on the telephone than in the e-mail - in the written word.” GB32B Project Manager, Perth*

*“Whereas the phone call can somewhat be faster, easier but then you also are mindful, I guess, during that phone call, shall we say, that one slip of the tongue.” GB32B Project Manager, Perth*

Several participants discussed the role of video conference facilities in their communication mix. Their views ranged from surprise at its effectiveness, how little videoconferencing was used and how videoconferencing was not a complete substitute for meeting face-to-face:

*“You could actually see that people actually increase the level of benefit from meetings.” HC32A Project Manager, Perth*

*“It never comes close to the one-on-one sitting in front of a machine” HC32A Project Manager, Perth*

*“video conferencing at the first, certainly last year would hardly have been used. Now, it’s being used every second day. So are we—we’re using that communication certainly a lot more.” GB34B Business Manager, Perth*

#### **4.2.1.3. Relationships**

When compared to other cohorts, these participants made little mention of relationships (see Table 8). Views included a belief that the work would happen regardless of any relationships, and that most relationships are managed and maintained using electronically mediated communications:

*“At the end of the day, if a deliverable needs to go out, whether or not you shared some beverages over a meal one evening or not, not really going to matter, and if one or the other had to drop off, you know those little team*

*building things, you'd certainly still survive without them." HC32A Project Manager, Perth*

*"relationships again are managed largely by phone, video conferencing, emails and yeah, there's a certain amount of face-to-face." GB34B Business Manager, Perth*

#### **4.2.1.4. Cultural Diversity**

Cultural diversity and working in a cross-cultural environment was mentioned by a number of participants. This included observations of how different cultures relate to one another in a project virtual team, including personnel from their own culture and other cultures. Additionally, observations of how personnel from different cultures communicate and interact were captured.

The need to accommodate different cultural types in the team dynamic was identified:

*"I find the—understanding cultural background of the people that you're working with is quite important to setting up that initial team dynamic" GB32B Project Manager, Perth*

The majority of participants commented on the importance of recognising cultural and personality differences, so managers can adapt their leadership and communication styles to get the best from their personnel:

*"I think one of the things I say culturally is quite important to understand how the others behave, how they react, how when they, you know, how they'll react to instruction as well." GB32B Project Manager, Perth*

#### **4.2.1.5. Individual's Suitability for Virtual Teaming**

Participants' observations focussed on the need to have personnel with the appropriate personalities and who were enthusiastic about being part of a distributed team:

*"people's attitude counts a lot. I supposed that's one of the other key ones that are in there." HC32A Project Manager, Perth*

One participant observed that his organisation had a direct policy of finding the most suitable individual they could and deploying them onto their project virtual team:

*"on a project of this size, you don't settle for the best you've got. You find the best you can; wherever they may be and you bring them in." BD21A Director, Perth*

Two other participants observed that having the wrong people could lead to broken communication and, on occasion, personnel who actively pursue agendas different to that of the overall project:

*"certain individuals have their own agenda and consequently will move away from the team thinking. Depending on what that agenda is, they're almost and probably not the right word, but they're always sniping the*

*project because you don't know that they're doing it, because on one hand, they're saying 'yes', they're following the team, but on the other hand, they're moving out and following their own agenda. And they're the most difficult ones to bring back in. And of course, they can be the most harmful as well." GB43B Director, Perth*

The need to find personnel with the right personality was also identified in the context of those working as expatriates. These are team members deployed into one of the other project offices as imported leaders or subject matter experts:

*"there's been examples of the wrong people being sent and there's been – thankfully in my experience, more examples where the right people have been sent and things have been more successful than they otherwise would have." HC32A Project Manager, Perth*

#### **4.2.1.6. Challenges of Virtual Teams**

One of the strongest challenges of virtual teams identified by these participants was that of the high cognitive load experienced by the leaders:

*"When you've had your Home Office plus 2 or 3 Workshare offices that burden becomes enormous for key individuals so it's certainly I think I would always advocate limiting the number of Workshare offices." HC32A Project Manager, Perth*

One participant suggested that an upper limit on the number of locations forming the virtual team is appropriate and would help with management and control:

*"limiting the number of Workshare offices is a big key in that. Just the administration burden, certainly for the leadership team of meetings and technical meetings and administration meetings and schedules and budgets" HC32A Project Manager, Perth*

An organisational reward structure that incentivises management behaviour counter to the project objectives was identified as a further challenge by two participants. For example, a bonus scheme for directors that did not recognise their contribution to projects based elsewhere:

*"A lot of our work is structured around financial incentives to individuals. So again, the team sets a goal; however, individual is saying, well, if I go down that path, that's going to directly affect my hip pocket. So consequently, again, I'm following, by name, following the team rules but I'm also now out here doing my own thing because it has a financial impact on my hip pocket... we acknowledged that—that we're incentivising people to work against the project." GB34B Business Manager, Perth*

One participant expressed their belief that there were more opportunities for social loafing in virtual teams than in co-located teams, where personnel were not visible to their line managers and could be tempted to reduce their focus on the project tasks:

*“Social loafing is very easy in a virtual team.” GB32B Project Manager,  
Perth*

#### **4.2.1.7. Impact of Time Zones**

This cohort of participants made limited observations on how time zone differences impacted their work. They all observed how working across time zones had a substantial impact on their non-work time, commenting that they frequently had to be available late into the evening or very early in the morning:

*“The worst part about it is that the virtual team does extend your working day. I mentioned earlier on working with Europe, they come on-line at 2:00 in the afternoon so we'll very often still be working seven, eight, 9:00 p.m. at night. That's an invasion but it's what happens.” GB32B Project Manager,  
Perth*

*“I was up to 3:00 o'clock this morning doing work and I'm just going, you know, that's not, not the space you want to be in.” GB34B Business  
Manager, Perth*

Two participants observed how large time zone differences can result in work being delayed by between days and weeks as discussions and reviews are impacted by time differences. This potential for delay poses a serious threat to maintaining schedules

*“it's too easy especially if you've got a time lag, the other side of the world, say here to Santiago or even here to South Africa. That an instruction would be given for something from the Home office to the Workshare office to do something. A interpretations have made that an initial duration of work is undertaken and then the deliverable is sent back for some level of review again, then by the time of over nights happened, it's very rarely, any turn around in less than two days and something that might happen in ten minutes if ones co-located, it would be days, even weeks in between the opportunity to review.” HC32A Project Manager, Perth*

#### **4.2.1.8. Trust and Confidence**

Issues of trust and confidence within a virtual team environment were raised by the majority of participants. They observed it was important to establish and maintain professional respect between personnel for the project to run successfully:

*“Respect; Respect of individuals, I find a challenge in the virtual world. You need to respect those people for those skills that they bring to the team. We have to respect that the guy's been brought into a team for a reason and we need to respect that individual for what he does bring rather than challenge*

*them for the bits that they don't. And, I think in a virtual world we don't do that very well." GB32B Project Manager, Perth*

*"I see it respecting your fellow colleagues in the team is quite important to get positive activity or positive outcome, I guess, from that team." GB32B Project manager, Perth*

In addition, all participants discussed trust between personnel and between offices within project structures. One participant observed a substantial lack of trust within their virtual team that was leading to dysfunction and communication breakdowns, placing the outcomes of the project at risk.

*"The level of trust that exists between Asia and Europe is astoundingly low and that dysfunctional relationship is really going to cause problems. It has already to some extent. I think there's been a bit of guilt on both sides." BD21A Director, Perth*

#### **4.2.1.9. Alignment of Personnel**

Team building was considered by most participants as an important activity, something they had undertaken or something they felt was lacking [Note - the term Workshare is used, this is an alternate industry term for virtual team that typically refers to the remote offices].

*"we've always encouraged "one big team" and you know if Workshare team's visiting and we've got a Home Office function on, you know we'll always made them part of it and vice versa." HC32A Project Manager, Perth*

*"The reason I was particularly there was to go through some team building exercises in order to fix the interpersonal communication issues." BD21A Director, Perth*

Several participants observed that they ensured work was clearly and explicitly defined, clear goals set and that the whole team was aware of these requirements.

*"when you're working across a team, it's very important that we have clear goals set within the team on what we're trying to achieve" GB34B Business Manager, Perth*

*"the goals of the team have to be documented, have to be signed off or agreed by the team. Everyone's clear on where we're going." GB34B Business Manager, Perth*

#### **4.2.1.10. Organisational Culture**

Organisational culture and corporate politics were identified as further challenges by members of this cohort. This was highlighted in an observation about getting personnel in the team to collaborate and work within the bounds of their corporate power structure:

*"I've seen where workshares haven't gone particularly well, whether the workshares got either links into a part of the large corporate party of the*



*engineering teams or have client relationships. So, say, home office and workshare, all part of the one global EPCM. I think you're dealing with home office gives – workshares instructions. that isn't enacted, do a bit of research to find out that the workshare office has gone through their corporate across the world, come down through corporate and home office is being told how's it's going to be because workshare offices has raised their concerns through body corporate generals and home office is feeling a bit beat up at the end of it, so I've seen that happened.” HC32A Project Manager, Perth*

#### **4.2.2. Cognitive map of Senior Perth based participants**

The cognitive map for this cohort is shown in Figure 16 **Error! Reference source not found.** It is a relatively complex map with around 70 individual nodes and a similar number of connections, complying with the views of Eden et al. (1992) of maps displaying a higher level of cognitive complexity. While the specific analysis of this map is presented in subsequent chapters, some of its key characteristics are as follows;

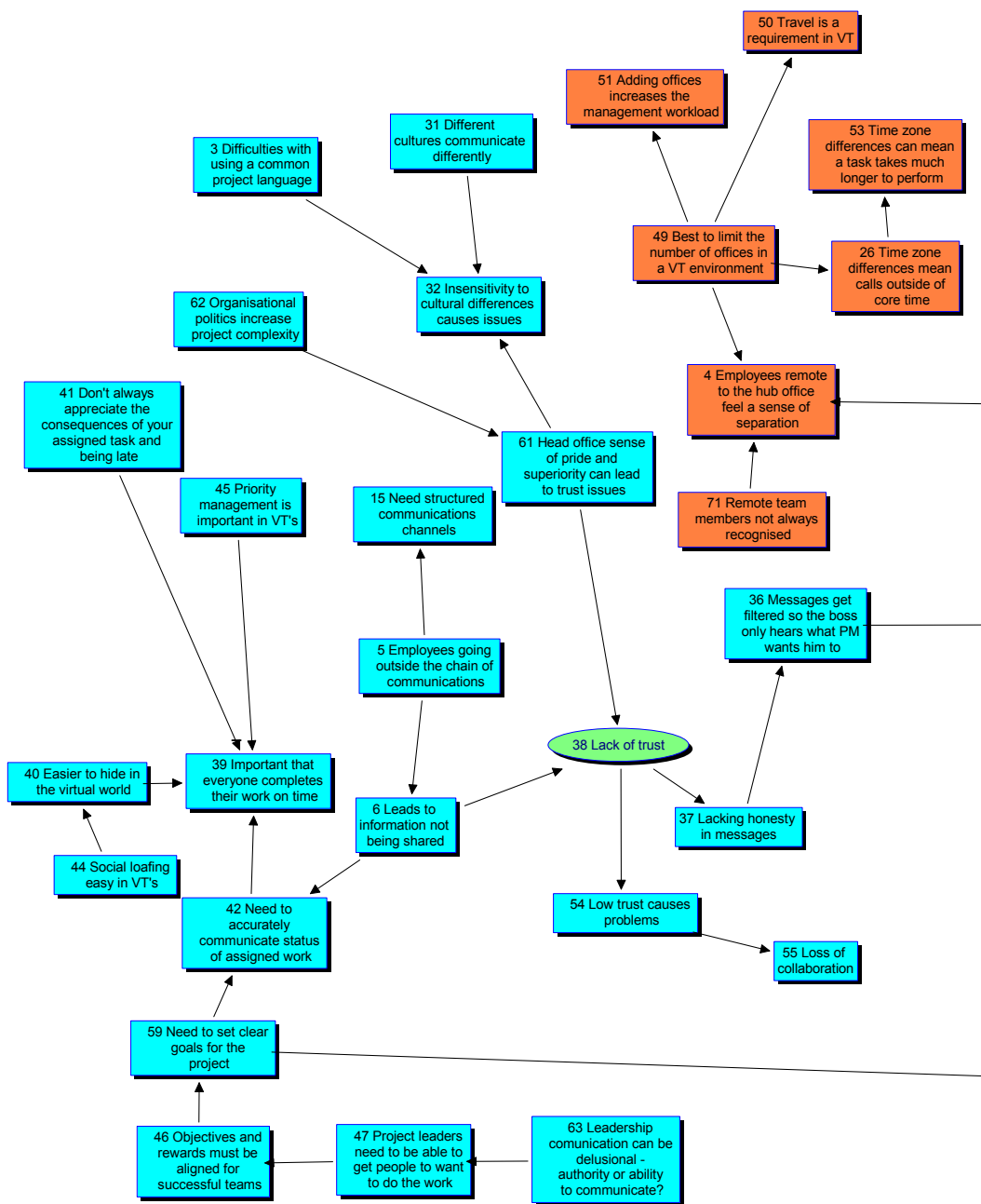


Figure 16: Cognitive map of Senior Home participant data



#### 4.2.2.1. Nodes

The central nodes on the map are indicated by green filled ovals in Figure 16. Of these, the most central node is **relationships are important to success**, shown in detail in Figure 17, where the major contributors to this are **longer relationships lead to better outcomes**, that **face-to-face meetings help build relationships**, that participants in this cohort believed that within their projects, **senior personnel typically know each other well** and that an organisation **needs personnel who can communicate and build relationships**.

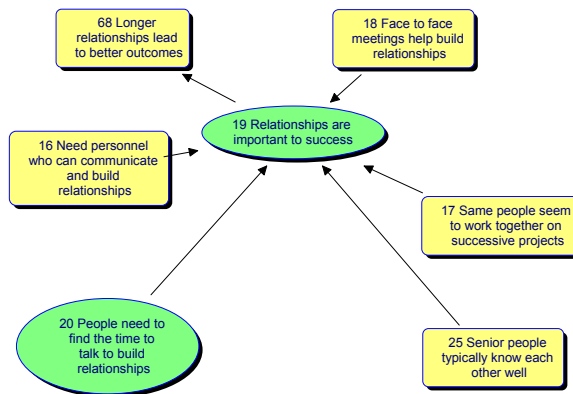


Figure 17: Node - Relationships are important to success

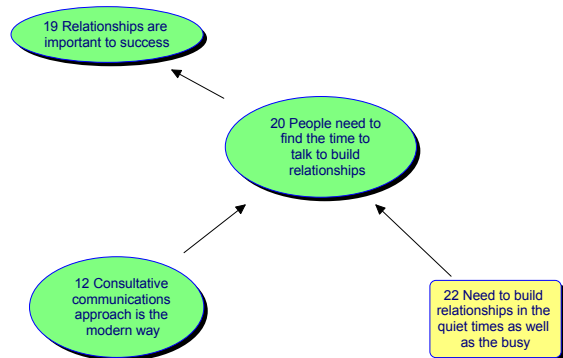


Figure 18: Node - people need to find the time to build relationships

The second most central node is that **people need to find the time to talk to build relationships**, shown in detail in Figure 18, where the major contributors were that a **consultative communications approach is the modern way** and that **personnel need to build relationships in the quiet times as well as the busy times**. This node itself is one of the supporting nodes to the central node that **relationships are important to success**.

The third most central node, related to communications, is that a **consultative communications approach is the modern way**, shown in detail in Figure 19. This node supports the second most central node identified above and is supported itself by nodes such as **organisations don't train personnel to communicate** and **that poor communication is often the cause of project failure**.

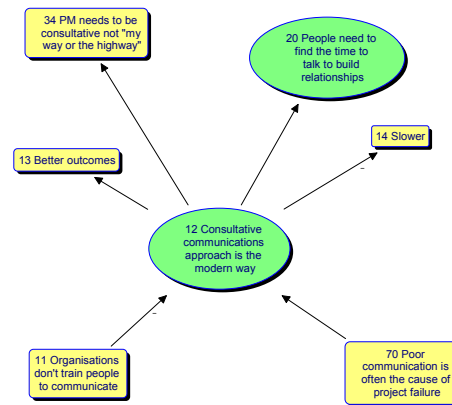


Figure 19: Node - consultative communications approach is the modern way

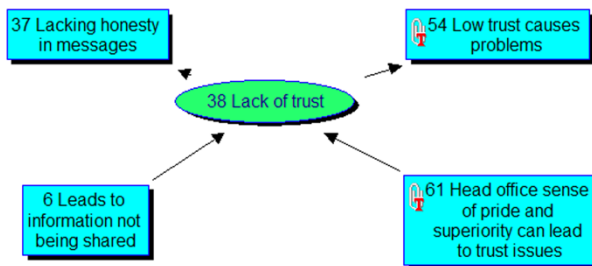


Figure 20: Node - Lack of trust

**Lack of trust**, shown in detail in Figure 20, was identified as the fourth most central node, where it was suggested that **low trust causes problems** and that a lack of trust can result in **lacking honesty in messages**.

The fifth most important node identified, shown in detail in Figure 21, is the **need to have the best person for the job, not just the best person available**. This node is influenced by the suggestion from participants that **managers must understand the skills of their people**. Nodes dependant on this are that **personnel should be respected for their skills**, that **the project manager needs to be consultative, not 'my way or the highway'** and that **tasks need to be allocated to the location with the best skills for the job**.

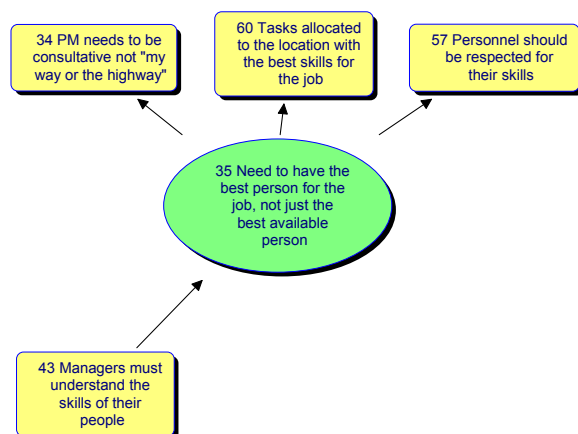


Figure 21: Node - need to have the best person for the job, not just the best person available

#### 4.2.2.2. Clusters

As well as the major nodes discussed above, the map also exhibited two significant clusters, highlighted on Figure 16 **Error! Reference source not found.** as the blue and orange coloured groupings of nodes. The cluster shown in orange describes how different **communication technologies** are used and viewed within virtual teams, the other, highlighted in blue, describes the need for **accuracy in communications** and the development and reliance on trust within these teams.

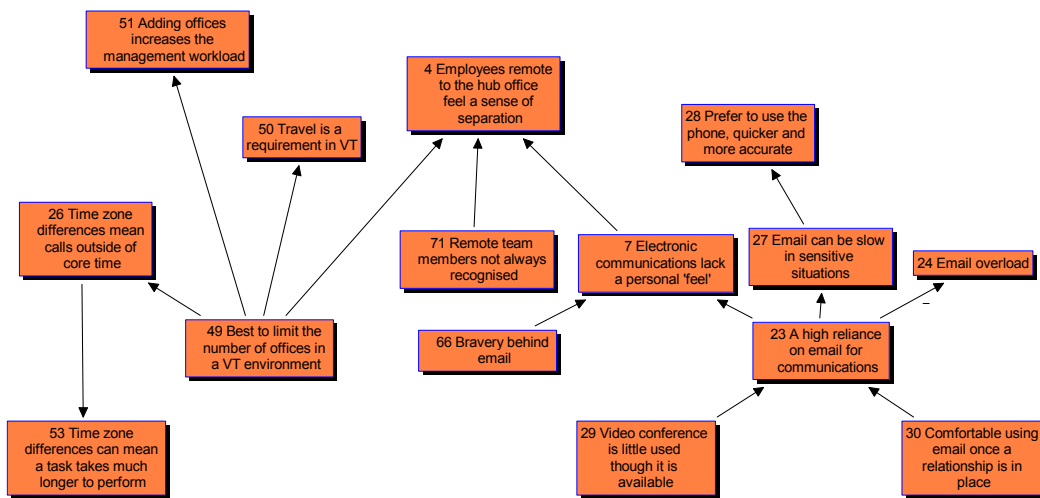


Figure 22: Cluster - communications technology use

In considering the communications technology cluster highlighted as Figure 22, the choices of different technologies to mediate communications within virtual teams, participants displayed a preponderance toward the use of email as their default communication tool. However, they also expressed a preference or desire to meet face-to-face wherever possible and, where not possible, use videoconference for at least the development and building phase of new teams. In this same cluster, there is a recognition of an awareness that care needs to be taken when communicating within virtual teams to include all personnel equally, given that failure to do so can result in a sense of exclusion being experienced.

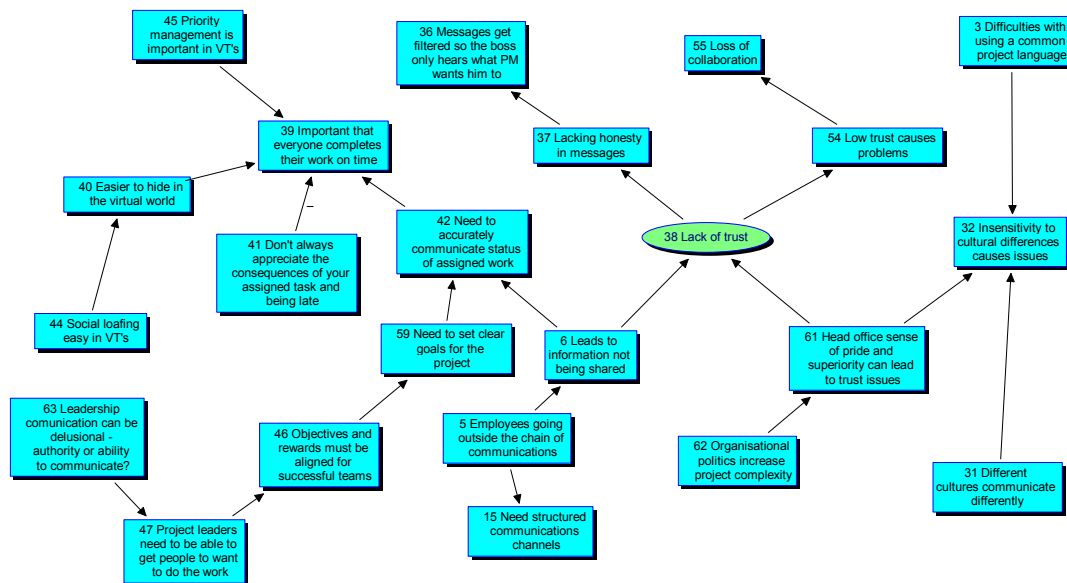


Figure 23: Cluster - cultural impact on communications

The second cluster evident on the map in Figure 16 **Error! Reference source not found.** and highlighted in Figure 23 considers the recognition of the different ways in which cultural differences can impact communications in project virtual teams. Nodes considering both the geographic and historic cultures of individuals and teams, along with some of the prevailing corporate cultures, how these cultures can influence the development and maintenance of trust within a virtual team and how the presence or lack of trust can impact the effectiveness and manner of communications are evident.

### 4.3. Senior Remote Office Participants (Senior Away)

This Senior Away cohort comprised five very senior leaders of the businesses represented. These five participants were coded as BD11D, FC35B, GB11C, GB14C and JB11E. The dominant themes identified from this cohort are listed below, along with key narrative passages to highlight the insights elicited from the participants.

#### 4.3.1. Thematic coding of findings

##### 4.3.1.1. Interpersonal Communication Challenges:

Interpersonal communication challenges identified by these participants included difficulties of working across different first and second languages and with team members for whom English was not a strong language:

*“Just when we thought English wasn’t important, it’s very, very important.”*

*FC35B Project Manager, Away*

*“It’s the understanding that the guy on the other side of the line doesn’t understand what you’re saying.” GB14C Business Manager, Away*

*“language has got to be important. They’ve got to be able to speak English well. I mean there’s no point in being very technically minded, but the communication is poor.” JB11C Project Manager, Away*

Language barriers led to participants having limited numbers of personnel in some locations to whom they could communicate, resulting in additional effort in planning their communications to ensure effectiveness:

*“I have to deal maximum with six people, or seven people there. All others, it would not make any sense to call them due to their function, due to their language” BD11D Project Manager, Away*

*“you spend a lot more time planning how you say, what you say, what not to say in order to make sure that they leave with a certain message and they believe it.” GB14C Business Manager, Away*

Where participants had personnel with different first languages in their teams, they identified that language barriers changed communication modes, switching from verbal communication such as telephone to written communication such as email.

*“That’s when you almost need to have those things in writing, provide a lot more detail in emails, in reports and things, so that you cover what maybe what you on either the phone or the video conference. Because you have to realise that the guy, let’s say for example in Thailand, all of what you said, he or she genuinely probably understood at best 50% of what you were saying and they were just filling in bits and pieces, assuming this and assuming that or missing out sentences completely.” GB14C Business Manager, Away*

Language barriers were thought to lead to frustration on the part of the team members for whom English was not a strong language:

*“It can be frustrating for them and for you because you’ll find that because if English is not their first language and you agreed that it’s going to be held in the English language, it’s much more difficult for them to contribute” GB14C Business Manager, Away*

The majority of participants also recognised the criticality of the technical lead personnel in their communications. These personnel needed the right relationships and connections in all other offices within the virtual team:

*“The most important part is around the lead roles, but I think as a general rule, the more connections you have, the better it is.” FC35B Project Manager, Away*



### 4.3.1.2. Communication Media

Communication media received a substantial amount of attention from these participants. They were often running a large part of their project in their office, remote from the home office. As such, they observed that they need effective communication in meetings with their home office colleagues. The data here are presented grouped by technology (video, telephone, written and face-to-face).

#### 4.3.1.2.1. Video

The majority of participants believed the use of videoconference technology was important, helping to increase the quality of the communications:

*“The video conferencing, you can get on there and do it; saves a lot of time. I think gives us a lot clearer on the direction you’re going.” JB11E Regional Director, Away*

*“This is much more than only picture and voice. It’s all this how you talk and the speed, or the words you use, or the fingers and the hands you’re using while talking, and the face; everything” BD11D Project Manager, Away*

However, others believed videoconference technology was either a tool they would only use for initial meetings and relationship establishment or an unnecessary piece of technology:

*“Video is good because you get that face-to-face; if you’re lucky, you’ve got that face-to-face communication but then once—generally, the ones I find, once you’ve got that, then just getting on a telephone is more than sufficient” JB11E Regional Director, Away*

*“We don’t really need to see each other. You know, I don’t need to see the body language of the guy in the room to understand whether they’ve got it or not.” GB11C Project Manager, Away*

#### 4.3.1.2.2. Voice and telephone

All participants outlined their reliance on the telephone to establish and maintain communications with their virtual team colleagues. Some observed that the telephone was their default tool and that their organisations were actively encouraging their personnel to communicate verbally rather than in writing:

*“I’m very much—yeah I think as a company in general, as whole we push on just make phone call. There’s no point in emails bouncing back all day long. Just make phone call and bat it out over the phone.” JB11E Regional Director, Away*

However, one participant commented that it was easy to be aggressive on telephone calls:

*“I think even over the telephone you can get away with being—I don’t know about a bit more hard-nosed,” FC35B Project Manager, Away*

The majority of participants disclosed that they would often follow up a telephone call with an email to produce a written record of their verbal discussion:

*“if you put in writing, make sure you’ve had the conversation with the party first so they, you know, know, either know what’s coming or it’s a confirmation of what you’ve already said.” FC35B Project Manager, Away*

#### **4.3.1.2.3. Email and written communication**

These participants had a complicated relationship with email. Most recognised it as an important and valuable tool in communicating in a project virtual team:

*“Email’s great—you’ve got to get things in writing for clients and other consultants you may be working with.” JB11E Regional Director, Away*

*“Emails are probably our most frequently used medium of communication these days, probably a bit too much.” GB11C Project Manager, Away*

However, they also recognised that email overload was a major issue and that simply sending an email did not guarantee the recipient had read it.

*“We’re typically overloaded with emails. It becomes – it’s become a little bit too – probably too pervasive in that respect.” GB11C Project Manager, Away*

These participants also observed that email can become a source of conflict, where individuals write and send emails when annoyed or frustrated only to regret the message later:

*“Email is very much us and them type stuff. The usual story of, unless you are very careful with your written words, that can be interpreted in a negative way. And it’s just, you know, the usual story of; if you’re feeling hot and bothered, don’t send the email.” FC35B Project Manager, Away*

#### **4.3.1.3. Relationships**

All participants provided observations associated with relationships in their project virtual teams. Many reflected their belief that strong relationships between personnel in different offices were important to the success of their virtual teams:

*“If they don’t have that, sort of, respect or recognition or value, then they just won’t - You know, there is only so much they’ll do before they say, “Too bad, I’m not going that extra mile,” so that’s why the strength of the relationship is really, really important.” FC35B Project Manager, Away*

*“If you haven’t worked together, or haven’t had some sort of shared history, or, you know, some sort of blood tie that binds you together, it’s very easy to get distracted by other events taking place in the workshare office. And I think it’s just important for the amount of focus and pride that you put into your work that you, you know, you’re doing it for a friend or you’re doing for*

*someone you respect, you know, and I think that's an important driver."*

*FC35B Project Manager, Away*

*"Projects about people, and you get the people element right then you get the project- will generally get delivered, but if you get—if the people side goes wrong, then your project's in serious trouble, and I think you can take, you know, if you focus on the people side, that's probably the most important part of getting workshare to work properly" FC35B Project Manager, Away*

All participants commented on the importance of investing effort in building relationships within their project virtual team, particularly by meeting face-to-face:

*"I still believe in personal relation is to meet someone in person, or to know someone in person, it's much better than only to know him by telephone or video conferences" BD11D Project Manager, Away*

Most of these participants described seeking out personnel with good communication skills from within their teams to be the key relationship holders:

*"it's important for our guys to have that sort of skill and that's not so easy to get." GB11C Project Manager, Away*

However, one participant expressed concern that if the relationship is too cosy there is a risk that project issues may not get fully addressed. The concern was that some personnel may support their relationship rather than serve the best interests of the project.

*"The two PMs were almost too familiar with each other and, you know, tended, instead of running it as a project and you've got scheduling, budget, and hours to manage, they tended to, almost tended to be too nice and they were too relaxed and comfortable where they didn't, you know- Well it's nice to have these relationships but then you've got a project to deliver and you need to keep track of that." FC35B Project Manager, Away*

#### **4.3.1.4. Cultural Diversity**

Cultural diversity was another theme where participants expressed a range of views. The majority believed that the multicultural make-up inherent in project virtual teams increased the overall management complexity of the team and added to the difficulties:

*"There's certain things that you can't do and can't say or shouldn't say or should do, not that you wouldn't do over here. Everything from hospitality to the way that you approach let's say, sensitive topics. The different units will react in different ways and understanding their cultures and mannerisms." GB14C Business Manager, Away*

*"The work's challenging to say the least. It's just got a different energy to it than probably I was used to back in Western Australia and it has a lot different cultures and you're working with a lot more different people with*

*different experiences and I think that holds me. I think it holds our company in general, in good state; moving forward. The more ideas you can get, the better possibilities there are in the future” JB11E Regional Director, Away*

However, two participants observed that engineering offices are becoming increasingly multicultural, and as such, the cultural challenges faced by virtual teams are similar to those of co-located teams:

*“The culture and the religious side of things; there are some challenges, but it doesn’t think any different to any other office around the world these days.” JB11E Regional Director, Away*

#### **4.3.1.5. Individual’s Suitability for Virtual Teaming**

Finding the right personnel for the communicator roles on project virtual teams was strongly recognised and discussed by the majority of these participants. They presented a consistent view that these individuals needed to be active communicators:

*“It’s not enough to be really an excellent engineer; you have to suit to the culture in that country where you are, or even with the people you are dealing with,” BD11D Project Manager, Away*

These communicator individuals also need to be willing and available to work outside of core hours:

*“That’s where the whole communications and the right people and you’ve got to be able to get them on a Blackberry, you’ve got to be able to get them on a mobile phone, and if they’re not accepting of that, well, they’re not the right person for that type of role.” JB11E Regional Director, Away*

Two participants observed that finding personnel suitable to undertake the virtual team communications was a major challenge, that not all personnel are suited to the task and when someone doing the role was not the right fit, they needed to be replaced:

*“It goes right back to the right person and you’ll find that the right person for the role of those inter-office communications will be more open to discussing things of personal nature. If they’re not, then generally, they’re probably not that approachable any way.” JB11E Regional Director, Away*

#### **4.3.1.6. Challenges of Virtual Teams**

The majority of participants identified several communication challenges they faced leading their teams. These included managing priorities of their virtual team colleagues, where they described finding it frustrating and highly challenging to keep visibility of work being performed on their project while ensuring the work is prioritised to meet the project’s needs:

*“trying to prioritise the activities and also sometimes convince the guys in the field that is the one that we want to actually concentrate on and so it may be about either releasing them from some other obligations or*

*convincing them that that's the activity that we want them to follow through on." GB11C Project Manager, Away*

One participant noted difficulties gaining consensus for decisions from remote team members. They contrasted an ad-hoc conversation within a co-located team reaching a quick decision with having to plan an electronically mediated conversation with virtual team members to achieve the same outcome:

*"in Sydney, if I'm wanting to communicate to my team, I'll just get up and go to somebody's desk or jump in the meeting room and say, "Guys, we need to have a bit of a discussion," and you can address everybody eye-to-eye, face-to-face and it's quite easy to adapt according to everybody and send one message in a 20-minute session or something like that. Doing the same remotely, they're very, very difficult to then send one single e-mail and do the same thing or even do a telephone conference or even video conference" GB14C Business Manager, Away*

#### **4.3.1.7. Impact of Time Zones**

As leaders of their portion of their projects, and senior personnel within their offices, all these participants described spending considerable time, both inside and outside of core working hours communicating with their virtual team colleagues. This included the impact on non-core time, such as needing to work either very early in the day, late into the night or both:

*"I'm supposed to be here from 8:30 to 6:00 P.M. On a regular basis, I'm here in the afternoon 6:30 at least. Seven is also very often, but it can be without end. I stayed here already after midnight. That's happened already at least five times in these seven, eight months." BD11D Project Manager, Away*

*"As long as you make it work for yourself otherwise, you'll find yourself starting work a 6 o'clock in the morning, finishing at 8 o'clock at night, so it doesn't help anyone." JB11E Regional Director, Away*

Describing how time differences between offices can lead to work slipping behind schedule due to the difficulties of personnel being able to discuss questions they may have that are preventing task completion:

*"you can easily fall a day behind by not taking into account time zone differences." JB11E Regional Director, Away*

*"the time difference is coming to the picture, they ask him something and he is lost until Germany wakes up and then they could call him and say "give me this information" or "did you work on this report and send it over" now we have to wait." BD11D Project Manager, Away*

To pre-empt the time difference impact, some described emailing the day before so their colleagues in the other time zone could work on an answer before they talk. This process

requires the initiator to be aware of the question ahead of time and able to initiate the discussion.

*“quite often, I’ve got to make sure that if I know that I need to speak to them, I’ll send them an email that night and let them know I’m going to talk to them or I’ll—send them an email with that information and then make sure I’m here first thing in the morning so I can get in touch with them.” JB11E Regional Director, Away*

Participants also described how, where an overlap of working time between offices existed, they would plan all their discussions to be held during that time.

*“I’ll make sure any questions I’ve got, any queries or any obstacles we may get, but I will communicate with them in that block of the day. So up in to lunch time here for example, I know that I need to try and communicate with them as much as possible and check with the team here to make sure that any queries, they don’t come to me at 2 o’clock in the afternoon needing an urgent and, well, I’m not going to get that from Perth.” JB11E Regional Director, Away*

They described how, as the time zone separation increased, they changed their mode of communication, using synchronous communication less and asynchronous communication more, and began to feel a sense of disconnection from their virtual team colleagues.

*“Seven hours at the moment. And again, when you’ve got such a big-time difference, it’s a lot of the times it’s not even on people’s minds over there and that can be a challenge because they’ve buggered off,” JB11E Regional Director, Away*

*“you lose that personal touch, you’ll find you’ll use video conference a lot less you’ll find it a lot less and it would be more emails and emails aren’t sufficient to communicate.” JB11E Regional Director, Away*

#### **4.3.1.8. Trust and Confidence**

The majority of participants discussed building trust, maintaining trust, and the impact of breaking trust. Additionally, how having confidence that assigned work would get done in an agreed manner resonated strongly in their narrative.

Some described building trust in a new team or with new team mates through face-to-face meetings, one-on-one phone calls and video meetings to establish personal contact.

*“It’s important to always start off most of the time with a face-to-face or a phone call to say, “Okay, introducing yourself, what you’re about, what you stand for”. GB14C Business Manager, Away*

These participants described this as a warming-up process rather than impersonal, business only first interaction.

*“start it from that way and before you get into the business side. If you’re going straight to business items, then it’s very cold, you feel that you have to get straight to the point and it becomes boring and you tend not to probably get as much feedback as well.” GB14C Business Manager, Away*

One participant described the establishment of early trust as a negotiation, with each party giving a little to begin to build their working relationship.

*“It’s basics for me in terms of how you can try and gain trust. It’s giving a little bit first and then hoping you get their reciprocals are coming back to you afterwards. Yeah, that’s how I found things work, especially in Asia.” GB14C Business Manager, Away*

The majority of participants outlined their belief that establishing a common respect between personnel was part of the overall trusting relationship, both at a personal and professional level.

*“you try and provide common respect. I think trust is one; respect is probably a little bit related to that as well.” GB14C Business Manager, Away*

*“If you trust someone has the technical knowledge, you believe him if he says this is the best solution.” GB11C Project Manager, Away*

They went on to identify how once trust was established, they became more relaxed in dealings with their virtual team colleagues, removing some of the desire to check on the activities of the other personnel.

*“You have to be able to trust that once you go through and give them the actions, they agree and the actions that you say, “Should be done by day X” and you just have to follow up maybe once a month, not the guy over shoulder type thing. I think trust is an area that is sort of fundamental to that in order to be successful.” GB14C Business Manager, Away*

*“Whether it’s trust or credibility or, you know, the esteem with which you hold on someone becomes a really important factor as to whether you would you die in a ditch for this person who’s on the other side of the country or in another continent, because if you’re not, then it’s going make workshare hard.” JB11E Regional Director, Away*

Two participants described how trust between senior personnel in project virtual teams can be placed at risk by pressures to meet organisational goals that may not always be aligned with the project’s needs.

*“Sometimes, on a project can lose a bit of trust, as well. You may feel that the other offices is not necessarily doing things in the best interest in the project, they’re doing more to make their own office look better because you know, the way that projects are generally set up, you’ve got to be*

*accountable for your office and they've got to be accountable for theirs."*

*JB11E Regional Director, Away*

#### **4.3.1.9. Alignment of Personnel**

When discussing alignment, these participants focussed on two activities. Firstly, describing team building through social events:

*"having something that is equivalent of a team building event, whether or not it's something as simple as dinner with that person, go and have a drink. Just a little bit more socialising as well, because it's important in a lot of cases, but in particular region based, it's all about, in my view anyway, it's all about the personality of the people, making sure that you can get on with them."* GB14C Business Manager, Away

Secondly, two participants described difficulties building a shared team vision. They observed that the lack of physical visibility of leaders can make it difficult to model required behaviours.

*"Virtual teams. From a leadership point, probably trying to build a shared vision because, again it's very difficult to communicate it across. You're not seen to be walking the talk."* GB14C Business Manager, Away

#### **4.3.1.10. Organisational Culture**

The culture of the organisation undertaking the project was one on which the majority of participants had observations. They discussed how the business culture and internal politics can impact how a project virtual team communicates and operates.

*"there is a lot of politic. You know, like in any big organisation or any organisation, there is a lot of politics, big 'P' and small 'p' and, you know, you've got to be, or in my set view anyway, you've got to be very clued to what that is, where the blood ties are, and therefore which battles you might choose to take on and others that you might roll over."* FC35B Project Manager, Away

They also observed that while a company or project can seem to be one homogenous entity, each office has its own culture and behavioural patterns influencing how they behave toward other offices.

*"financially or economically, they are different companies. So, we have to give them an order, so some works are covered, some other works maybe not covered, which we are requiring from them, so they start to argue."* BD11D Project Manager, Away

The impact of organisational culture clashes was outlined by one participant who observed:



*“you need to make sure that everyone’s focused on delivering the project on a whole and not being overly concerned about just what’s happening within their office.” JB11E Regional Director, Away*

Having personnel distracted by internal wrangling can begin to have a detrimental impact on the focus and delivery of team members.

#### **4.3.2. Cognitive map of Senior Away based participants**

A cognitive map for this cohort is shown in **Error! Reference source not found.** below. This map demonstrates a high degree of cognitive complexity, with 49 discrete nodes and 52 links. This map also exhibits a number of defined clusters where nodes are tightly packed around one specific theme and less tightly connected to the overall map.

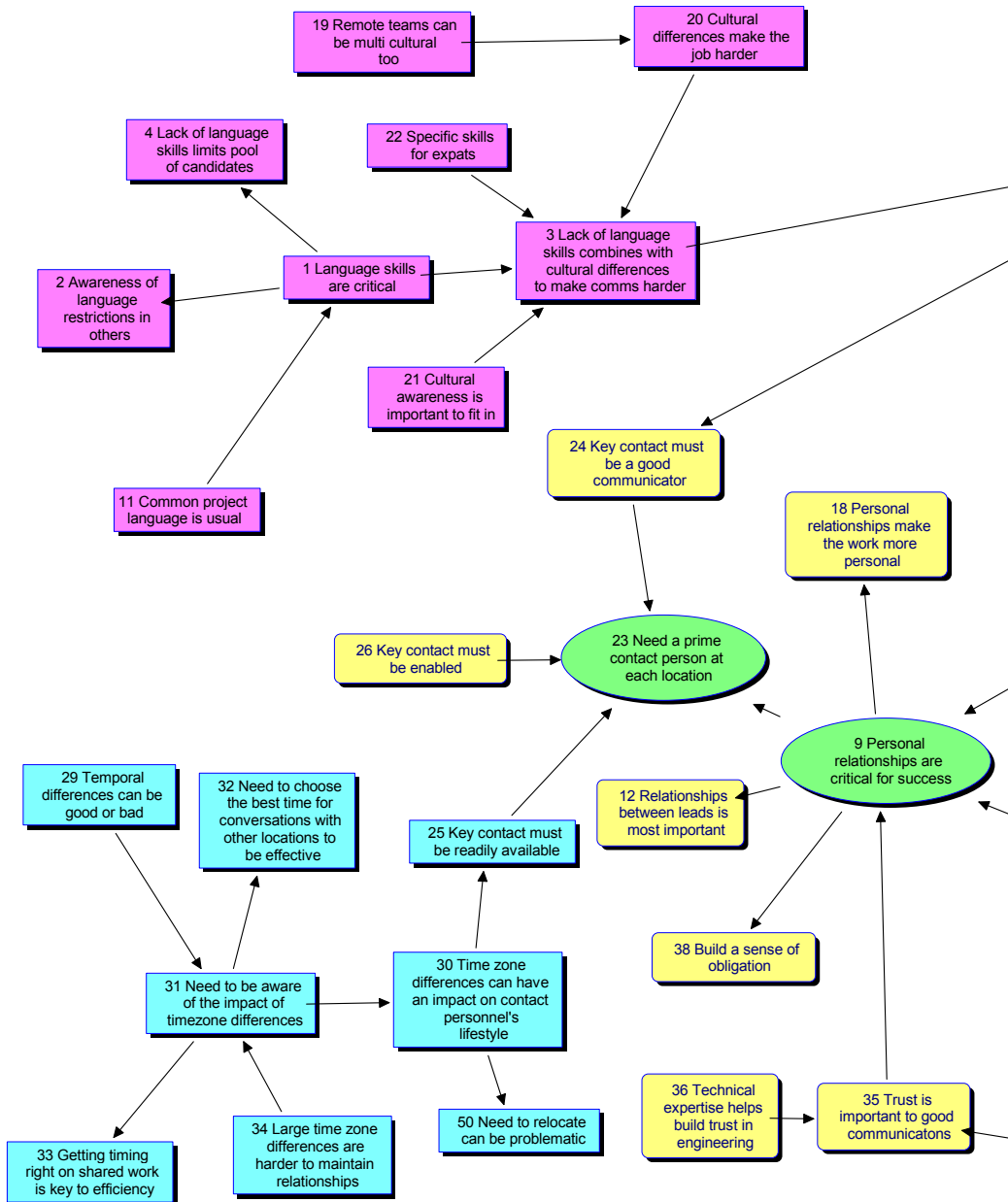
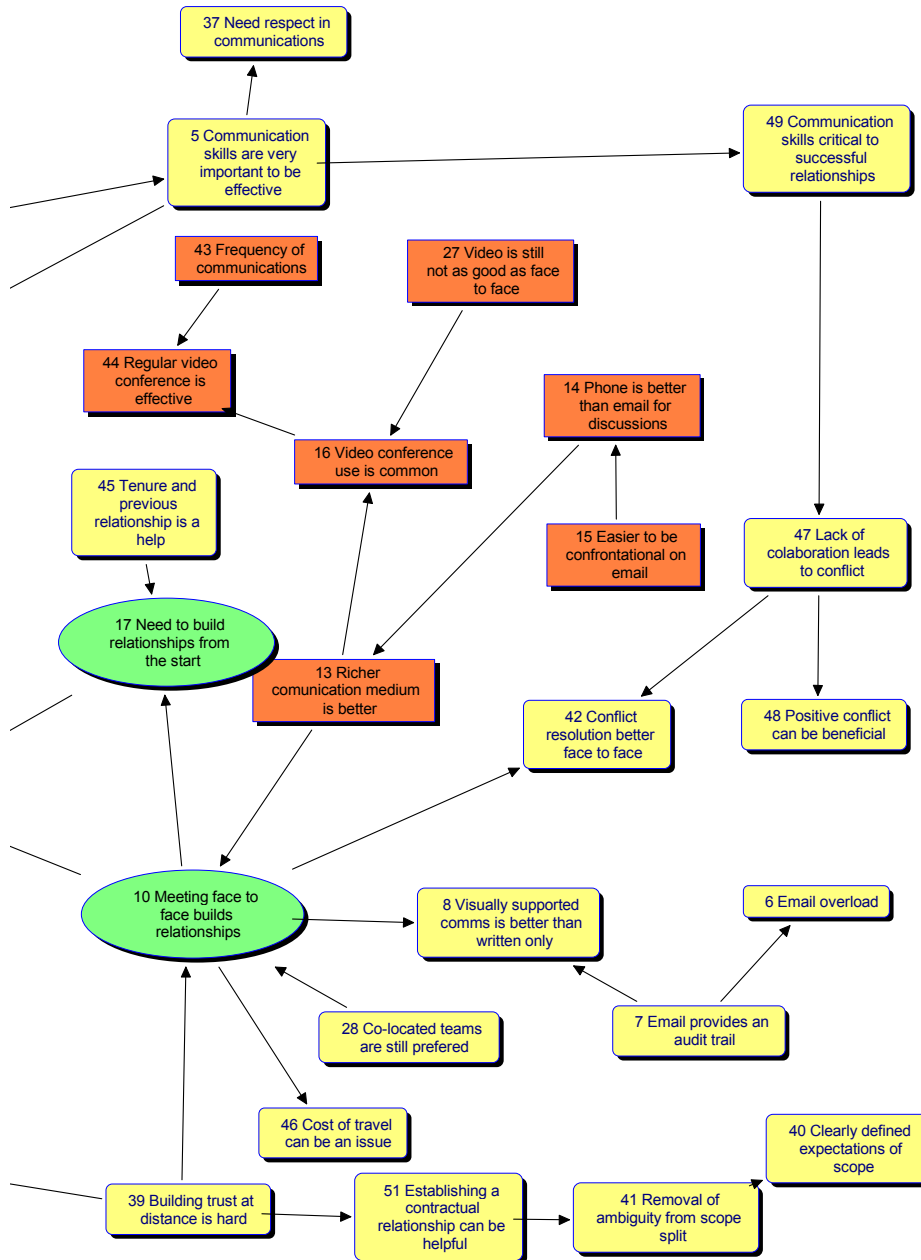


Figure 24: Cognitive map of Senior Away participant data



### 4.3.2.1. Nodes

Key nodes are highlighted by green ovals on Figure 24. Of these, the most significant is highlighted in Figure 25; that **meeting face-to-face builds relationships**. This node has support from nodes suggesting that **building trust at a distance is hard**, that a **richer communication medium is better** and that participants believe that **co-located teams are still preferred** over virtual teams. This

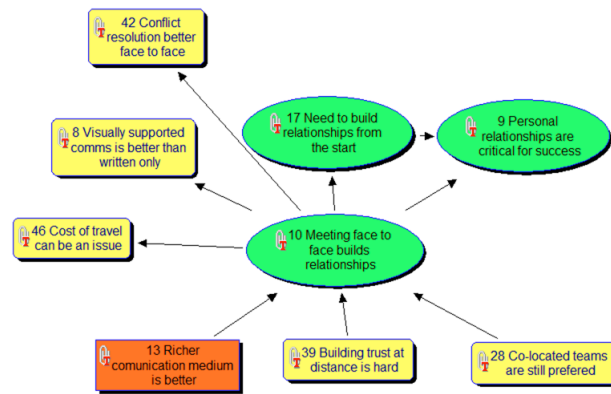


Figure 25: Node - meeting face-to-face builds relationships

node also supports other nodes which indicate that in virtual teams, **the cost of travel can be an issue**, that **visually supported communications is better than written only**, that **conflict resolution is better face-to-face**, that virtual teams **need to build relationships from the start** and that **personal relationships are critical for success**.

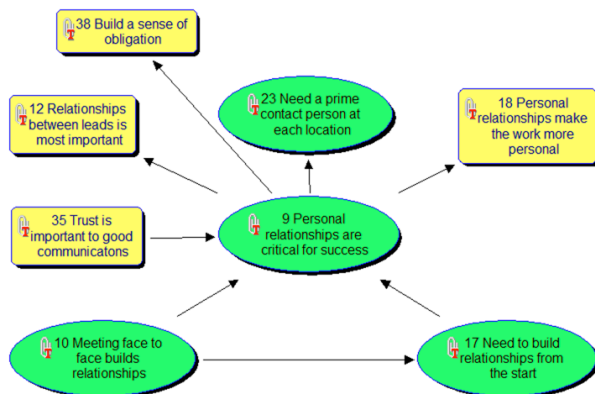


Figure 26: Node - personal relationships are critical for success

The second most significant node, highlighted as Figure 26, suggests that **personal relationships are critical for success**. This node is supported by other nodes suggesting that **trust is important to good communications**, that there is a **need to build relationships from the start** and that **meeting face-to-face builds relationships**. This node of **personal relationships are critical for success** also supports nodes which indicate that

virtual teams **need a prime contact person at each location**, that **personal relationships make the work more personal**, that **relationships between leads is most important** and that interpersonal working relationships **build a sense of obligation**.

The **need for a prime contact person at each location**, shown in detail in Figure 27 is the third most influential node in this map. This node was supported by observations that the **key contact must be enabled** by the project to act with relative autonomy in the project's interests, that the **key contact must be readily available** and that the

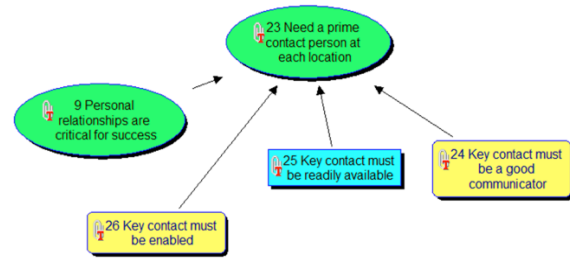


Figure 27: Node - need for a prime contact person at each location

**key contact must be a good communicator.** This node is itself supported by the node that identifies that **personal relationships are critical for success.**

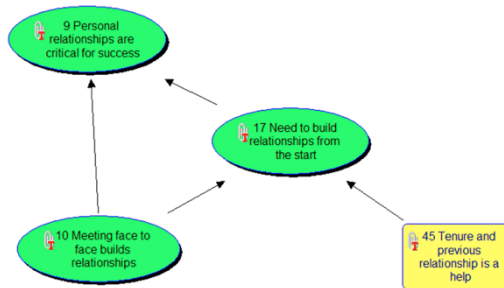


Figure 28: Node - need to build relationships from the start

The fourth most significant node, shown in detail in Figure 28, identifies the **need to build relationships from the start**, which is supported by nodes stating that **meeting face-to-face builds relationships** and that both **tenure and previous relationship is a help.** This node itself supports the expressed belief that **personal relationships are critical for success.**

#### 4.3.2.2. Clusters

Along with the significant nodes discussed above, this map also includes three large clusters highlighted with pink, orange and blue rectangles on Figure 24. **Error! Reference source not found..** These clusters are each collected around a core issue; the effectiveness of the various forms of technology available, highlighted by the orange boxes; the impact of cultural and linguistic differences between locations, highlighted by the pink boxes, and; the impact of time zones and communicating in a coordinated manner across time zones and distance highlighted by the blue boxes.

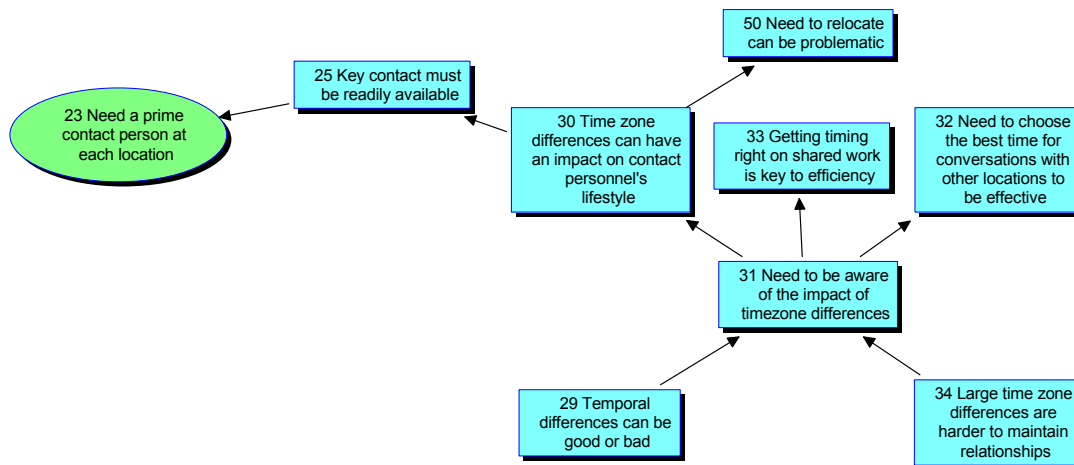


Figure 29: Cluster – time zones and key contacts

The cluster highlighted by the blue boxes and shown in Figure 29 illustrates the impact of time zones and physical separation, participants indicated they believe it is important for the project leadership to actively consider and manage how teams communicate when separated by multiple time zones and, that one way to ensure a robust line of communication was to have a single point of contact at each location whose role was to ensure messages were sent and received in a timely and accurate manner.

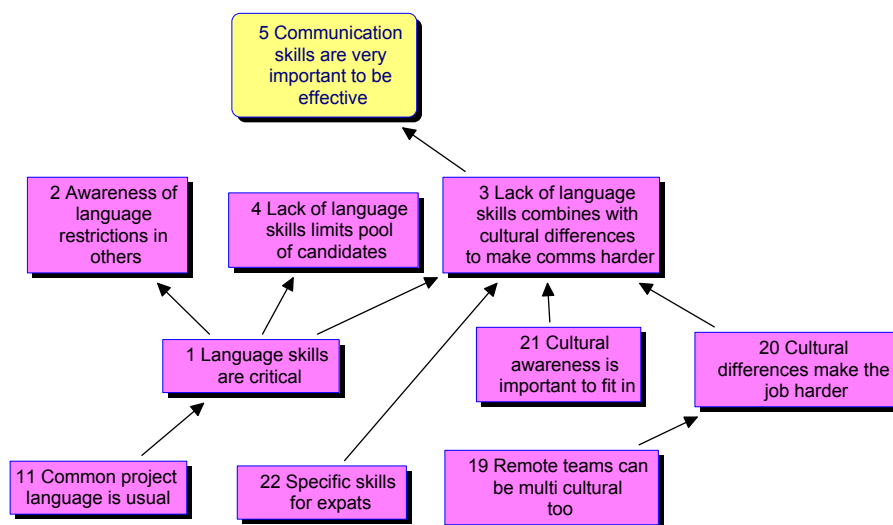


Figure 30: Cluster - understanding cultural and linguistic differences

The cluster shown by the pink rectangles in Figure 24Error! Reference source not found. and highlighted in Figure 30 is collected around the impact of cultural and linguistic differences between virtual team members and locations illustrates challenges faced working across cultures and the importance of having personnel who are both culturally and linguistically sensitive, with two similar nodes expressing that **communication skills are critical to successful relationships** and that **communication skills are very important to be effective** as a virtual team member.

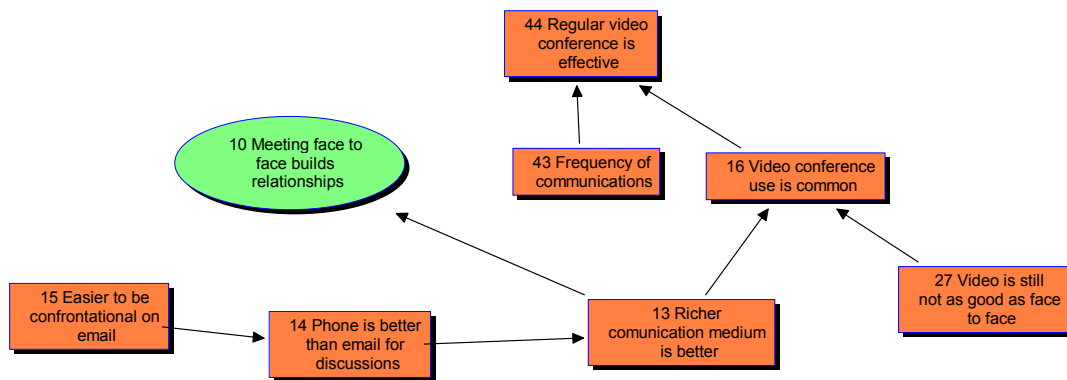


Figure 31: cluster - use of technology

The third cluster, illustrated with orange rectangles in Figure 24 **Error! Reference source not found.** and highlighted in Figure 31, shows the perceptions of the value and usefulness of various communication technologies to the participants. They expressed a clear preference for richer forms of communication, identifying that videoconference was preferable to telephone and that both were preferable to email, with one node highlighting that it is **easier to be confrontational on email**.

#### 4.4. Middle Perth Participants (Middle Home)

This Middle Home cohort comprised three middle managers from the participating projects. These were coded as GB31B, HC31A and HC33A. The dominant themes from this cohort are below, with key narrative passages to highlight the insights.

##### 4.4.1. Thematic coding of findings

##### 4.4.1.1. Interpersonal Communication Challenges

Challenges associated with interpersonal communication identified by these participants included difficulties working with people who speak a different language or who may not speak English (the common project language for all projects investigated);

*“difficult to get really inside of a good relationship with people to actually understand exactly where they’re coming from, so language is definitely a problem. So quite often, what we would say either written on a drawing or in an explanation verbally to somebody may not necessarily result in what we actually ask for.” HC31A Interface Manager, Perth*

These language issues sat alongside difficulties distributing information in a way that all relevant personnel could access and understand;

*“maybe we’re not very good at distributing that information or getting people to understand it.” GB31B Product Manager, Perth*

One participant indicated that a combination of language barriers, including the need for many personnel in remote offices to work in a foreign language, along with weak interpersonal relationships between offices as well as difficulties in sharing information contributed to frustrations between personnel in the different offices;

*“I said, “these blokes they don’t even speak English and yet they’re doing an English drawing. You know all the notes—everything’s on that drawing is in English that you can read it and you can follow it”. You know, I said now, but it takes a bit to do it. Bring yourself back down to the fact that they were speaking a foreign language, they’re working it in foreign language. I mean a drawing is a drawing but all the notes and everything that goes with it took a bit of sorting out.” HC33A Interface Engineer, Perth*

#### **4.4.1.2. Communication Media**

When considering the effectiveness of communications media, all participants indicated a preference for richer tools such as video conference.

*“Interviewer: And the video was better than just doing it by phone?  
Interviewee: Especially with, because with of the accents as well. I mean I’m sitting here on one end of the phone over in Chile and listen to people talking here, and you’ve got Scotsman and you’ve got—and it’s just with a phone—a speaker phone, you lost a lot of the clarity sometimes. You had to go back and say, ‘What are you saying’ you know. And you can look right on the table within your meeting and you can see the faces going, ‘What’s he saying’ and vice-versa because they’re speaking their English too.”  
HC33A Interface Engineer, Perth*

However, while participants generally described how they preferred videoconferences, one participant indicated that in some applications videoconference was still not as effective as anticipated;

*“Technology around web meetings you know, big web meetings in the conference rooms I still think it doesn’t quite work. It’s not a one-on-one discussion environment. You know, you got that screen up—supposedly looking at their—you know, their video and you’re also looking at ours and it just doesn’t seem to work. Then you’ll flick a drawing up and start to try and point to and it just... There’s still some developments there that need to go through. I we’ve never solved that one, just can’t. Generally, if we’ve got a full room, we just go with a phone conference.” HC31A Interface Manager, Perth*

Two of the three participants indicated they believed email was less effective due to the need for additional clarification inherent in such asynchronous communications.



*“email communication is difficult because even written word is in fact written words probably even harder because you can’t go, ‘is that what you meant’,” HC31A Interface Manager, Perth*

#### **4.4.1.3. Relationships**

All participants observed that they believed it was important to build relationships with their virtual team colleagues at both professional and personal levels.

*“It’s what’s important to me anyway, it’s the way I try and work. I did when I was drawing office manager and the rest of it—yes, it is a very important thing and it’s important to sort of get to know people and realise their quirks” HC33A Interface Engineer, Perth*

They described building relationships over time through multiple interactions with their virtual team colleagues, either electronically mediated or through face-to-face contact;

*“It was a long process to break it down but I mean in that six months stint I spent out there, it was completely different because, you know I sort of walked in and we started from day one talking about the job, working through it and they knew I was there to answer their questions and they’re sort of, the seniors that I had worked with before, if you like put that message through so that the younger ones would come and talk straight away, you know and start to ask the questions.” HC33A Interface Engineer, Perth*

Participants described how good personal relationships helped improve their ability to deliver their work, through removing risks of embarrassment by asking questions and through helping to alleviate some of the otherwise contractual discussions that could eventuate.

*“More relaxed about asking questions, changing this sort of culture of ‘I’m not going to ask because I’ll be seen to be silly’. Getting them to actually talk and ask a question, what’s wrong, you know.” HC33A Interface Engineer, Perth*

#### **4.4.1.4. Cultural Diversity**

Cultural diversity was discussed by all members of this cohort. Observations included how the hierarchy in different countries impacted the way personnel interacted across national boundaries:

*“By culture, I mean the—just the personal relationships within the workshare office. The way they dealt with each other was different to the way we do. There’s a hierarchy which is different to ours.” HC33A Interface Engineer, Perth*

*“There was also a fear of looking silly because they asked a question; they didn’t know the answer” HC33A Interface Engineer, Perth*

Similarly, two participants observed that there are cultural differences between personnel in different Australian states:

*“Cultural can even be within different states of Australia.” HC31A Interface Manager, Perth*

All participants observed the importance of recognising and understanding cultural differences and finding ways to work with them to achieve the project outcomes:

*“Understanding some of those cultural differences is half of your battle before you start. Going in there and expecting for the senior engineer to speak to the draftsman, you’ll never going to get it.” HC31A Interface Manager, Perth*

#### **4.4.1.5. Challenges of Virtual Teams**

The principal observation of these participants on the challenges of virtual teams was to avoid the arrogance of believing that only personnel from the home office can do things right:

*“You’ve got to have an open mind. You can’t—I mean these blokes, they’re good Engineers, they’re good Drafters and there’s a conception sometimes over here that the only people that can do it is us, nobody else can do it.” HC33A Interface Engineer, Perth*

#### **4.4.1.6. Impact of Time Zones**

The impact of time zones on members of a project virtual team to communicate effectively was something all participants in this cohort were aware of. They discussed the impact of displacement across time zones and how different cultures use their days:

*“We forced our Santiago Office initially into having two mornings a week at 6:30 their time, it started. Quite seriously, having spent the time there, you are the only taxi on the road going to the office at that time of the morning and when you get there, they’re the only people in our office until 8:00 in the morning. So, it’s a major shift to their timing and their normal working hours and everything else.” HC31A Interface Manager, Perth*

#### **4.4.1.7. Alignment of Personnel**

Achieving alignment of personnel was briefly raised within this cohort. One participant observed that getting a common understanding of the project goals was important to avoid personnel acting independently:

*“we try our best but they don’t understand what we’re trying to do locally. So, everybody goes off on their own little tangents all over the place.” GB31B Product Manager, Perth*

Going on to comment that it was difficult to achieve real alignment of personnel:

*“I sort of respect everyone’s views but getting them to all mesh together is never - never an easy task” GB31B Product Manager, Perth*

#### **4.4.1.8. Organisational Culture**

The area of corporate culture identified by these participants was overcoming the culture of the remote office treating the home office like a client. Two participants described feeling that the project would benefit from the different offices working as peers rather than as client and sub-contractor:

*“I suppose they looked upon us as the client rather than the workshare. And it was a thing that I spent a lot of time trying to change and explaining ‘we’re not your client. the client is “Company A”. you’re just an extension of our office’ and that’s why we’re working together. But I think even down towards the end, it still had that same sort of outlook that we were the client” HC33A  
Interface Engineer, Perth*

#### **4.4.2. Cognitive map of Middle Perth based participants**

The cognitive map for this cohort is shown in Figure 32, while this map includes a smaller number of nodes and links when compared to maps generated from data from other cohorts in this research, it still demonstrates the interconnectedness of participants views.

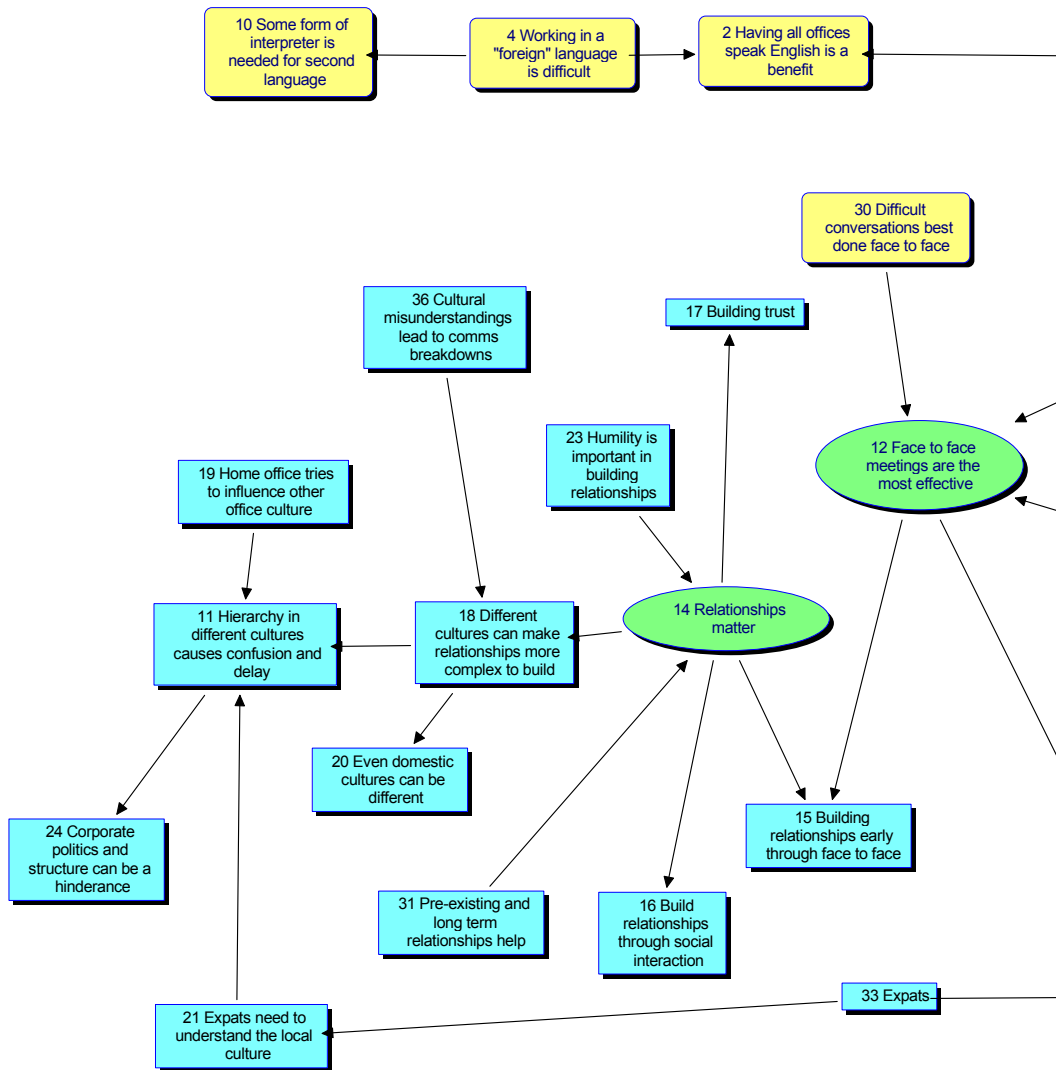
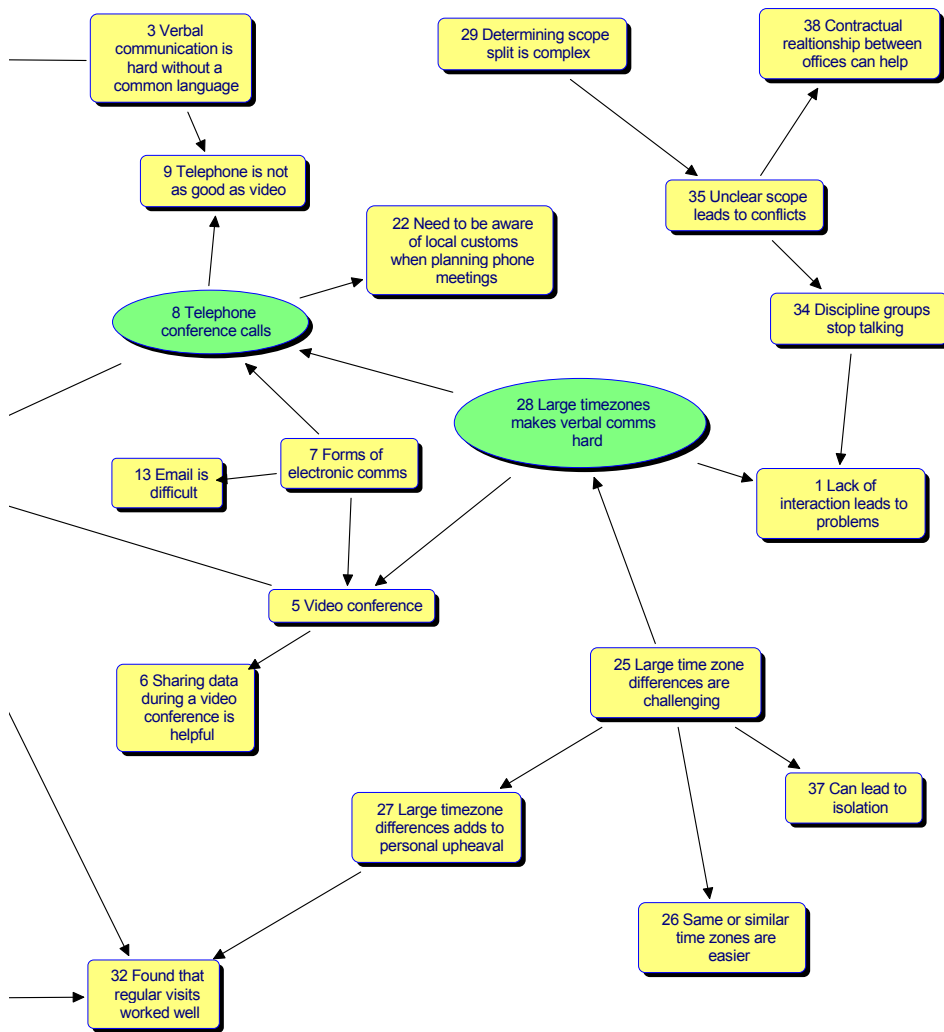


Figure 32: Cognitive map of mid-level home participant data



#### 4.4.2.1. Nodes

The dominant nodes are highlighted by green filled ovals on Figure 32 **Error! Reference source not found.**, with extracted sections shown below to illustrate the individual central nodes.

The most central node is that **face-to-face meetings are the most effective**, shown in Figure 33, which is influenced by nodes observing that **difficult conversations are best done face-to-face**, **video conference** and **telephone conference calls**. This node of **face-to-face meetings are the most effective** also influences the need for **building relationships early through face-to-face** and an observation that it was **found that regular visits worked well**.

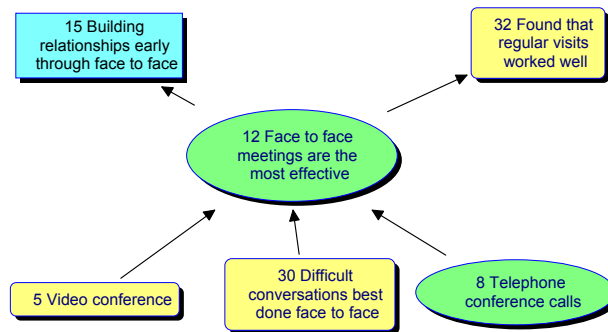


Figure 33: Node - face-to-face meetings are the most effective

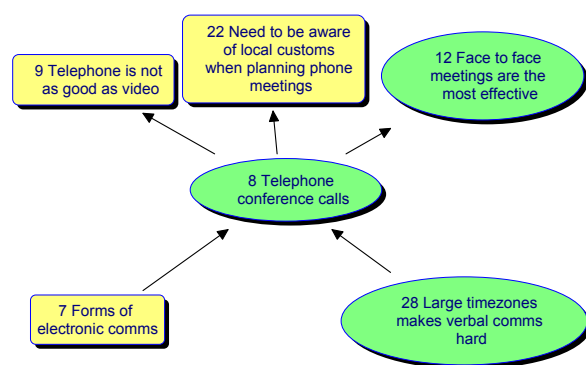


Figure 34: Node - telephone conference calls

The second most central node, shown in Figure 34, is **telephone conference calls**. This node is influenced by the general node of **forms of electronic communication** and the node identifying that **large time zones makes verbal communications hard**. The node of **telephone conference calls** itself influences nodes observing that **telephone is not as good as video** the **need to be aware of local customs when planning phone meetings** and the central node for this cohort of **face-to-face meetings are the most effective**.

**when planning phone meetings** and the central node for this cohort of **face-to-face meetings are the most effective**.

The third most central node, shown in Figure 35, is **large time zones makes verbal communications hard**. This is influenced by a node identifying that **large time zones are challenging**, and this node itself influences nodes identifying that a **lack of interaction**

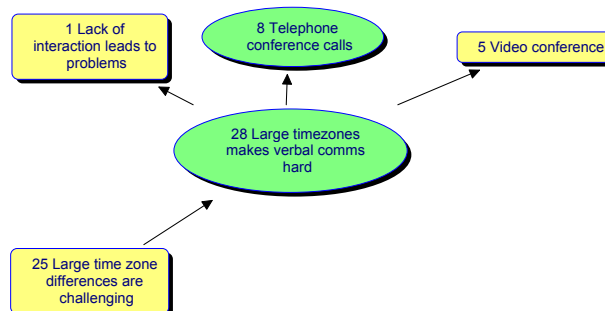


Figure 35: Node - large time zones makes verbal communications hard

leads to problems and two technology related nodes of **video conference** and **telephone conference calls**.

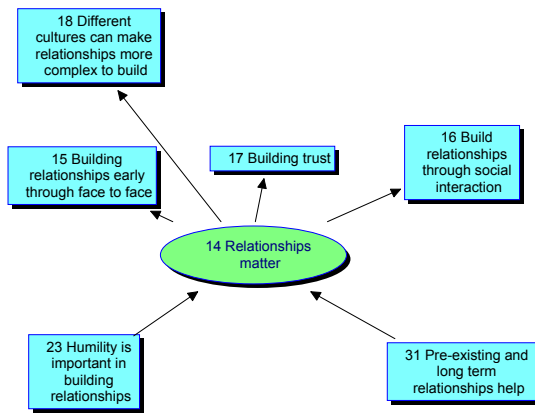


Figure 36: Node - Relationships matter

That **relationships matter** is the fourth most influential node on this map. This node, shown in Figure 36 is supported by the beliefs that **humility is important in building relationships** and **pre-existing and long-term relationships help**. This node itself influences nodes of **building trust**, **building relationships through social interaction** and **building relationships early through face-to-face** along with the observation that **different cultures can make relationships more complex to build**.

#### 4.4.2.2. Clusters

This map of perceptions of the Middle Home cohort incorporates only one significant cluster, highlighted with blue filled rectangles on Figure 32 **Error! Reference source not found.**. This cluster, reproduced as Figure 37, is centralised around the relevance of relationships in the management of interpersonal communication in project virtual teams. Within this cluster, the participants consider the value of relationships, how relationships can be impacted by cultural differences within the project and within the organisation, the need for both expats and home-based personnel to be culturally aware and the value of trust in the maintenance of a good working relationship.

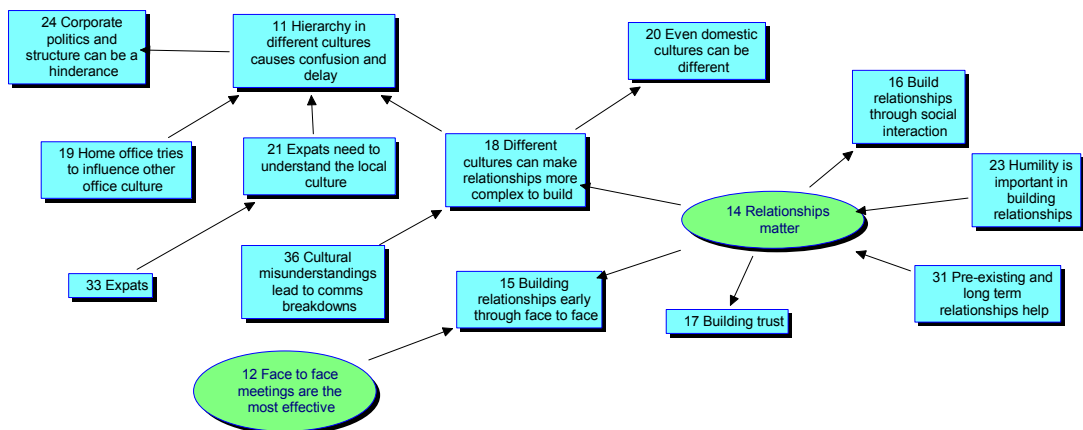


Figure 37: Cluster - relationships

## 4.5. Middle Remote Office Participants (Middle Away)

The Middle Away cohort was the largest in this research, comprising eight middle managers and junior leaders from participating projects. These participants are referred to in the research data as BD31A, BD42D, FC31B, FC33B, FC34B, GB12C, GB13C and JB31C. The dominant themes identified are below, along with key narrative passages to highlight the insights provided.

### 4.5.1. Thematic coding of findings

#### 4.5.1.1. Interpersonal Communication Challenges

The majority of participants discussed several challenges associated with interpersonal communications in their projects. These included misunderstandings arising from asynchronous communications such as email where the messages sent and received led to conflicts:

*“suppose it’s always easy to misinterpret an email or the way somebody’s trying to convey something in an email.” BD31A Project Engineer, Away*

*“It’s very easy to be strong, hard, difficult, nasty in words when you don’t look someone in the eye.” GB13C Interface Engineer, Away*

Many of these conflicts were caused or compounded by language differences between personnel in different offices. Linguistic issues, with authors and readers having different levels of ability in the project language led to confusion and frustration:

*“project all has to be done in English and everyone can speak English that we’ve got there; some a lot better than others. We’ve got people, lead engineers now that are going to meetings and they have to be chaperoned to a meeting because they can’t understand,” BD31A Project Engineer, Away*

Three participants also observed that language and understanding differences led to confusion over work directions, with some personnel not understanding the directions they were given.

*“I do have some concerns over particular people being asked something and not realise they’re being asked something, or go and asked to do something and they just don’t do it because they didn’t realise they’re being asked.” BD31A Project Engineer, Away*

The majority of participants commented on the challenges of remoteness, with their office not being included in some communications and having to defend their actions from criticism from other offices when confusion occurred:



*“harder for a remote office to appreciate because you are not surrounded by the larger project, and, you know, you don’t get all the communications and things that’s running around within the home office, so there are challenges in keeping up to date with the current thinking in the home office.” FC31B Project Engineer, Away*

*“when there is any criticism because we are far away, we find we can’t defend them and any errors we make are very visible, it stands out.” FC33B Project Manager, Away*

Expectations of immediacy of communications were highlighted as a challenge. Two participants believed that, as communications become faster there is a commensurate expectation of immediacy of reply:

*“you can see that natural evolution and compression in time and the expectations. I think just the nature and expectation of people is “I sent you an email, I didn’t get an answer.” Already people are upset about that.” GB13C Interface Engineer, Away*

To alleviate some of these issues, they described how their management had instigated matrices setting out structured lines of communication for their personnel:

*“To manage the communications through those chains, you do have to have some rigours and controls in place, you know. And if you don’t, it gets out of control” FC33B Project Manager, Away*

#### **4.5.1.2. Communication Media**

The media used for communication between project virtual team members were discussed at length by the majority of these participants. This predominantly focussed on the different electronic platforms available. Participants described using email for much of their day-to-day information exchange:

*“Emails are used for just sort of day to day communication I suppose, and you know, non-critical communication to do with the project.” FC31B Project Engineer, Away*

Most felt it was easy to become overloaded with email and consequently its effectiveness was questionable:

*“The effectiveness of email, electronic media, has been probably limited I would say in the recent years now that people are bombarded by information.” GB12C Project Engineer, Away*

However, the clear preference among the majority of participants was to use synchronous tools of telephone and video. They described how the telephone was quicker and more effective:

*“the best way to resolve it and keep the project moving is just to be able to pick up the phone and talk it over with whoever has made the comment, so*

*the phone is still the most important medium really.” FC31B Project Engineer, Away*

Three participants described how the telephone was not the most effective tool for all communications, commenting that email was preferable for communications where language may be a barrier to verbal discussions:

*“The phone, yes, the phone to Europe but not into Asia. In Asia, it tends to be email.” GB12C Project Engineer, Away*

Four participants discussed their use of videoconference technologies, describing how they believed they were underutilised in many businesses:

*“we have been using the videoconference a fair bit, which I think is a great tool. I think it’s probably a very under used utilised tool.” GB12C Project Engineer, Away*

However, other participants felt videoconferences were unnecessary in some situations. One described how they felt that once they knew the other party, they did not need to see them on video:

*“Video is not adding any dimension. You see these guys sitting at the table you know them anyway, so I don’t see any benefits of it.” FC34B Principal Engineer, Away*

Another issue was where the group on the videoconference is so large it is not possible to see individuals:

*“They (video conferences) do tend to lose value very quickly once you started adding more people to them. If you have three people one on one in three different locations, you’ll still seem to have benefit, but when you’ve got three people at one location, two at another and one at another, the whole thing starts to unravel.” GB12C Project Engineer, Away*

However, the general opinion of this cohort was that videoconference was beneficial as it added a sense of presence through visible body language.

*“video conferencing so that also is a good thing I think, again ‘cos you get a bit of that face-to-face interaction even though it’s with a whole table of people” FC31B Project Engineer, Away*

#### **4.5.1.3. Relationships**

The role of relationships was something this cohort had some clear beliefs about. Specifically, the majority of participants described the need for trusting relationships and how such relationships help project delivery:

*“The person is more accountable when they know you and the person they’re letting down is a real person and vice versa. When you know the*

*guy's a nice guy and putting him in the thick of it. It makes you motivated to make sure that you don't do that." JB31C Project Engineer, Away*

These participants described how having pre-existing relationships could be helpful but was not essential:

*"Look they are important, they don't necessarily need to be pre-existing, you always need to form and build new relationships for different packages, because there tend to be different people on the teams." FC31B Project Engineer, Away*

Over half of the participants also described how a lack of relationship and lack of mutual confidence could lead to an overall lack of trust and project delivery problems:

*"They didn't have confidence on us or in us because we didn't know each other. I think that confidence can be built and should be built on the base of personal contacts." FC34B Principal Engineer, Away*

Three participants commented how relationships in virtual teams needed to be nurtured and maintained through regular contact. They indicated that one way to maintain this relationship was through regular face-to-face meetings:

*"I believe that we were not maintaining personal contacts with home office in the West with the frequency the job really needed. I think once per week the PM should go there and just check even if they are just shaking hands and checking what has been done and acknowledging good progress." FC34B Principal Engineer, Away*

Two participants commented that, in an engineering project, personal relationships should not be so important since much of the work is proceduralised, but they also acknowledged that the personal contact helped move things forward:

*"It's very important. It shouldn't be in some respects where we have processes and setups, but it's just astounding as to how important that is to oil the wheels of the whole machine. It's a very hard slog if you don't have a personal contact independent of that." GB13C Interface Engineer, Away*

Overall, this cohort expressed a strong belief that relationships and trust were essential to successful project virtual teams:

*"it goes around, the more you know about people, the better it is." FC33B Project Manager, Away*

#### **4.5.1.4. Cultural Diversity**

The influence of cultural diversity on interpersonal communications within virtual teams was raised by the majority of this cohort.

*"Culture is certainly a big thing," BD31A Project Engineer, Away*

Several participants observed that some of their offices and personnel were culturally blind, not recognising cultural differences and their impact on the project:

*“Sometimes, the cultural aspects of the projects, not all the offices are sensitive to, and that’s probably something you need to have the people in charge conscious of that.” JB31C Project Engineer, Away*

*“If you are working in a region, you’ve got to be sensitive to that region.”  
JB31C Project Engineer, Away*

In some instances, personnel would carry their cultural biases from one project to another:

*“The team in Perth came from that background of having to make it work with Chile and they have probably brought some of that approach to us, which I don’t think was necessary.” FC31B Project Engineer, Away*

Three of the participants observed that it was important to learn to work with the different cultures to be effective:

*“if you understand the culture, it makes it easier to communicate with them.”  
JB31C Project Engineer, Away*

They observed that building cultural understanding was an enjoyable part of the project experience:

*“I think that’s one of the things we enjoy in our group and that we learn and understand how to work in that environment” GB13C Interface Engineer,  
Away*

#### **4.5.1.5. Individual’s Suitability for Virtual Teaming**

The suitability of personnel to be part of and eventually lead a virtual team was a strong theme in the beliefs expressed by these participants. Many observed that there were certain people and personality types that suited to working in such a team:

*“We find that some people tend to communicate and get through issues better in the virtual environment we have than those who don’t. I’d put it down to a little bit of drive and personality. So, I’d say that those who are willing to push it as you need to push any issue and be self-driven, positive self-motivators, self-starters, you’ve got to be tenacious to push through”  
GB13C Interface Engineer, Away*

Conversely, there were some personalities participants felt were unsuited to working in virtual teams:

*“It depends on the mentality if you see it as a team effort. It’s different to when you’re concentrating on your own personal development, your own personal achievements. You don’t see the group benefit. It’s easy to have that mentality. If you got that mentality then that’s hard to be a team player and see when the whole group delivers a good job, it’s good for the*

*company and good for more than just yourself.” JB31C Project Engineer, Away*

Leadership attributes for project virtual teams were identified as being important to the majority of these participants:

*“If you want to be like a leader or project manager of this kind of work, you need to be quite strong personality. You cannot be afraid of saying something that—maybe for a customer is a bit harsh, but for me, you can not mince words to the customer.” BD42D Senior Engineer, Away*

They described how having unsuitable personnel can lead to conflict and communication breakdown, with an evolving lack of trust and consequent micromanagement of personnel:

*“It was absence of confidence in our ability to deliver so consequence of it is that if you are not really sure if they can do it, you have to split the work into some sort of visible, easy to manage self-packages and then start micro-managing the progress.” FC34B Principal Engineer, Away*

Ultimately, the need for suitable personnel in a virtual team was summed up by one participant:

*“You’ve got to have the right people in the right positions doing the right thing for the whole thing to work.” JB31C Project Engineer, Away*

#### **4.5.1.6. Challenges of Virtual Teams**

Participants described several challenges they felt were unique to project virtual teams and which influence their ability to communicate effectively. These included different procedures and processes in each of the offices forming the project team:

*“We’ve got very different systems, very different documentation to what they use in Germany and theirs is always better. But when you actually look at it, it’s not any better at all.” BD31A Project Engineer, Away*

How the physical separation of team members resulted in extended communications lines and delays causing concern:

*“it’s very different to get off your seat; walk over there and say, “Hey, you want to do this?” have a quick chat about it 5 minutes, 10 minutes later, boom, your away and you can direct your team to get a—for us, it’s more about we do the work, we send it to them, we give him a day or two to review it. “Oh, that’s not what we wanted.” Yeah, and it can go back and forth, and we can—and you can into a—an issuing of drawings, yeah, debate or not debate, but a cycle and that is and that’s what we find. It’s inefficient.” FC33B Project Manager, Away*

The need to engage additional personnel to manage interfaces between offices and ensure work is being coordinated was another dimension:

*“There are inefficiencies in the virtual teams, in that you need additional people spending additional hours on the coordination and the running of the package” FC31B Project Engineer, Away*

#### **4.5.1.7. Impact of Time Zones**

The time zone separations in different projects in this research varied from zero for one project to twelve hours for another. Consequently, the experiences were different but reflected a continuum of disruption as the separation increased. Impacts described ranged from the need to plan workflows and communications to leverage any overlap between offices as much as possible, such as the two to three hours between east coast Australia and Perth:

*“Melbourne, Brisbane, you’ve got to make sure you get your questions in and you get the answers within that small timeframe. Otherwise, you’re up all hours of the night” BD31A Project Engineer, Away*

Having to manage a level of time separation that meant a high reliance on asynchronous communication was another issue mentioned:

*“the only real effective communication they’ve got is email – of course with the eleven hours, thirteen hours difference” BD31A Project Engineer, Away*

Participants working with the largest time zone differences described the difficulties they experienced, leaving them needing answers when their virtual team colleagues were sleeping, feeling completely isolated due to the inability to have synchronous discussions and extended delays to completing work due to the impact of time differences:

*“because, you know, they’re in bed while we’re trying to engineer, and we need answers.” BD31A Project Engineer, Away*

*“we’ve probably been six months they’ve been doing some stuff out of Houston and it’s just impossible for those people to attend so, they’re completely in the dark” BD31A Project Engineer, Away*

They described working extended hours, starting before leaving home and continuing long after returning home:

*“Because we have mobile phones and you have email that if there is something you can send me an email. I’ll fire up my email at home, have a look at it and see if there’s anything we can do” GB12C Project Engineer, Away*

Some participants described the strong negative impact on their personal life, with one describing his project experience as being like a prison sentence:

*“I’ve quite often used to go home at night wanting to speak to the wife on Skype or something like that, see the kids and you know. I’m getting all these messages flying through – “Oh, can you just look at this? Can you just do that?” You know. It’s eleven o’clock and I’m thinking “No!”” BD31A Project Engineer, Away*

*"I just keep my head down, do my work, come home, do a little bit more work, speak to the wife and kids, you know. It almost felt like a prison sentence, just biding my time, waiting for my release date." BD31A Project Engineer, Away*

*"Some of us are fatigued and some of the team are fatigued, "Oh, they're slipping away again. Oh, it's getting harder again"." GB13C Interface Engineer, Away*

However, two participants felt the impact of time zones on their project was minimal and some even found ways to utilise the differences to the benefit of their project:

*"the time zone thing, I think we learn to live with it. I don't see it as a big an issue as everyone wants to make it out to be." GB12C Project Engineer, Away*

*"it helps us; like I said the time differences has been a plus" JB31C Project Engineer, Away*

#### **4.5.1.8. Trust and Confidence**

Confidence in delivery of work and a trusting relationship were regarded as important influences over effective interpersonal communication in project virtual teams by these participants. They described needing to spend time face-to-face with their colleagues to build a trusting relationship:

*"What helped with me is that I had worked with the team in Perth, built up relationships and trust, you know, personal relationships and trust with that team in Perth, and that then gave them confidence to give packages of work over here." FC31B Project Engineer, Away*

They outlined their belief that confidence and trust are built on personal relationships:

*"Confidence is built on a personal platform. It's not something, which you can build exchanging correspondence or even sending your CV to someone" FC34A Principal Engineer, Away*

Two participants described how they believed they were not trusted by their virtual team partners, being micromanaged, and told only what personnel from the other office believed they needed to know about the project, rather than having full insight across the project:

*"We have found on the more recent teams is that they have tended to want to micro manage us to a greater extent than on some of the earlier packages that we did" FC31B Project Engineer, Away*

*"They didn't let us know the entire budget. They inform us selectively. They didn't have any trust in us" FC34B Principal Engineer, Away*

One participant discussed their belief that they and their virtual team co-workers are more likely to trust strangers than work colleagues:

*“We’ll happily send our credit card number over the internet to some organisation in some other country to buy something that we really want without even thinking about it. But when we ask someone in our work to say, “Look, can you do this and follow this up?” Their reaction is, “Yeah, I can do that. Can you send me an email to remind me?” Why? We’ve agreed—oh, but if something happens. So, what’s going to happen? If something happens, I’ve had the conversation with you, you’ve had a conversation. Who’s going to lie? Why can’t we trust each other?” GB12C Project Engineer, Away*

This participant also described the mental process they experienced when deciding whether to trust their virtual team colleagues:

*“that to me is the most challenging, is that you don’t know really know what they’re doing. I think a lot of things stem off that. You think well are they doing it? So now do I need to check up more, do I need to give more instructions, do I need to create more control? If something happens, did they do it the right way? We didn’t get that order, but I bet you he messed it up. He didn’t do it right, he didn’t listen to me, so you must have all the things that follow through from that lack of trust and it’s not that you don’t want to trust the people. It’s just that little niggling thing that sits in the back of your mind that says, “Are they really doing that?”” GB12C Project Engineer, Away*

Ultimately, these participants recognition of the challenges and belief of the need for trust in a project virtual team was summed up in two brief quotes:

*“The most challenging thing is trusting people” GB12C Project Engineer, Away*

*“one of the main things that you need is a, erm, sense of trust in the relationship” FC31B Project Engineer, Away*

#### **4.5.1.9. Alignment of Personnel**

The ongoing need for personnel alignment was raised by many in this cohort. They described how the alignment of personnel to project goals started during project formation, with kick-off meetings bringing together personnel and developing projects goals and delivery process:

*“it is always that ‘getting them to have the common understanding’ that is the challenge, so it’s partly about a good induction process and about forming these relationships and communication channels, reality is, the main challenges are around communication” FC31B Project Engineer, Away*



*“To see the smooth flow of work, you should start from the right end. Get the team together. Get the aims or targets on the list, the hit list has to be transferred and readable and understood then split has to be agreed”*

*FC34B Principal Engineer, Away*

However, while acknowledging that holding a comprehensive kick-off meeting was important to the success of their project, three participants described how such a meeting was omitted due to time pressures:

*“We didn't have time. We didn't have money for it. We had a very, very brief meeting called a kick-off, which was not really a kick-off as such, which was not serving the purpose of which kick-off meeting really should serve”*

*FC34B Principal Engineer, Away*

The challenge of aligning personnel was seen as an ongoing task, as members leave and new members join, the team profile changes and the alignment must be repeated:

*“What's the most challenging? Yeah, probably organize convert the individuals into, into a gearbox, something which works together in harmony so it's a challenge and it is repeated time after time because each package we do, study that I'm doing now which I had mentioned “project A”. It's again, different group of individuals which 50% of them new to “Company B””* FC34B Principal Engineer, Away

#### **4.5.1.10. Organisational Culture**

The majority of participants described how the organisational culture had a major influence on interpersonal relationships and the ability of personnel to communicate in their virtual teams. They described how different office pressures affected the relationship between offices:

*“Even though we like to think we all work together, you still got your isolated ecosystems if you want that have their own hierarchy”* JB31C Project Engineer, Away

Two participants described how organisational pressures on each office to meet its own profit targets can lead to conflict between offices within a project virtual team:

*“I've dealt with inter-office people where they've been looking at the budget component in their office and being concerned that their office is starting to lose money and might look bad and so they don't necessarily deliver the service that I would have expected from them”* JB31C Project Engineer, Away

Overlaying the top of much of the organisational culture discussed by this cohort was the belief that the humans in the project team were often overlooked in favour of compliance to corporate procedures:

*“I think the human factor is quite often under estimated. It’s a very important part of it. It’s totally and completely overridden in case of “Company B” by procedure There’s a cult of procedure... adherence to the procedures. So, I think that cult of system satisfaction, which is done sometimes with total disregard for personal connections is not really helping” FC34B Principal Engineer, Away*

#### **4.5.2. Cognitive map of Middle remote based participants**

The cognitive map for this cohort is shown in Figure 38**Error! Reference source not found.** The complexity present in this map, including a total of 83 nodes and 87 links, indicates a high degree of cognitive complexity in the data represented. This map also exhibits two distinct clusters outside of which is otherwise a very tightly grouped overall map structure.



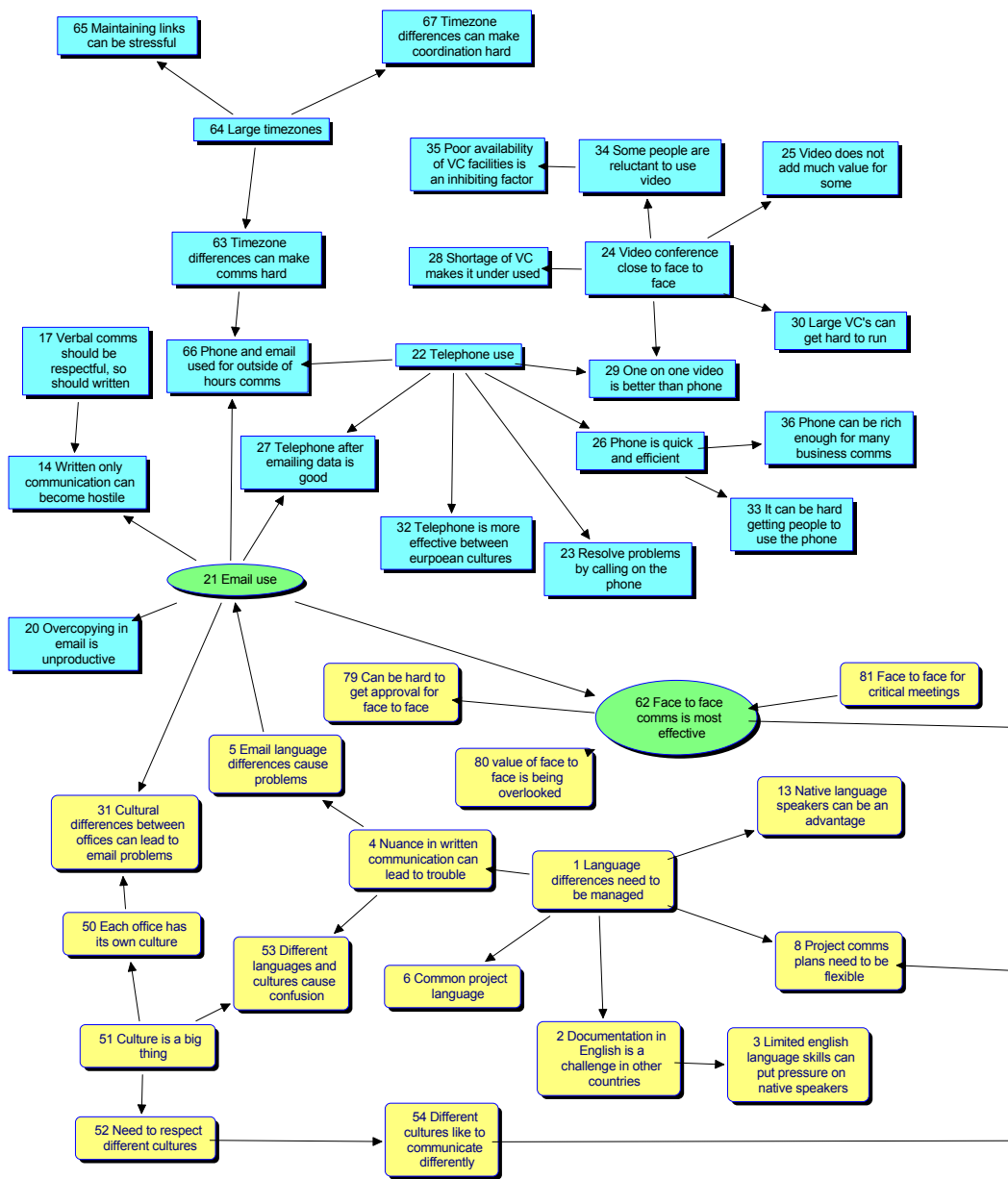
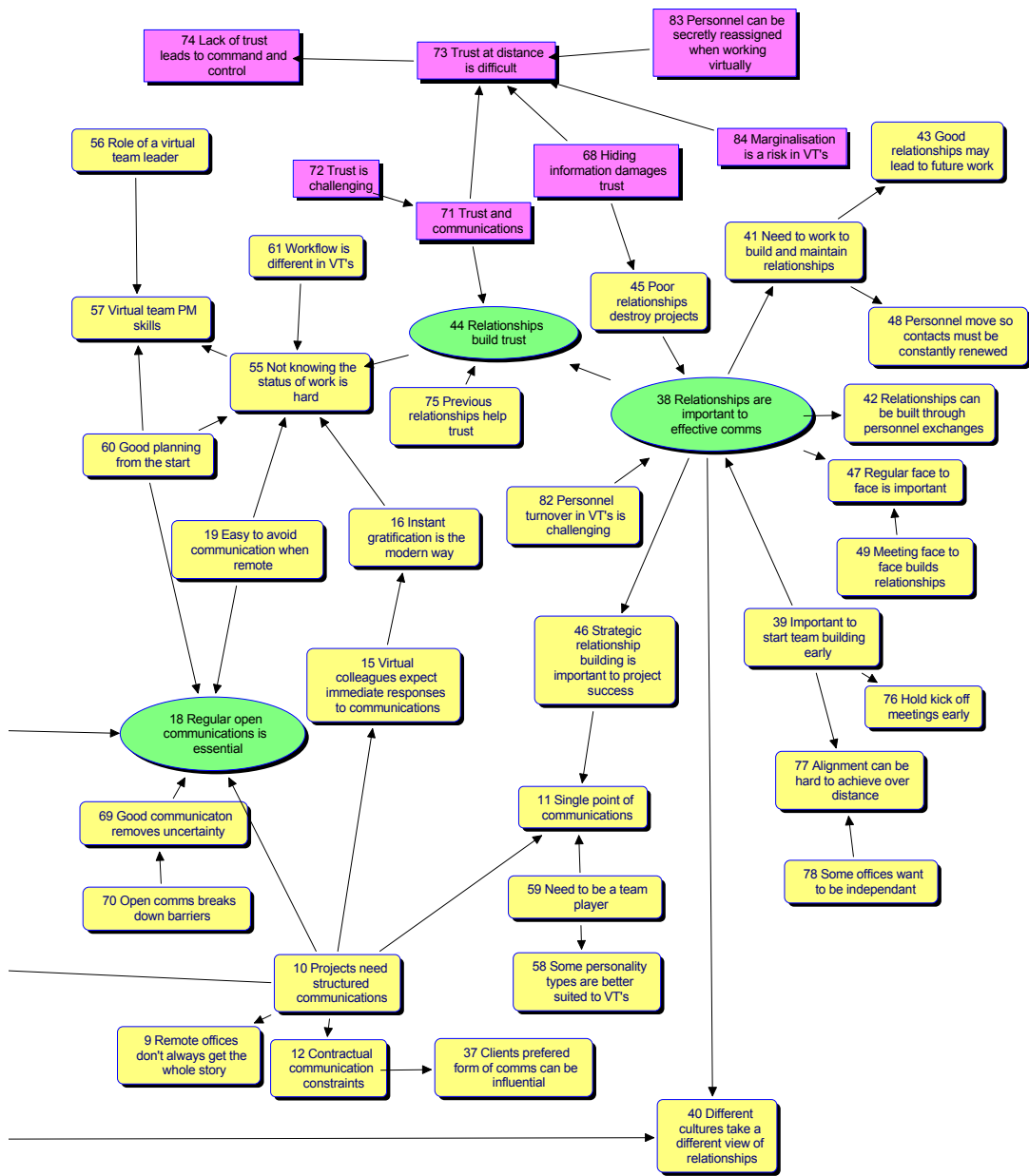


Figure 38: Cognitive map of mid-level remote participant data



### 4.5.2.1. Nodes

Nodes are highlighted on this map using green filled ovals and details of each node is also shown below.

The most significant node is shown in Figure 39 and focusses on observations that **relationships are important to effective communications**. This node is supported by nodes observing that **personnel turnover in virtual teams is challenging**, the belief that **poor relationships destroy projects** and that within virtual teams, it is **important to start team building early**. This node supports a number of nodes, including **strategic relationship building is important to project success**, that **relationships build trust**, that in virtual teams, personnel **need to work to build and maintain trust**, that within project virtual teams, **relationships can be built through personnel exchanges**, but the participants believed **regular face-to-face is important**.

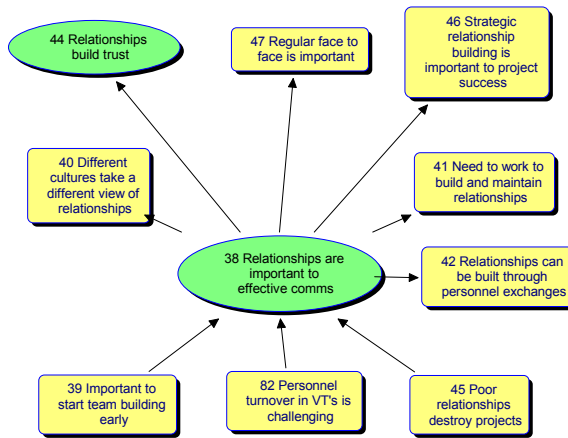


Figure 39: Node - relationships are important to effective communications

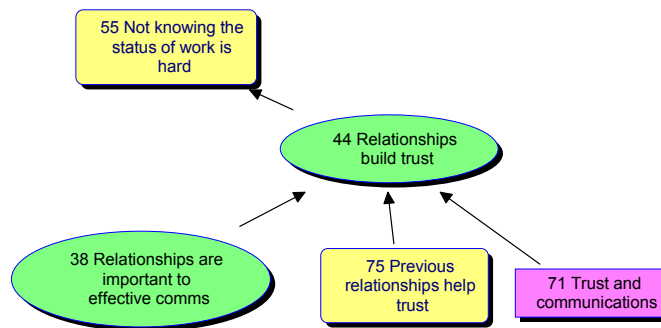


Figure 40: Node - relationships build trust

the effectiveness of **trust and communications**. This node also supports the node considering that **not knowing the status of work is hard**, part of an overall discussion on ambiguity and visibility of work progress within virtual teams.

The second most significant node, shown as Figure 40, which is closely related to the most significant node, is the recognition that **relationships build trust**. This is supported by nodes recognising that **relationships are important to effective communications**, that **previous relationships help trust** and an overall discussion of

**Email use**, shown in Figure 41, is the third most significant node in this map. This is supported by the node that recognises that **email language differences cause problems**. This node also supports nodes that suggest **over copying in email is unproductive**, that **written only communication can be hostile**, and that **phone and email used for outside of hours communications**.

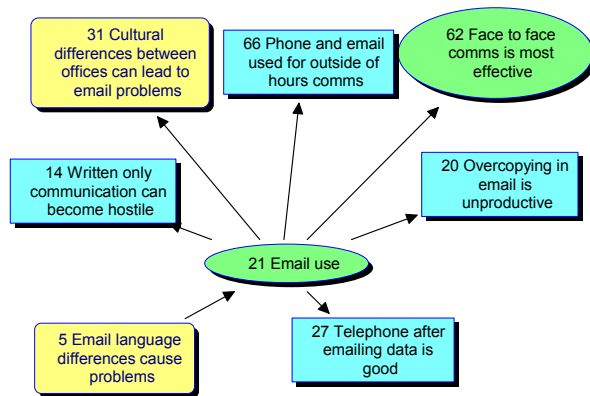


Figure 41: Node - Email use

The participants believed that **telephoning after emailing is good** allowing personnel to convene on the telephone to discuss the email, that **cultural differences between offices can lead to email problems** and that **face-to-face communications is most effective**.

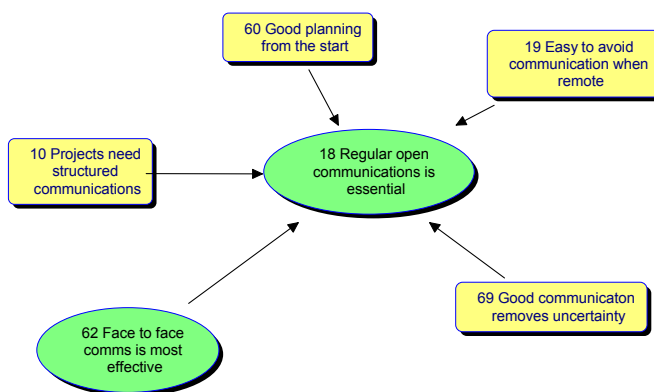


Figure 42: Node - regular open communications is essential

The fourth most significant node, shown as Figure 42, considers how **regular open communications is essential**. This node is generated from inputs from nodes which discuss how **projects need structured communications**, that **face-to-face communications is most effective**, that **good communications removes uncertainty**, that virtual teams

need to have **good planning from the start** and that, it is felt to be **easy to avoid communication when remote**.

The node discussing how **face-to-face communication is most effective**, shown as Figure 43, is the fifth most significant among the major nodes on this map. This is developed through input from nodes outlining methods of **email use** and that, in the view of this cohort, the **value of face-to-face is being**

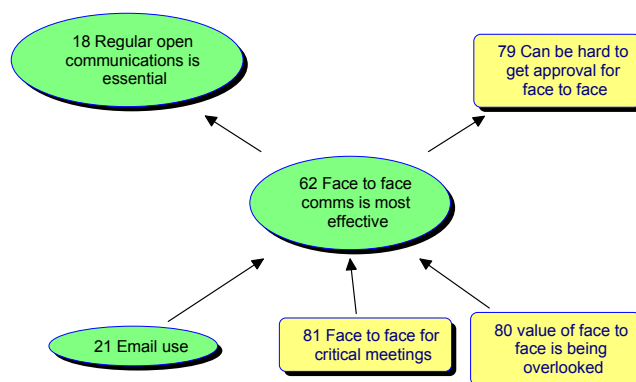


Figure 43: Node - face-to-face communication is most effective

**overlooked** but that **face-to-face for critical meetings** is important. This node also provides input to nodes that suggest that in many modern projects it **can be hard to get approval for face-to-face** and that **regular open communications is essential**.

#### 4.5.2.2. Clusters

This map also displayed two distinct clusters highlighted by the blue and pink filled rectangles in Figure 38 **Error! Reference source not found.**. One is a larger cluster, coloured blue, grouped around the ways different technologies are used in virtual teams and a second, smaller cluster, coloured pink, around the role of trust.

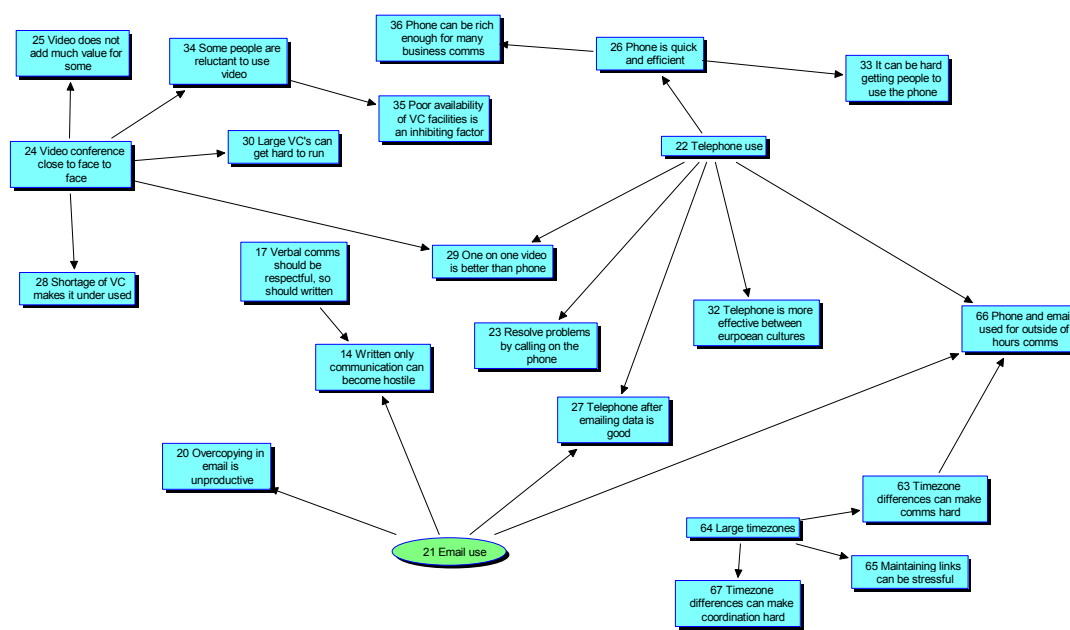


Figure 44: Cluster - communications technology

Within the communications technology cluster shown in Figure 44 are nodes reflecting the different choices of technology made necessary by large time zone differences, along with views expressed around the challenges of using videoconference facilities. Challenges included issues such as; some personnel not being comfortable with using the technology and that a shortage of facilities can lead to it not being available to the project team when needed.



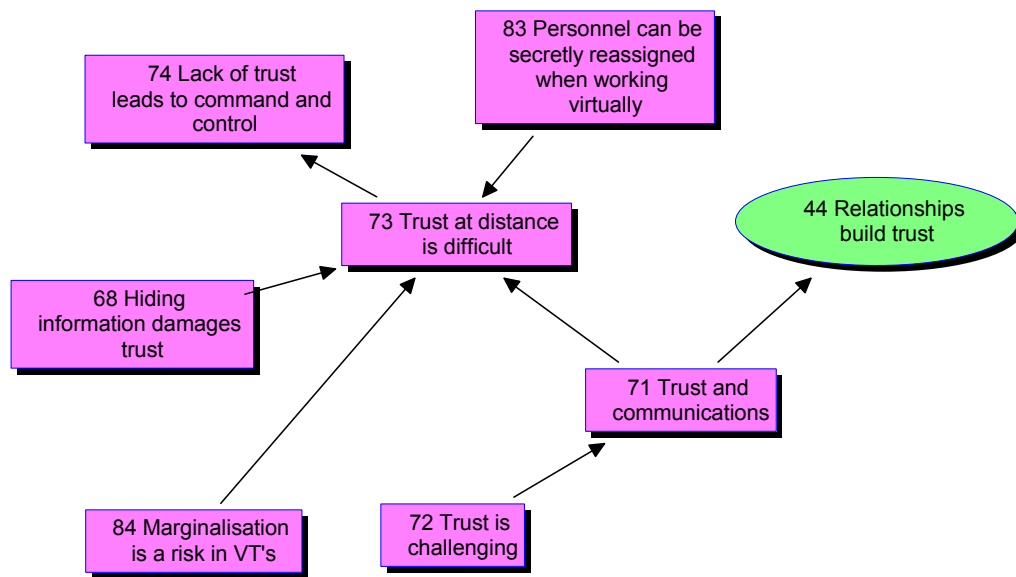


Figure 45: Cluster - Trust

The second, smaller, cluster shown as Figure 45, centres around the views of the participants on the role of trust in virtual teams. Within this cluster are nodes recognising factors such as **trust at a distance is difficult**, where **personnel can be secretly reassigned when working virtually** leaving the project lead unaware that their team is not working on their project. These nodes also include how **marginalisation is a risk in virtual teams** and that a **lack of trust leads to command and control** forms of management.

## 4.6. Junior Perth Participants (Junior Home)

This cohort comprised four personnel holding the least senior roles in the projects investigated and, while some held relatively responsible roles within their teams, they were in positions with the least leadership responsibility with more technically focused roles and responsibilities. These four participants were identified as GB33B, HC41A, JB31A and JB32A. The dominant themes identified from this cohort are set out below, along with key narrative passages from each theme highlighting the insights.

### 4.6.1. Thematic coding

#### 4.6.1.1. Interpersonal Communication Challenges

These participants displayed a transactional view of communication challenges, with many of their observations focussed on the mechanics of communicating such as clarity of writing and brevity:

*“try and teach these people that if you’re writing to someone, you’re either telling them something or you’re asking them something. And if someone gets to the end of an email and doesn’t know what the point is, then you’ve*

*failed. You need to trim it down to the bare bones and just be direct.” JB31A  
Project Engineer, Perth*

Two participants also highlighted the need to communicate frequently and maintain communications flow so that all parties are current with the needs of their part of the project:

*“But that communication flow then, is vital. You’ve got to have information flowing back as to what the issues were and that information has to then be looked into, the drawings or the design and change. Those changes then sent back for them to be closed out, so you’ve got that communication flow. So, verification processes is extremely important that people are happy to communicate and to keep ideas or things bounce back with each other.”  
JB32A Interface Engineer, Perth*

As with other cohorts, language barriers was identified as a challenge to be overcome:

*“Different language, that barrier; that communication barrier is a huge wall to breach” HC41A Project Engineer, Perth*

Most participants also commented on the need for identified points of contact in each office, responsible for communications between teams:

*“So, we need somebody in that other office, who is going to be pulling it all together as well. So, I need to have one point of contact.” JB32A Interface Engineer, Perth*

Recognising the pressures of modern projects, they outlined the stress and fatigue they were experiencing:

*“People are more stressed and sleeping less, exercising less, all the stuff that keeps you sane and healthy they're doing less of.” JB31A Project Engineer, Perth*

#### **4.6.1.2. Communication Media**

The media used for communication formed part of the experience shared by these participants. They described a focus toward synchronous communications, using the telephone for regular communications and for ad-hoc discussions between formal meetings:

*“I think that's one of the keys to this whole sort of project concept is that you need to use the phone a lot and not just for meetings and teleconferences.” JB31A Project Engineer, Perth*

Two participants considered videoconference and video meeting technology as beneficial to their overall communications effectiveness:

*“video conferencing, actually seeing—being able to actually see somebody and see facial expressions actually is a big deal when you think about it, I suppose because the power of communication, you can communicate that much better with them I suppose” JB32A Interface Engineer, Perth*

Three participants considered that email for general interface communications was less effective than richer technologies:

*“You get the usual risk of things being misunderstood or not understanding people's tone or whatever, all those classic pitfalls of emails.” JB31A Project Engineer, Perth*

These same participants described using desktop sharing of documentation when discussing technical issues. This matter did not arise in interviews with the more senior members of the projects:

*“you can sign into a screen and they can see what you're doing on the computer screen. That one's actually really handy. So, if you're trying to explain something, we had a piece of software, you can be showing with your mouse rather than taking screenshots with putting red circles around things or trying to draw it” JB31A Project Engineer, Perth*

#### **4.6.1.3. Relationships**

Building, maintaining and valuing relationships with their virtual team co-workers was discussed by most participants. They described how positive personal relationships were beneficial to their ability to deliver the project effectively:

*“I see that as a big thing, you know, building that relationship because if you need something, then they're more likely to do it, so.” GB33B Package Engineer, Perth*

They observed that it was easier to work with people they had a previous working relationship with than someone they met for the first time at the start of the project:

*“if you had a person with exactly the same technical skills but you didn't have a relationship with, I don't believe things would flow as well. I honestly don't believe they will flow as well.” JB32A Interface Engineer, Perth*

One participant described taking several months to build new relationships, during which communications may not be as open:

*“if you hadn't met them and they're on the other side of the country, you can potentially go for a longer period before you really twig that something's wrong or it gets to a point where it can't be ignored anymore or something like that. Whereas if you're close, you can kind of straightaway talk about it, you just make them” JB31A Project Engineer, Perth*

The majority of participants observed how having good personal working relationships with their project virtual team colleagues meant they were more likely to share information openly and be more committed to supporting each other:

*“that's where having the personal relationship there with the team means that will be open to telling you and you can understand the circumstances*

*and help them to get through it so that they can continue to work efficiently.”*

*JB31A Project Engineer, Perth*

They also observed that they felt the relationship building side of their work was a highly rewarding experience and something they focussed on a lot:

*“If you’ve got a good team you’re dealing with and build relationships with people I mean and the job that I do, probably the most rewarding thing I do.”*

*JB32A Interface Engineer, Perth*

#### **4.6.1.4. Cultural Diversity**

For these participants, cultural diversity was not an area of discussion. As with some other themes, they viewed cultural differences in a very tactical manner, looking at how differences impacted the pace of the project:

*“They weren’t that keen on doing overtime, and obviously a slower, less rushed pace that they tend to work at compared to our go, go, go, pressure, pressure, pressure. You know, guys always pushing forty-five, fifty hours a week as a minimum and then some were doing overtime on top of that.*

*Santiago is, “No, no, we don’t want to do overtime” HC41A Project Engineer, Perth*

Observing that it was necessary to ‘fit in’ in a multi-cultural project environment:

*“That is critical in Workshare is being able to fit in and - and understand the cultural differences and the work environment differences” HC41A Project Engineer, Perth*

#### **4.6.1.5. Individual’s Suitability for Virtual Teaming**

The suitability of personnel to participate in a project virtual team was a very strong theme among this cohort. Participants identified several characteristics that made a person suitable or unsuitable for this work. They believed they needed to be patient:

*“Having the patience and the understanding and I just fitted into the role and enjoyed it and was able to use thirty years of experience to try and mentor and advise and guide and use that experience” HC41A Project Engineer, Perth*

Willing and open communicators:

*“willingness to communicate is a big one.” JB31A Project Engineer, Perth*

Self-motivating and stay on task even when working without regular direction:

*“People who can focus so there’s always a few people in the office where you know if you leave them alone for five minutes, they’ll go way off on a tangent. And in a lot of ways in consulting that’s really encouraged because you want to, you know, you don’t want to squash people down too much.*

*But at the same time, when there's an identified task, you just have to focus, doing it." JB31A Project Engineer, Perth*

They observed that team members need to be calm, not reacting strongly to unexpected events:

*"Someone who remains calm—textbook type stuff anyway but calm and who's able to see solutions, to find solutions, help the team find solutions by remaining in a calm manner because as soon as you get an alarmist in a team and if they are the team leader, then everything just starts freezing up." JB32A Interface Engineer, Perth*

One participant observed that project virtual team leaders need to establish rules and guidelines early in the project:

*"Just got to be proactive and set the rules, not as a schoolmaster but just; we need snapshots regularly every week of where we you're at." HC41A Project Engineer, Perth*

Another commented that these personnel need to be self-aware:

*"There's people that are self-aware they're good but that's probably a rare enough trait that you can't really just go out there and pick people like that." JB31A Project Engineer, Perth*

However, they also observed that being in an interface role in a virtual team can be a frustrating experience as the role can be largely administrative, leaving them feeling they are not really contributing to the project:

*"it feels a bit like I'm just a conduit to be honest. You know, sometimes it doesn't feel like you're adding that much value to the process because you don't feel like you're actually engineering anything." JB31A Project Engineer, Perth*

While some believed they were not contributing to the technical development of the project, they also recognised that virtual teams needed interface managers in all offices responsible for communicating between the teams to keep information flowing:

*"Interstate then or overseas, be looking at anywhere from—a small project we'll probably have another project manager across there, which will be my opposite or my equivalent because we find that's required, you're going to have those leads in those various offices as well, which would—it's a bit of a duplication but you need to be speaking to somebody at that level." JB32A Interface Engineer, Perth*

One participant summed up their description of a person suited to project virtual teams as a strong, calm, and organised people oriented individual:

*"if you can be a strong person, a people person, you can be calm but if you're once again, not organised and across things, your team starts falling*

*apart and that is just—that becomes bigger when things become remote.”*

*JB32A Interface Engineer, Perth*

#### **4.6.1.6. Challenges of Virtual Teams**

This cohort identified one major challenge faced in working virtually, understanding the capabilities of their virtual team colleagues. Describing relying on CVs, which they believed did not tell the whole story of the strengths and weaknesses of the other party, one participant noted:

*“I believe the frustrations they were having was assuming – not fully understanding their capabilities in terms of what’s on their CV’s. CV’s can be – CV’s can be tuned, if you like, one way or another. The true reflection of abilities is not always easy to read off a CV.” HC41A Project Engineer, Perth*

#### **4.6.1.7. Impact of Time Zones**

Challenges faced working across multiple time zones were identified by some participants. Referring to how the communication requirements of their roles meant they were working extended days:

*“I tend to work early and not stay that late so in that regard, I fitted quite well with the Sydney time. So if I was in here at 6:30, it’s only 9:30 there so you’ve still got the whole morning.” JB31A Project Engineer, Perth*

*“it is a challenge; dealing with – in my instance, Santiago; twelve, thirteen-hour time changes; so up early mornings for regular meetings.” HC41A Project Engineer, Perth*

Time zone differences were at their most extreme with one participant who had recently been part of a project between Perth and South America, with a 12-hour time difference:

*“you’ve got to just understand, and that affects the schedule and I suppose that affects where you put the Workshare, because you can’t have a schedule that you might be able to meet here but we have a Workshare office that starts on average at 9:00 in the morning, 9:30, and it’s going on to 7:00, 7:30 at night and then they’re going out there and they’re going out to dinner at 10:00; only getting home at midnight, and the work is just not very important.” HC41A Project Engineer, Perth*

Two also commented on the different working week between their Perth and Dubai offices, where the time shift was not just of time zones but also of contrasting work weeks, and how those differences meant both benefits and additional problems for work delivery:

*“What is an impact is Dubai’s working week because Dubai stop working on a Friday and Saturday so you’ve got that Friday and Saturday where you don’t and then they work on Sunday, back on Monday so you’re losing—you sort of got a day there that you’re losing every Saturday, back on a Sunday.*

*We're not back yet. We're here on the Friday." JB32A Interface Engineer, Perth*

#### **4.6.1.8. Trust and Confidence**

When considering trust and confidence, this cohort only had a small number of observations. They described how frequent face-to-face contact helped build a trusting relationship with personnel in a virtual team office:

*"that changed quite a lot after our team started going across there on this regular eight-week two-week there and back, and we established this rapport and this understanding and we were there to help and get involved and help them along to the point where they actually, that team wanted to go on our jobs." HC41A Project Engineer, Perth*

One participant described an incident where team members in another office were taken off their project and reassigned onto local work. This eroded the faith that their project was being given an appropriate level of priority:

*"if an office suddenly got their own work, they would drop the other office's stuff and you'd never get priority." JB31A Project Engineer, Perth*

Participants also described how regular communication needed to be positive, that if it became one of constantly checking up it would quickly erode any trust:

*"Regularly communicating can be good but I guess if you're communicating because you just don't trust what the hell they're doing and you're trying to micro-manage what they're are doing that could be a bad thing." JB32A Interface Engineer, Perth*

#### **4.6.1.9. Alignment of Personnel**

Alignment of personnel was not an area with a large amount of discussion from this cohort. Their key point was the need for a team alignment meeting at the start of a project with all personnel participating:

*"we will then have a start-up meeting whereby everybody in the team; drafters, engineers, director, projects managers, in the various offices and all—we try do it through video conference as well." JB32A Interface Engineer, Perth*

#### **4.6.1.10. Organisational Culture**

With respect to organisational culture, these participants' focus was on silos within their virtual teams. One outlined how the business units who were the parent to the project in each location had their own culture and characteristics, with some being more supportive of virtual work than others:

*"you have these individual silos and I think depending on which business unit you're in, you can look at these silos as either being, you know,*

*concrete, that you can't break into them, or they could be, you know, gauze or shade cloth or something like that, where, you know, you can get in and out quite easily." GB33B Package Engineer, Perth*

#### **4.6.2. Cognitive map of Junior Perth based participants**

The cognitive map produced from the coded data for this cohort is shown in Figure 46**Error! Reference source not found.** This map has 50 individual discrete nodes and 61 links, indicating a high degree of cognitive complexity.





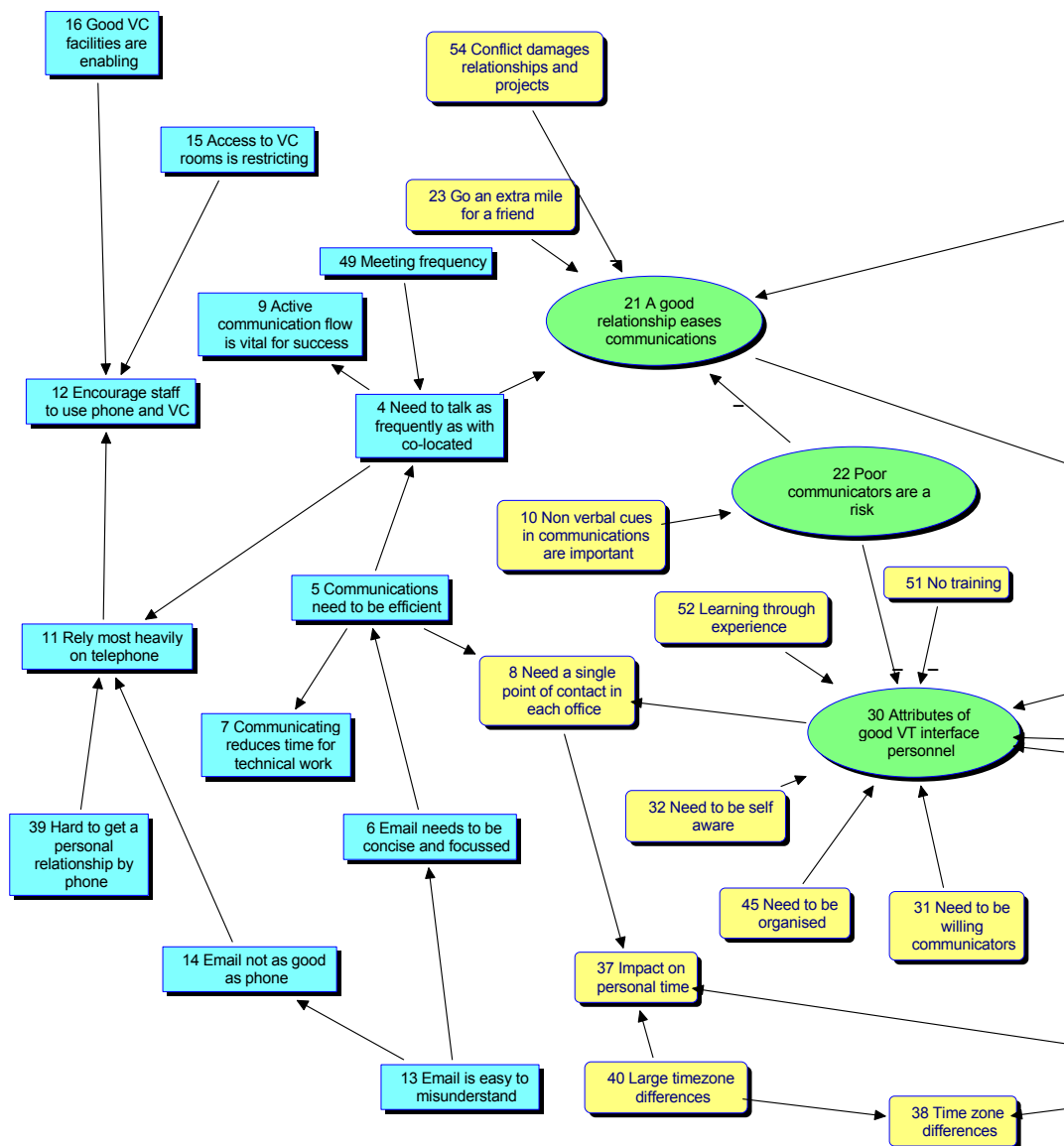
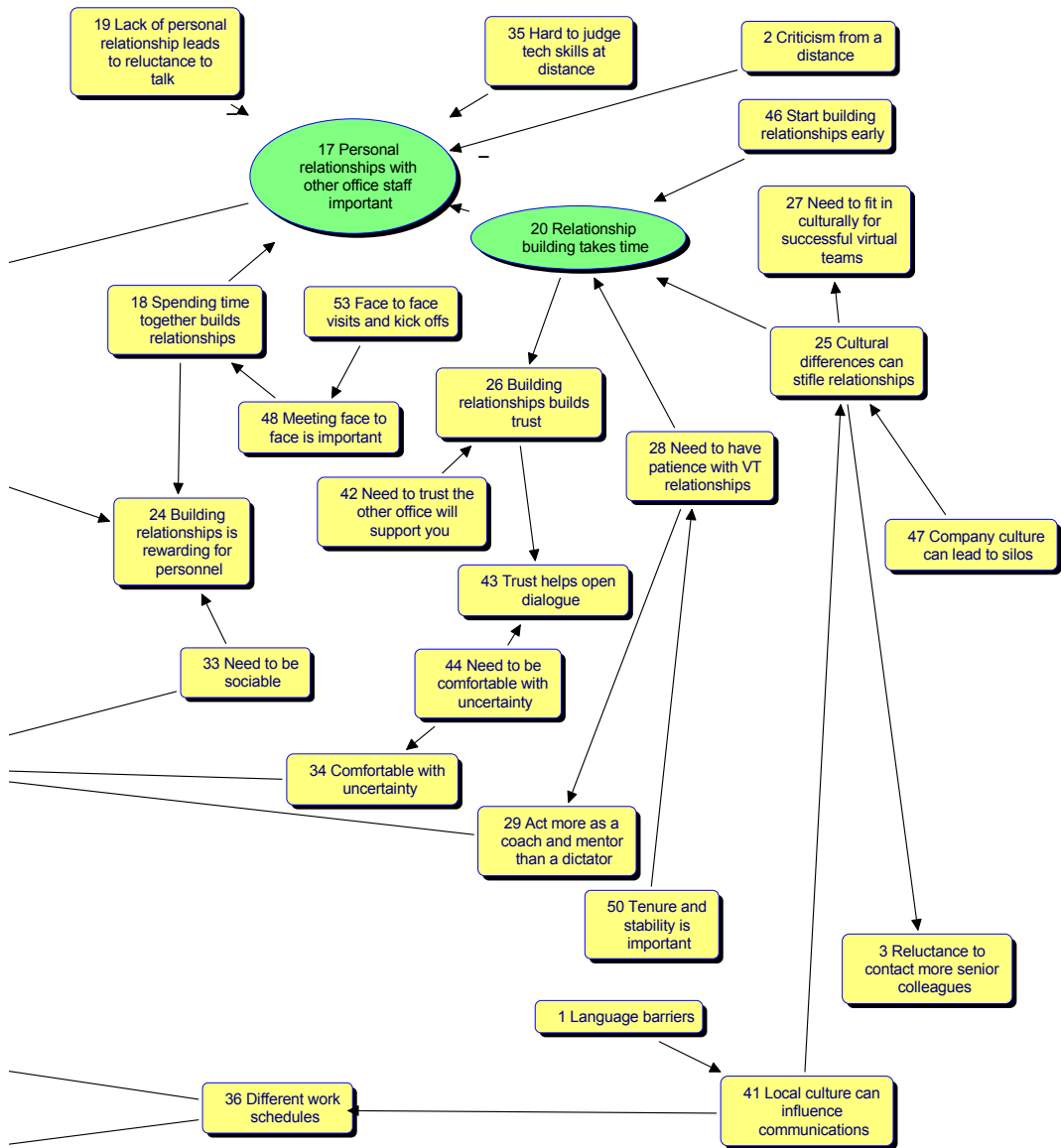


Figure 46: Cognitive map of junior Perth participant data



### 4.6.2.1. Nodes

Nodes on this map are highlighted with green filled ovals.

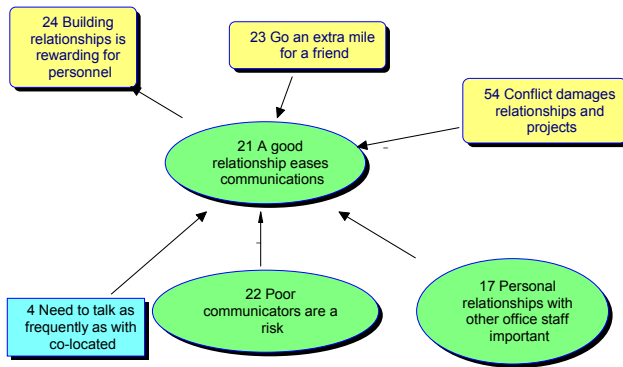


Figure 47: Node - a good relationship eases communications

The most central node, shown as Figure 47 is a **good relationship eases communications**. This node is informed by the nodes observing that non co-located personnel **need to talk as frequently as co-located**, that **poor communicators are a risk**, that **conflict damages relationships and projects** but that **personal relationships with other office staff** are important and that

personnel will **go an extra mile for a friend**. This node also supports participants belief that **relationship building is rewarding for personnel**.

The second most central node, shown as Figure 48, considers the **attributes of good virtual team personnel**. The positive contributing nodes are the **need to be self-aware**, the **need to be organised**, the **need to be willing communicators**, the **need to be comfortable with uncertainty**, the **need to be sociable** and that virtual team

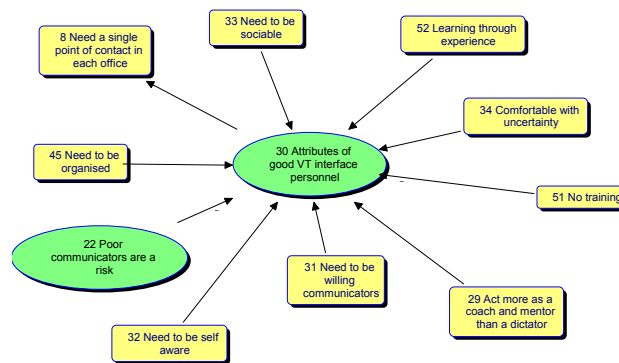


Figure 48: Node - attributes of good virtual team personnel

personnel need to **learn through experience**. On the negative side however, nodes also identify that **poor communicators are a risk** and that frequently **no training** is available to these personnel to assist their effectiveness as communicators.

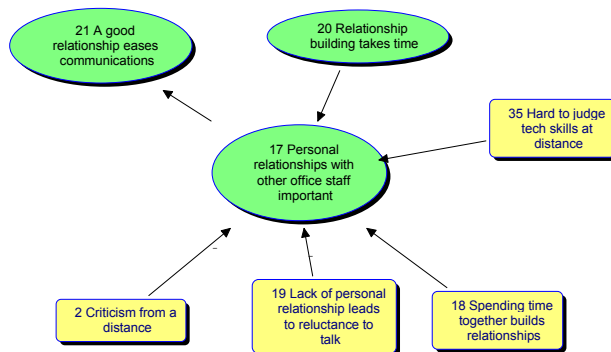


Figure 49: Node - personal relationships with other office staff is important

The node **personal relationships with other office staff is important**, shown as Figure 49, was the third most central. This was supported by the beliefs that it can be **hard to judge technical skills at a distance**, that **relationship building takes time**, that **spending time together builds relationships** and that a **good**

**relationship eases communications.** The negative observations that contribute to this node were that **a lack of relationship leads to a reluctance to talk** and that **criticism from a distance** occurs in virtual teams.

The fourth most significant node found on this map and shown as Figure 50, is that **poor communicators are a risk.** This node is supported by the node identifying that **non-verbal cues in communications are important** and has negative influences on both the first and second most significant nodes mentioned above that **a good relationship eases communications** and the broader node of **attributes of good virtual team interface personnel.**

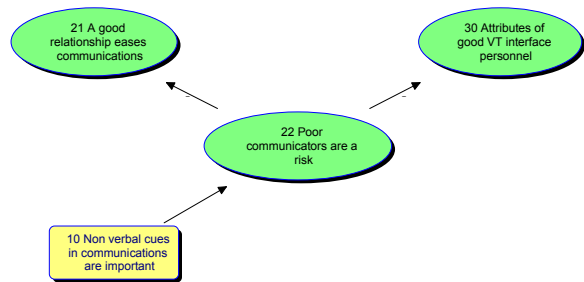


Figure 50: Node - poor communicators are a risk

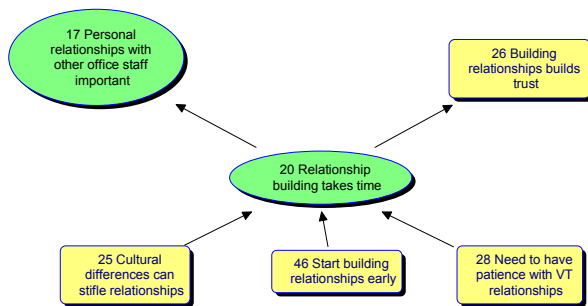


Figure 51: Node - relationship building takes time

Fifth in significance among these nodes is that **relationship building takes time**, shown in Figure 51. This is supported by nodes identifying that personnel need to **start building relationships early**, that **cultural differences can stifle relationships** and that personnel **need to have patience with virtual team relationships.**

This node supports the views expressed that **personal relationships with other office staff is important** and that **building relationships builds trust.**

#### 4.6.2.2. Clusters

This map exhibited one major cluster indicated by the blue rectangles in Figure 46 **Error! Reference source not found.** and then highlighted separately in Figure 52, centred on the need for **timely, efficient and focussed communications**; communications using technology which is appropriate for the task at hand. Generally, this cohort expressed a preference for telephone and where necessary video communications, relying on email principally for the exchange of formal messages and documentation.

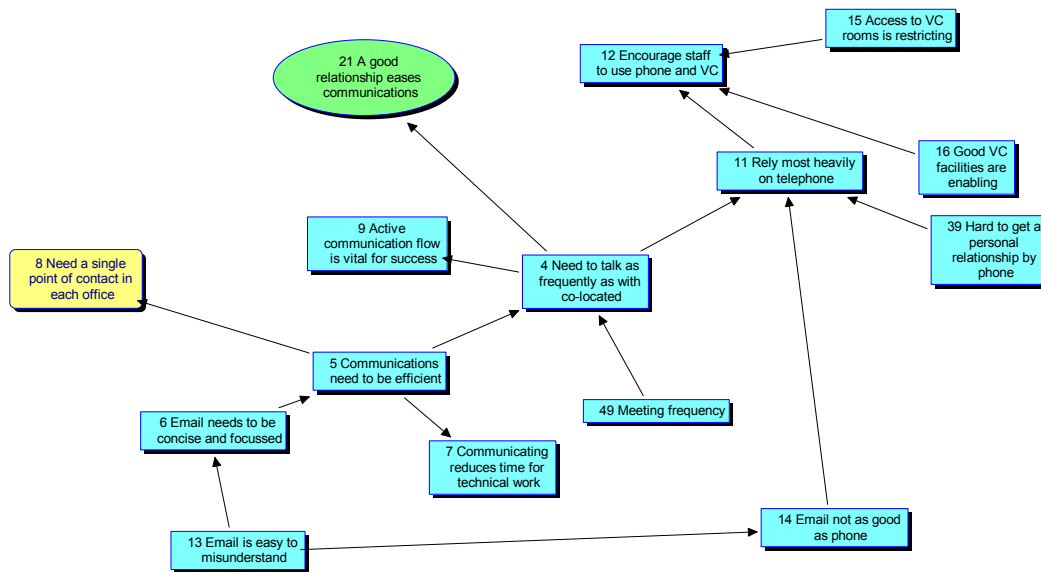


Figure 52: Cluster - timely, efficient and focussed communications

## 4.7. Junior Remote Office Participants (Junior Away)

The Junior Away cohort comprised five junior members of the participating projects. These five were identified as BD41D, FC32B, JB32C, JB33E and JB41E. The dominant themes identified from this cohort are set out below, with key narrative passages to highlight insights.

### 4.7.1. Thematic coding

#### 4.7.1.1. Interpersonal Communication Challenges

Participants identified a number of communication challenges they believed impacted their ability to deliver their project commitments. One participant described feeling that there was a lack of sharing of information broadly between project personnel:

*“the only thing about communication is that maybe we’re not always in the full picture of things. We don’t really know what’s going on and we can’t really know if we don’t know anything. We can’t ask the question if we do not know” JB32C Senior Engineer, Away*

Another outlined their belief in the importance of clear, established lines of communication between the offices:

*“When things can go awry, is if you don’t go through that central channel and that person doesn’t know and the wrong people get copied in so... and then the key people that need to know about it don’t know about it, and it’s assumed” FC32B Senior Engineer, Away*

Language barriers between personnel was suggested as a communications challenge by two participants:

*“a language barrier can play a role. Not so much between me and other Australian people in the office. Maybe between a draftsman or engineers in my team, that English isn’t their first language and they’re kind of getting responses back and forth” JB33E Senior Engineer, Away*

Difficulties finding the time and discipline for regular communication was raised as an issue. One participant described being engrossed in their work and overlooking communicating with their virtual colleagues:

*“you might get into a groove and you’ll just keep going and you think, ah, there’s no need to ring them and we’ll keep going down this path, then you find later that oh no, we went to this meeting and they said this this and this and you might have wasted a few hours” JB32C Project Engineer, Away*

Having a clear understanding of the tasks they are expected to perform was also seen as a challenge, where imprecise or ambiguous instructions led to abortive work and wasted effort:

*“then there have been times where it’s been an email and someone said “Hey, can you check this and this” and an engineer, another engineer has interpreted it to mean something different and done some work. It’s not very regular but when it happens, it is frustrating” JB33E Senior Engineer, Away*

#### **4.7.1.2. Communication Media**

The majority of participants identified audio communication using telephone and skype audio as very commonly used and a preference:

*“with critical issues and email, I’d rather ring someone and talk it through with them and then drop them an email about it to summarise what we discussed on the phone” FC32B Senior Engineer, Away*

However, two participants stated they frequently confirmed outcomes of verbal discussions with an email:

*“when critical issues come up, people should talk more and talk through things before they send emails but they should also send the emails to backup what they’ve talked about” FC32B Senior Engineer, Away*

One participant described email as a sufficient default communication tool but then audio was the media they used when they needed clarification:

*“I think basically; our first form of communication would be by email. So, if there is some ambiguity then we go on to the next, or more communications, which is via Skype. Our main or secondary means of communication will be through Skype.” BD41D Senior Engineer, Away*

Desktop document sharing was also identified as a useful tool:

*“We have done with these Skype, there is a function for it. So, we can show some of things on our desktop with them. We do it occasionally, but not all*

*the time are we required to. Interviewer: Do you find that helps at all?*

*Interviewee: Definitely, like the saying goes: the picture paints a thousand words” BD41D Senior Engineer, Away*

#### **4.7.1.3. Relationships**

Discussions regarding relationships focused primarily on relationship building, and how participants felt personal relationships affected their working relationship and ability to perform their roles. Two participants described finding it difficult to initiate communications with people they had not previously dealt with or met:

*“You’re dealing with some people which you haven’t seen before or maybe you have seen photos only of. To start with that is a bit—like you have the feeling that you’re not very comfortable doing it with them” JB41E Project Engineer, Away*

However, one believed they could establish personal relationships by telephone only:

*“I think if I can get to know them over the telephone, as long as there’s opportunity to have some communication that’s not just strictly project related” JB33E Senior Engineer, Away*

Additionally participants described how the experience of meeting face-to-face enabled them to work better together as illustrated in the exchange below:

*“you find that once you know someone it’s easier to talk to them, you sort of know a little bit about their personal background and what’s going on in their lives, so that makes it easier. Interviewer: Do you think the job goes better for it as well? Interviewee: Oh, yes, definitely” JB32C Project Engineer, Away*

One participant described being sent to the Australian office to build relationships:

*“They sent me to Australia to meet the actual people that I’m talking to. When I came back, it’s a lot, lot easier to talk to them. You can say what you want. Yes, you’ve been dealing with them and how humorous they are or the kind of personality they have” JB41E Project Engineer, Away*

When asked what the most rewarding aspect of working in a virtual team, one participant stated that they believed it was the personal relationships:

*“Most rewarding with workshare? I think when you do get to a point where you start to build relationships with the parent office because that takes time. It doesn’t happen overnight, and you feel like you’ve achieved something together” FC32B Senior Engineer, Away*

#### **4.7.1.4. Cultural Diversity**

This cohort made very little reference to cultural diversity, focusing heavily toward technical aspects of their work:



*“Normally, we only talk to them about work because they’re not here, but of course with my other colleagues from Australia, we tend to talk more about other things like life, you know things that’s away from work” BD41D Senior Engineer, Away*

While these participants focused on technical challenges of their work, they acknowledged that different national cultures could influence their ability to effectively communicate with virtual team colleagues:

*“I think it comes down to culture and also their technical capability” JB33E Senior Engineer, Away*

*“I find it a bit challenging because you know, different countries, meaning different cultures they are there and of course not everyone is the same” BD41D Senior Engineer, Away*

#### **4.7.1.5. Individual’s Suitability for Virtual Teaming**

In discussing the suitability of individuals for virtual team work, this cohort primarily focussed on the role of the interface coordinator, describing the attributes they believed were important in such a role in detail:

*“the ideal person to be the communicator for interoffice would be somebody who doesn’t hesitate in picking up the phone and calling somebody, but that’s the best person to work on it” JB41E Project Engineer, Away*

*“He has to have the technical knowledge also to be able to discuss with— maybe senior engineers back in Australia because they’re all good there. I mean, the office has put up good persons to handle the project, so if I have to communicate, I have to at least know what I’m talking about and I would understand their comments. So, a technical and probably interpersonal trait has to be there” JB41E Project Engineer, Away*

The need to be a team player was mentioned:

*“I think you definitely have to be a team player; you don’t want people having their own agenda, and things like that.” JB32C Project Engineer, Away*

#### **4.7.1.6. Challenges of Virtual Teams**

The majority of participants identified the need and ability to prioritise and manage time efficiently as a major challenge associated with communications in a virtual team environment, where the person controlling the work needs to be able to set and manage priorities:

*“If you can plan the deadlines, plan when you need the information and plan the stages to develop that information to get the deliverable and allow enough time for the communication between and make it clear for all parties on what information do you expect, at what time and where the*

*responsibility lies to deliver that information. Then it means that people are ready, know what they've got to do and can get organized themselves"*  
JB33E Senior Engineer, Away

Specifically, one participant noted that personnel tasked with executing the work need to effectively balance workloads:

*"then people have to be good at prioritizing what they work and all of that sort of thing because they're going to be inundated more often"* FC32B Senior Engineer, Away

#### **4.7.1.7. Impact of Time Zones**

The impact of time zones on the ability of this cohort to communicate with their project colleagues was a strong theme. The majority of participants described needing to be aware of their colleagues time zone before initiating communications:

*"Sometimes, you have a question like close to the end of the day, you can't get the answer immediately unless—because they're four hours away, they're out of office or sleeping at that time. So, you have to wait for the answer the next morning"* JB41E Project Engineer, Away

Time differences were identified as leading to adopting specific practices to manage communications. This included the use of different media for different times of day:

*"I guess you just have to be disciplined, if there is stuff you do have to talk about one on one rather than by email you have to try to make the effort, at 2:30 in the afternoon when they are starting their day you have to make those calls and discuss things then, sometimes it doesn't work, they might be in a meeting and you may not get them until it's too late and it is time to go home, so yeah, then you might resort to emails"* JB32C Project Engineer, Away

One participant described structuring their working patterns to ensure tasks are completed to meet the needs of the remote office, sometimes as priority over local work:

*"I try to close out any issues by the end of my day. If it is something that I know needs to get done for Sydney or in Perth; if I can make that a priority to finish by the end of the day, then I will do that ahead of other projects in Abu Dhabi where I've got working in UAE"* JB33E Senior Engineer, Away

The majority of participants described working outside core hours to communicate with colleagues in other time zones:

*"with communicating with them, they're more staying there longer just to wait for queries because we work until 5, by 5—let's say we work until 6 and it's 10 o'clock in Perth. So, one of the guys there, she just stays there a couple of hours after the office hours to address some issues and maybe to make comments or queries"* JB41E Project Engineer, Away

*“they may be ringing you in the middle of dinner or just about to go to bed, but sometimes it’s very urgent things that they might need a short answer on and it’s not much effort to do it, so I don’t have any problem doing that”*  
JB32C Project Engineer, Away

The different working week experienced by some participants, where one office worked a Monday to Friday and others a Sunday to Thursday was also discussed:

*“Sometimes, it’s positive, sometimes it’s negative. Like if the deadline is Monday in Perth, we have Sunday to work on it, which is good, but, sometimes if the deadline is Friday there and we have until Thursday only. So, what they’re trying to do is try to make the deadlines that work with the client, that can only submit on this day”* JB41E Project Engineer, Away

#### **4.7.1.8. Trust and Confidence**

These participants predominantly described trust in transactional terms, developed through the delivery of satisfactory work:

*“Trust them to do the job that you’re requiring of them”* JB33E Senior Engineer, Away

*“Overtime, it developed because they have to look at your output and if your output meets their expectations, then they have confidence in you”* JB41E Project Engineer, Away

Similarly, participants described endeavouring to deliver quality work to build trust with their colleagues:

*“You’re not doing not something they are not happy of, so that makes you want to work harder. Just to make sure you maintain that level of quality of your work”* JB41E Project Engineer, Away

Two participants also described building relationships over the project duration that allowed them to establish trust for future work:

*“You know, you can trust them, you know that you can do the job again with them and it kind of breaks down any barriers as well”* JB33E Senior Engineer, Away

#### **4.7.1.9. Alignment of Personnel**

Two participants described the alignment sessions held at the start of their projects and how these helped personnel get to know each other and understand the project requirements:

*“We prepared... they gave us an agenda. We modified it a little bit under their approval and then we just prepared everything against all the queries we had against what they had in the agenda and we just kind of worked through that day, I guess. Yeah, so that was quite effective and that involved the bulk of the team. It was all leads from their side and our side*

*and, I mean there was twenty odd people in the room for that day. So, everybody got to be there for the whole thing, which was good” FC32B Senior Engineer, Away*

They described feeling that, as junior members of the project, they were less able to influence the overall team alignment, but that they did what they were able at their level:

*“I try to work it at my level, but I see that it is something that I can try to do, but it is also something that it should be more driven from the top management downwards” BD41D Senior Engineer, Away*

#### **4.7.2. Cognitive map of Junior remote based participants**

A copy of the cognitive map for this cohort is shown in Figure 53 **Error! Reference source not found.** While this cognitive map is less complex than those developed from some other cohorts in this research, it still exhibits a high level of cognitive complexity, with a total of 46 discrete nodes and 50 links. This map also incorporates two highly concentrated clusters built around specific facets of the expressed beliefs of the participants.



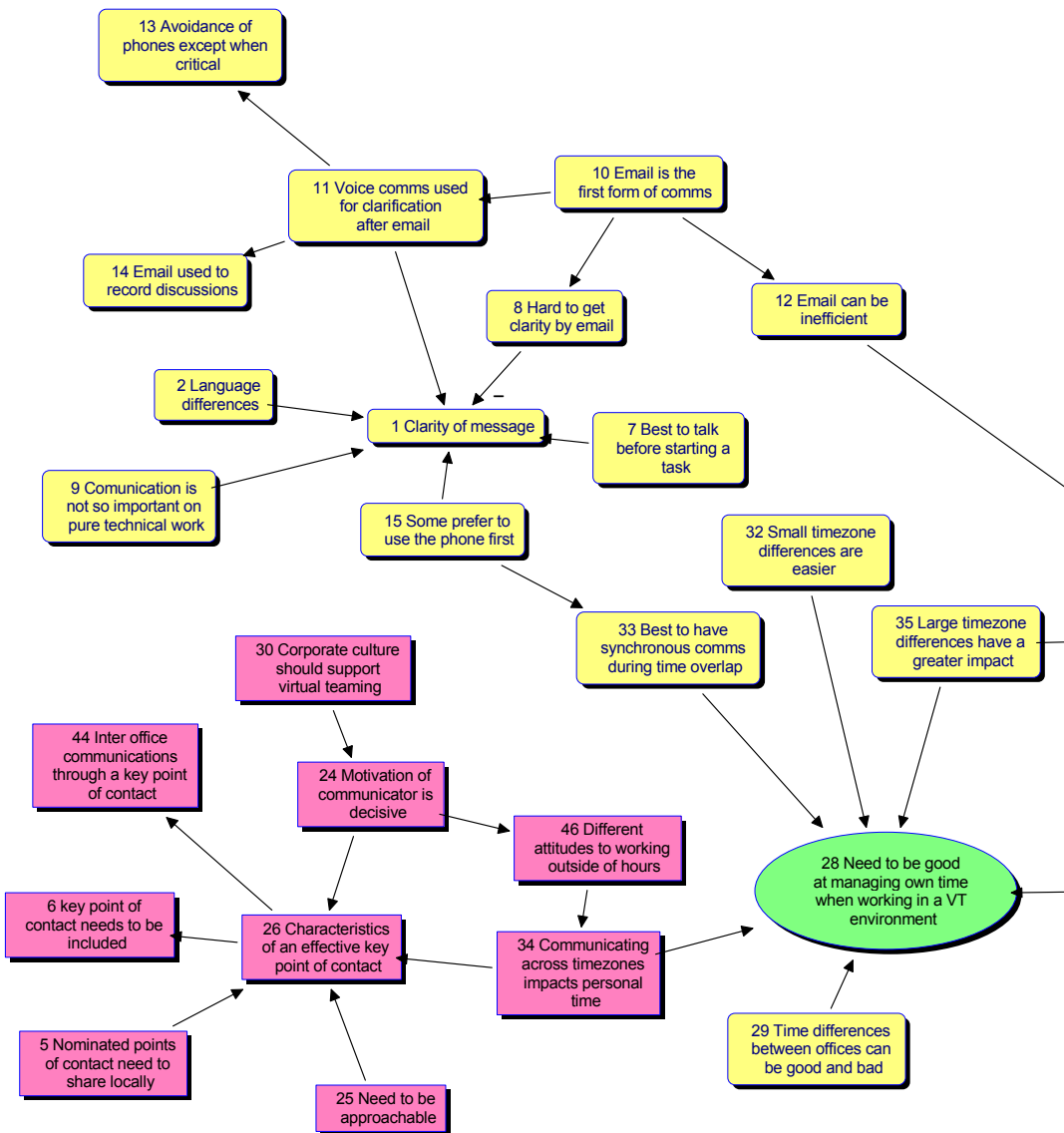
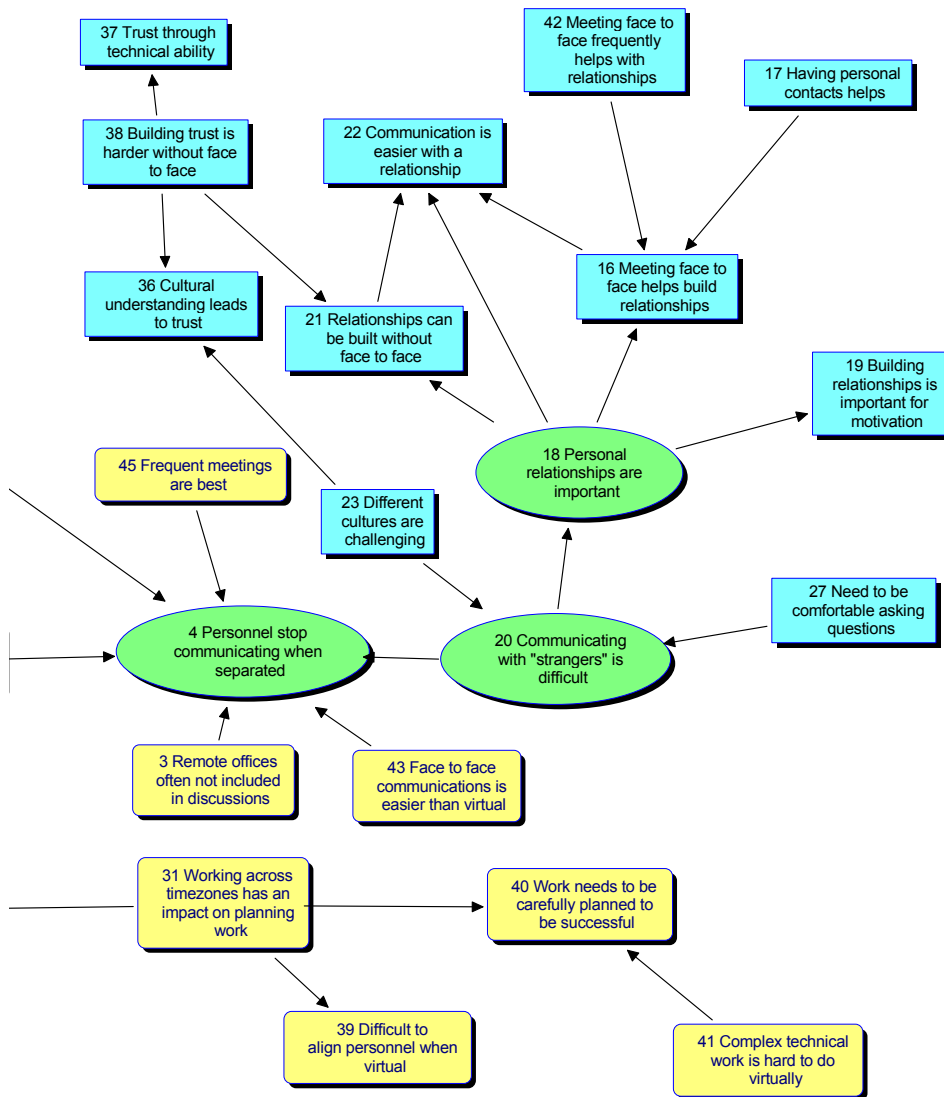


Figure 53: Cognitive map of Junior Away participant data



#### 4.7.2.1. Nodes

Central nodes on this map are highlighted using green ovals.

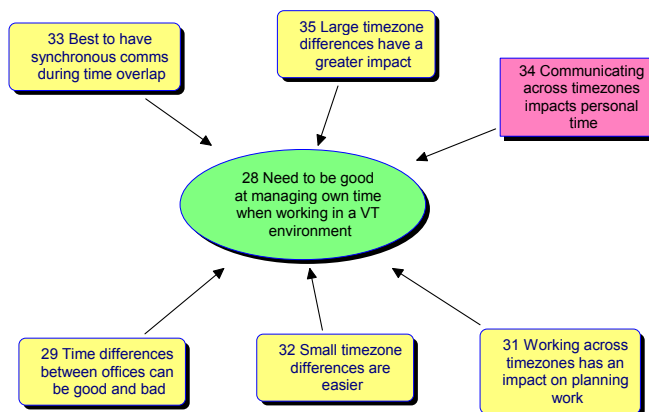


Figure 54: Node - need to be good at managing own time when working in virtual teams

The most significant node, shown as Figure 54, identifies the participants' belief that they **need to be good at managing own time when working in virtual teams**. This node is developed from others which indicate that **small time zones are easier to work across, time differences between offices can be good and bad, that communicating across time zones impacts personal time**, particularly when

the time zone gap is large, that when communicating with virtual team colleagues it is **best to have synchronous communications during time overlaps**, that **large time zone differences have a greater impact** and finally that **working across time zones has an impact on planning work**.

The second most significant node, shown as Figure 55 is the belief that **personnel stop communicating when separated**. This node was informed by a number of additional nodes, namely; that **face-to-face communications is easier than virtual**, that when working in a virtual team, **large time zone differences have greater impact**, that **remote offices are often not included in discussions** leading to them not knowing all they should about the project, that in virtual teams **frequent meetings are best**, but that **email can be inefficient** when communicating in virtual teams, and finally that **communicating with strangers is difficult**, leading to the generally identified value of building personal relationships within virtual teams.

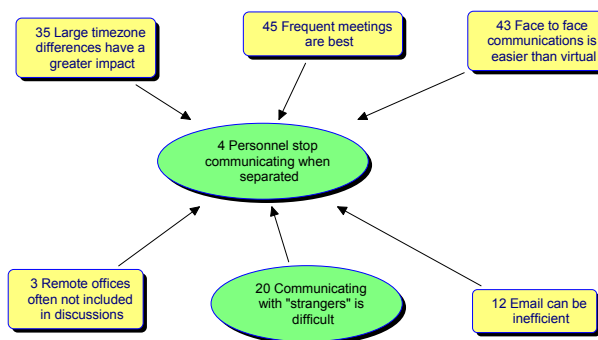


Figure 55: Node - personnel stop communicating when separated

leading to them not knowing all they should about the project, that in virtual teams **frequent meetings are best**, but that **email can be inefficient** when communicating in virtual teams, and finally that **communicating with strangers is difficult**, leading to the generally identified value of building personal relationships within virtual teams.



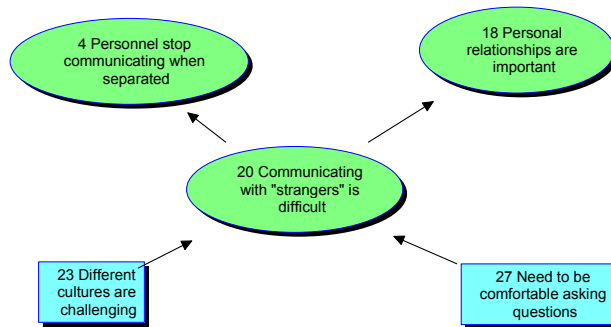


Figure 56: Node - communicating with strangers is difficult

This node supports observations that **personal relationships are important** in virtual teams and that **personnel stop communicating when separated** within their virtual environment.

The third most significant node found on this map is the reflection that **communicating with strangers is difficult**. This node, shown in Figure 56, is supported by nodes that virtual team members **need to be comfortable asking questions** of their virtual colleagues and that **different cultures are challenging** to work across. This

The recognition that **personal relationships are important** is the fourth most significant node in this map and shown as Figure 57. This node is supported by the observation that **communicating with strangers is difficult**. This node itself supports nodes that consider that **building relationships is important for motivation**, that **meeting face-to-face helps build relationships**, that **communication is easier with a relationship** and that, in a virtual environment, **relationships can be built without face-to-face meetings**.

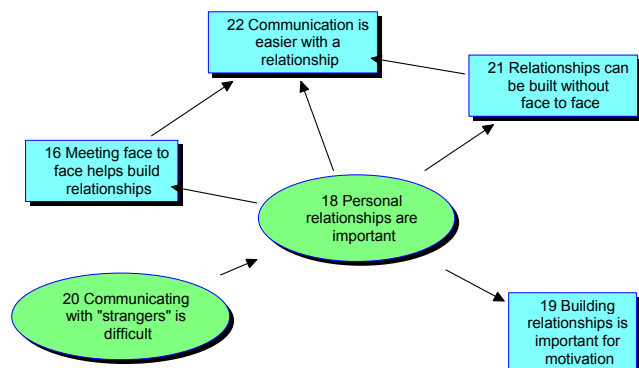


Figure 57: Node - personal relationships are important

#### 4.7.2.2. Clusters

This map incorporates 2 distinct, tightly grouped clusters, highlighted using blue and pink filled rectangles on Figure 53. One capturing the cognitive views of the cohort around the value of relationships within a virtual team highlighted with blue rectangles and the second, highlighted using pink rectangles, considering the merits of having a single point of contact at each location.

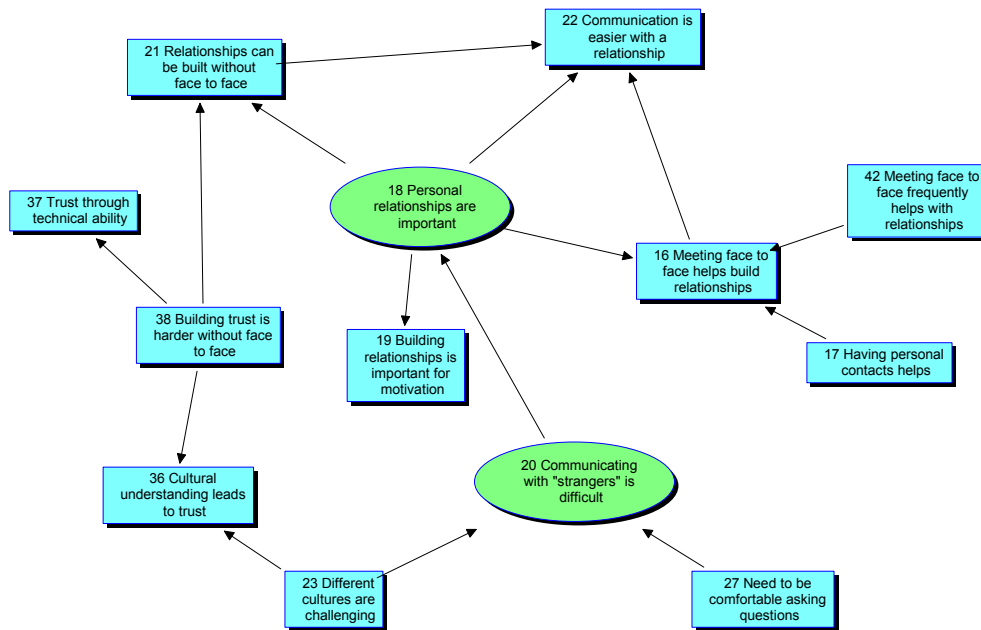


Figure 58: Cluster - role and value of relationships

The cluster considering the **role and value of relationships** shown as Figure 58, includes observations that, without relationships it is harder for many to communicate with their virtual team colleagues, that it is easier to build relationships through meeting face-to-face at an early stage in the development of a project team and that once these important relationships are built, communication becomes easier.

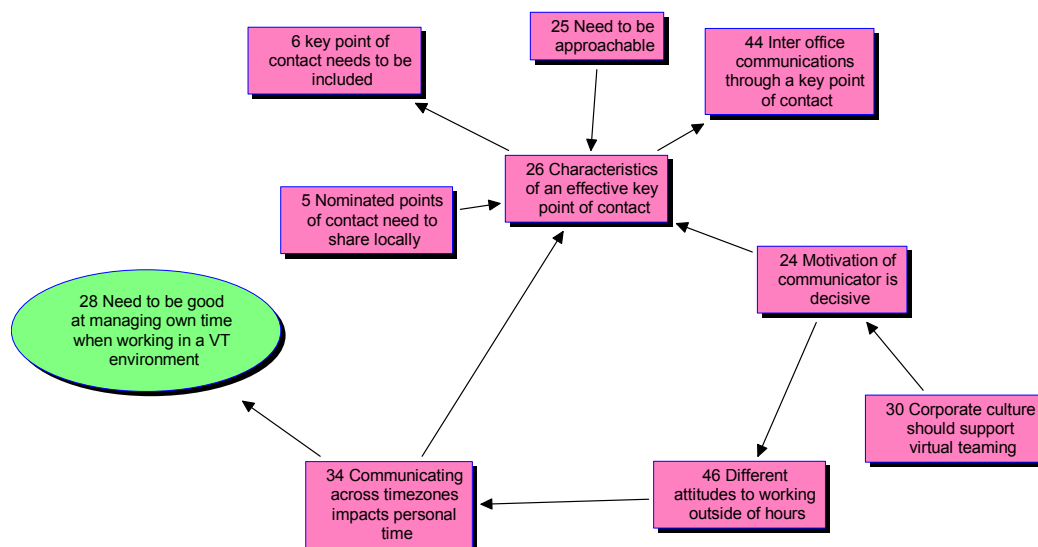


Figure 59: Cluster - need for single points of contact

The second cluster shown in Figure 59, is grouped around how this cohort described the **need for single points of contact** and managing communication with their home office. In this cluster participants identified and interlinked the skills needed to be an effective point of contact between offices. They recognised the skills needed and the function this role fills, they

also recognised that acting as the interface between offices where there are time zone differences can place a requirement on the individual to work outside of normal, core office hours, often communicating to the other offices early in the morning or late in the afternoon and evening.

## **4.8. Independent Participants (Independents)**

The cohort of seven independent participants was Perth based. While they were all employed by different organisations and had backgrounds in different projects, their common factor was that they had held senior roles in recently completed virtual team engineering projects for the WA resources sector. This recent experience gave them a different, reflective perspective to those of the other participants who were directly engaged in projects at the time of interview. Interestingly, their overall responses were quite similar and cohesive. These participants are identified as AA31A, BB31A, CB11A, DB11A, DD11A, EB31A, KB31A. The dominant themes from this cohort are set out below with key narrative passages.

### **4.8.1. Thematic coding**

#### **4.8.1.1. Interpersonal Communication Challenges**

One participants described challenges they had experienced establishing virtual teams, including the impact of passive resistance within the home office to the use of another office to support their deliverables:

*“If the company culture within the office here is resistant to virtual teams, there is a lot of passive resistance that happens and it is very—sometimes can be difficult to overcome” KB31B Senior Project Engineer, Independent*

Noting how their project leadership attempted to overcome the passive resistance:

*“it made perfect business sense from the start, it just took, you know, it’s one thing when you explain it, broadcast in front of the whole company and it comes from the top, but it’s a different thing when you go and talk to individual resisters and when you explain to them, “Look, we get that you actually need help, to finish the job. It’s not that you’re made obsolete. You actually need more help because you had more work coming through.”” KB31B Senior Project Engineer, Independent*

Some participants described difficulties holding discussions where parties did not regard the issue with the same level of importance:

*“even if you want to have a detailed conversation about it, the person on the other end wants to have more of a superficial conversation” EB31A Project Engineer, Independent*

#### 4.8.1.2. Communication Media

The majority of this cohort expressed a strong preference for videoconferencing over the use of audio or email, describing how they had tried both audio only and video:

*“We ran meetings with teleconferencing, at the start; that is great pain. It is much easier to run the meetings as video conference because not only that body language is 75% of communication, but you can read lips as well”*  
KB31B Senior Project Engineer, Independent

However, they also described several problems with videoconferences, such as accessing rooms equipped with the technology:

*“The only limitations there were that the video conferencing facilities were not always accessible, so we had to revert to teleconferencing at times”*  
KB31B Senior Project Engineer, Independent

Another described how large videoconferences become inefficient, often dominated by a small number of participants:

*“because it’s a video conference and everyone is not in the same room it can become a bit unstructured and a bit of a free for all, where the person who shouts loudest and is closest to the microphone manages to put their point across better than anyone else”* EB31A Project Engineer, Independent

Expressing their belief that one-on-one video meetings could be more productive:

*“video conferences on a one-to-one basis probably would go part of the way to satisfying my need for a bit of personal contact”* EB31A Project Engineer, Independent

Outside of the use of videoconferences, participants observed that email was often a poor substitute to richer communication tools:

*“email is often the only thing available to you and that’s really a poor communication medium, particularly when you start thinking what does that person really mean by that statement”* AA31A Senior Project Engineer, Independent

However, another participant commented they preferred email for formal communication and instructions:

*“Most important, official, problem solving should go through email”* KB31B Senior Project Engineer, Independent

Two participants noted a level of caution around comfort with technology use, where they believed the technology could impede the quality of the communications due to its complexity:

*“be careful of technology, because in a virtual environment... there’s lots of superb technologies around they are constantly evolving, very, very fast, if you can harness them and everybody is on board with them they can really*

*enhance virtual working but, and it's a huge but, unless everybody is totally comfortable with the technology it can be really destructive" BB31A Project Manager, Independent*

#### **4.8.1.3. Relationships**

With relationships, this cohort made several observations. Most participants expressed a strong belief that relationship building was important to effective communications in virtual teams:

*"I think relationships is probably far more important, engineering is engineering, and whatever it is, but relationships are probably the most important part or the relationship" AA31A Senior Project Engineer, Independent*

*"the benefits of good personal relationships surface a lot more readily in virtual teams, people who know one another and who can communicate much more readily, that comes out very quickly" CB11A Project Manager, Independent*

While recognising that building relationships virtually can be difficult:

*"one of the things I find via having initial contacts with people by telephone is there is much more defensiveness in the initial contacts because, like what I said before, because you haven't really sized each other up, so that inhibits things a little bit in the beginning, so once you are comfortable with people you can have reasonable progress in telephone conferences" EB31A Project Engineer, Independent*

More than half believed they spent a large amount of time on relationships with virtual colleagues, suggesting as much as 50% of their time was dedicated to remote team relationships:

*"50% of the time is spent in relationship coordination, because we are all strangers, even the guy's in my own team, the team I worked within, some of us were strangers, the guys who were on the other side of the fence, the EPCM, they were complete strangers, to me anyway, and they themselves were complete strangers to themselves, in many cases, so you would spend a lot of time working the floor and trying to talk to people" AA31A Senior Project Engineer, Independent*

One participant considered their co-located colleagues consume up to 80% of their time due to proximity and ease of access, but that the priority should be more the other way around:

*"the tendency in general is that people spend 80/20, they will spend 80% of the time on the local team, 20% on the virtual team and actually from my own bad experiences, and good ones you actually need to flip it the other way around, I am not sure it is 80/20 but it is definitely, definitely you should*

*spend more of your time with the virtual team” BB31A Project Manager, Independent*

However, when there are multiple locations involved in the virtual team this balance was considered as being very difficult to achieve:

*“if you have got multiple remote locations, again you've got to think about how you will allocate your time” BB31A Project Manager, Independent*

Most participants also believed it was important to have a clear communications structure established within the virtual team, and good contacts and relationships in each project location:

*“making sure that you have a good contact into each location, even if you don't have time to spend with all of the individuals on the project” BB31A Project Manager, Independent*

#### **4.8.1.4. Cultural Diversity**

The impact of culture on communications in a project virtual team was well represented in the observations of these participants:

*“Culture is a big one, there are clearly different cultures, some cultures are very proactive communicators, and some cultures are not proactive communicators” BB31A Project Manager, Independent*

Describing the importance of being open to different cultural perspectives and behaviours in a virtual team:

*“I think you have to go in with your eyes wide open, you have to be accepting of what people are and who they are and where they come from at the same time too they have to accept that you are coming in to their world and they have to accept who you are and what you are looking for from a client's perspective” AA31A Senior Project Engineer, Independent*

One observed that it was important that those leading the project recognised cultural differences so they could be incorporated in the project processes:

*“making sure that the manager is aware of the cultural differences but then that they can go beyond that but that they can actually accommodate the culture so that they can adapt the way that they work, so you can either work the culture at the team or at the manager level” BB31A Project Manager, Independent*

These participants also described how different cultural expectations of power and formality of communications could impede efficient communications:

*“In our culture here, we quite freely go and talk to the level of general manager, to that guy, to make decision quickly on the spot if needed and that's welcomed. As opposed to culture in this country that I was working*

*with, where those things just simply do not happen. There is invisible barrier there—and there is actually quite significant resistance in transferring information vertically” KB31B Senior Project Engineer, Independent*

One described encountering issues in obtaining feedback on work:

*“We needed to get the feedback and it took us a while to encourage that feedback to be said. When we recognize that invisible barrier between vertical levels, then we were keeping communications separate between the levels to find out all information that is needed” KB31B Senior Project Engineer, Independent*

Similarly, surfacing and resolving issues, a critical part of the engineering design process was described:

*“Yes, the most important is elevating issues when the problem arises. In Australia, we get together, thrash it out and solve the issue. If the problem arises there, it’s swiped sometimes under the carpet, depending on the power that people think they have or they don’t have within the team over there” KB31B Senior Project Engineer, Independent*

#### **4.8.1.5. Individual’s Suitability for Virtual Teaming**

The majority of participants in this cohort believed that a virtual team project manager needed to have a different, complementary skillset to the manager of a co-located project, and that finding such people was not easy:

*“there’s not that many people who are naturally suited to managing virtual teams, it’s a very different skill set I think to managing a regular project team” BB31A Project Manager, Independent*

They also recognised that in a distributed structure multiple project leaders were needed, one in each location, all working under the guidance of a single leader:

*“you might have one project manager or director at its head, you have effectively got a sub-project manager in every location, fulfilling a similar sort of role and they need to be stand-alone sort of people to carry the responsibility to the project” CB11A Project Manager, Independent*

Two participants identified that personnel need to be confident communicators:

*“from a personal character depends the amount of communication that happens during the running of the project. If a person does not communicate, no matter how technically precise or smart he or she is. If it doesn’t communicate, things just don’t happen” KB31B Senior Project Engineer, Independent*

The need for team members to act as mentors for their colleagues was described:

*“in creating the virtual team, it is very important to have not only team members with good communication skills but also mentors” KB31B Senior Project Engineer, Independent*

This same participant also outlined that a large part of the project managers and interface managers role was to be a funnel between offices:

*“We needed to be the funnel on both sides and to clarify information”  
KB31B Senior Project Engineer, Independent*

#### **4.8.1.6. Challenges of Virtual Teams**

The primary challenge identified by this cohort was to remotely influence team members in other offices, where these other personnel would likely be controlled locally in preference to remotely:

*“they tend to prioritise largely based upon who can give them the most hassle and from what range.” EB31A Project Engineer, Independent*

*“because you are not there and they know that you won’t find out for 24 hours and you won’t get back to them for however much longer, you tend to be the one that drops off the list compared to the guy that turns up at their desk and says, “I need this now”,” EB31A Project Engineer, Independent*

#### **4.8.1.7. Impact of Time Zones**

The impact of time zones on the effectiveness of communications was raised as an issue that became more pronounced as separation increased. Participants described how communications were easier with small differences:

*“if they were remote but on the same time zone or similar time zone I would be more inclined to contact them more regularly” EB31A Project Engineer, Independent*

With three or four hours’ difference, communications were still reasonably effective but had to be managed and structured to make the best use of overlaps:

*“if you’re going to do a workshare environment you need to at least be within a three or four hours window of time, that way, if you start a discussion, you have plenty of time to finish it and you have plenty of time to take action” AA31A Senior Project Engineer, Independent*

As separation increased, extending to 12 hours, communications become more difficult:

*“as soon as you put a 12, 13, 11 hours between two countries, we’re at the beginning of the day, you’re at the end of the day, or vice versa, they’re up late, we’re up early, it creates, it’s a fatigue issue, it’s also trying to set meetings where everyone can attend” AA31A Senior Project Engineer, Independent*



One participant described fatigue resulting from the need to communicate in non-core working time because the time difference meant they needed to work beyond their normal working day:

*“most of your time was spent with the virtual teams and so you spent a lot of time outside of working hours and in the end your conduit with virtual teams was pretty much on email so you would be responding back and forth, back and forth, so you would come in to work in the morning and there would be all of this flurry of stuff appeared overnight and it would go off again and come back again tomorrow morning” AA31A Senior Project Engineer, Independent*

Another identified the challenge of managing the unavailability of virtual team colleagues:

*“we find ourselves having to deal with unavailability and making decisions sometimes and communicating that to those who due to their unavailability were unable to participate” CB11A Project Manager, Independent*

One participant described adopting various approaches to manage large time differences between offices, including one or more members of the team being available for discussions outside of hours:

*“I am presently dealing with a colleague who is based in the US, in Houston, he is either 11 yours or 13 hours adrift from us whichever way you want to talk about it, couldn’t be worse, and most of the time there is him on his own in his environment, and we have found it convenient now to deal with him in his evening time, which is in our working time, and its outside of his working time but he is OK with that” CB11A Project Manager, Independent*

*“we have adopted a situation that is more convenient to the greater number of parties, that is often been the way I have resolved that in the past” CB11A Project Manager, Independent*

An issue noted was recognising that combined time delays can lead to work taking longer to complete in a virtual team with large time zone differences:

*“you effectively loose almost 48hours if you are lucky by the time you get to the answer” EB31A Project Engineer, Independent*

#### **4.8.1.8. Trust and Confidence**

Relationships, trust and the confidence that virtual team colleagues were working as expected were important factors identified by these many participants. Converting the performance of transactional work into the confidence that team members were working as agreed was mentioned as both a builder of trust when done as agreed and a destroyer when work was late:

*“it’s not trust at an emotive or emotional level, its trust in the competence of the people that are working for you at the other end, and if they give you*

*reasons to question them because they just let you down its really hard to build back” DB11A Business Manager, Independent*

*“if there is a nagging fear based on either actual or perceived performance that they are saying one thing and they are doing something else, or that they over promise and under deliver, then that starts to inform the way you behave and then it becomes a vicious circle” DB11A Business Manager, Independent*

Another described needing to feel confident their project virtual team colleagues would be working as part of their team and would not let them down:

*“Pivotal, you can’t do without it, you have to be able to rely on and trust the person on the other end of the telephone and the person in the room” AA31A Senior Project Engineer, Independent*

Participants noted that once trust is broken, possibly simply through messages not being conveyed on time or with sufficient clarity, it is very hard to rebuild:

*“once the trust goes it is very hard to rebuild, and if it goes early in the project, the project is doomed, end of story” DB11A Business Manager, Independent*

One participant described how, within one of their projects, the virtual team had not established an initial working relationship, resulting in poor overall communications and project delays:

*“Had there been I think more trust between the groups, the issues, it would not necessarily have resolved them but it would have come out much, much sooner and could have been resolved without the project going so badly wrong and taking so long to go wrong” BB31A Project Manager, Independent*

Three participants described how having a trusting relationship within a virtual team allowed comfortable ad-hoc meetings because team members did not feel they were being monitored:

*“you can have ad-hoc meetings and the more your team trusts you and the more you trust your team the more you can have ad-hoc meetings, because they will happily tell you I’m too busy can we do it tomorrow” BB31A Project Manager, Independent*

Overall, participants in this cohort observed that trust was top of their list in importance in effective interpersonal communications:

*“top of the list is trust, between the various arms and personalities within the team” DB11A Business Manager, Independent*

#### **4.8.1.9. Alignment of Personnel**

Participants described their belief that holding alignment workshops and events for personnel was very important but, they also observed that it was often not done well:

*“the other mistake that companies make when they build these teams quite often is that they don’t invest any time in actually getting people to know each other” DB11A Business Manager, Independent*

The majority commented that it was important to hold these events at the start of new projects:

*“you have got to do it right at the beginning, because if you don’t make the effort right at the start it is going to be harder through the project” BB31A Project Manager, Independent*

In addition, with a level of frequency in a long project to ensure continued alignment:

*“if you have a very long project phase and everything is very stable and nothing is happening I think it is very easy for people to drift off, or for teams to drift off and go in the wrong direction or for things to be lost or missed and I think there it is very easy to sit back and think it’s all good, it’s all going well and everything is fine and I don’t need to do very much and those are probably the time when you need to do a bit extra when it is all going so well, and you need to keep the motivation high and keep the morale high” BB31A Project Manager, Independent*

Two also commented on needing to repeat alignment activities when new personnel join the project:

*“if you bring new people into the team you have got to do that from scratch, not just with that individual but with the team, and with the team in both locations because you can change the dynamics of the team you have a different personality or you’ve brought a different culture in or you’ve brought somebody with a different experience” BB31A Project Manager, Independent*

It was also considered important to refresh the alignment at key points of change within the project:

*“recognising that you’ve, that something has changed in the project and then going back over the training, the team building, so continuously managing, not just the culture but the other issues through the project” BB31A Project Manager, Independent*

One participants observed that, within a virtual team environment, interoffice alignment of personnel is sometimes overlooked due to assumptions that each office works autonomously on their portion of the project scope:

*“I think that is where people don’t spend the time that they perhaps should because they perceive the locations as being fairly autonomous in the tasks that they are doing and they miss the issues” BB31A Project Manager, Independent*

#### **4.8.1.10. Organisational Culture**

The majority of participants outlined the importance of the whole organisation supporting the project objectives. They described how the lack of such common understandings could lead to major delivery issues:

*“there is that invisible element that is always there, or almost always there of corporate politics, where if you have a virtual team, what is the agenda of each of the cells within that team, what is the driver for that cell” DB11A Business Manager, Independent*

One described experiencing corporate politics challenges when trying to maintain communications between offices:

*“trying to keep those disparate parts of the business talking to each other was problematic and then you overlay corporate politics over that and it was quite a struggle at the time” DB11A Business Manager, Independent*

Another participant described the difficulty they had to contextualise problems within a virtual team due to the different pressures experienced by team members in different locations:

*“you can’t see the dynamics in this office, you can’t see the pressures these guys are under for whatever the reason might be, the pressure of language, the pressure of time, the pressure of technique, the pressure of trying to get up to speed with Australian Standards in this case” AA31A Senior Project Engineer, Independent*

And another described how a corporate culture that supported the use of virtual teams made it easier to establish and build the necessary organisational structure:

*“Company culture would mean a lot if you’re creating a virtual team overseas and Worksharing projects. If the company is open to that concept, it is much easier to mobilize the team for that type of project” KB31B Senior Project Engineer, Independent*

#### **4.8.2. Cognitive map of independent participants**

The cognitive map for this cohort is shown in Figure 60 **Error! Reference source not found.** This map is the most complex of all the cohorts investigated in this research. It includes 103 nodes and 121 links. Among its many relationships, it also includes one large, cohesive cluster and two virtuous loops.



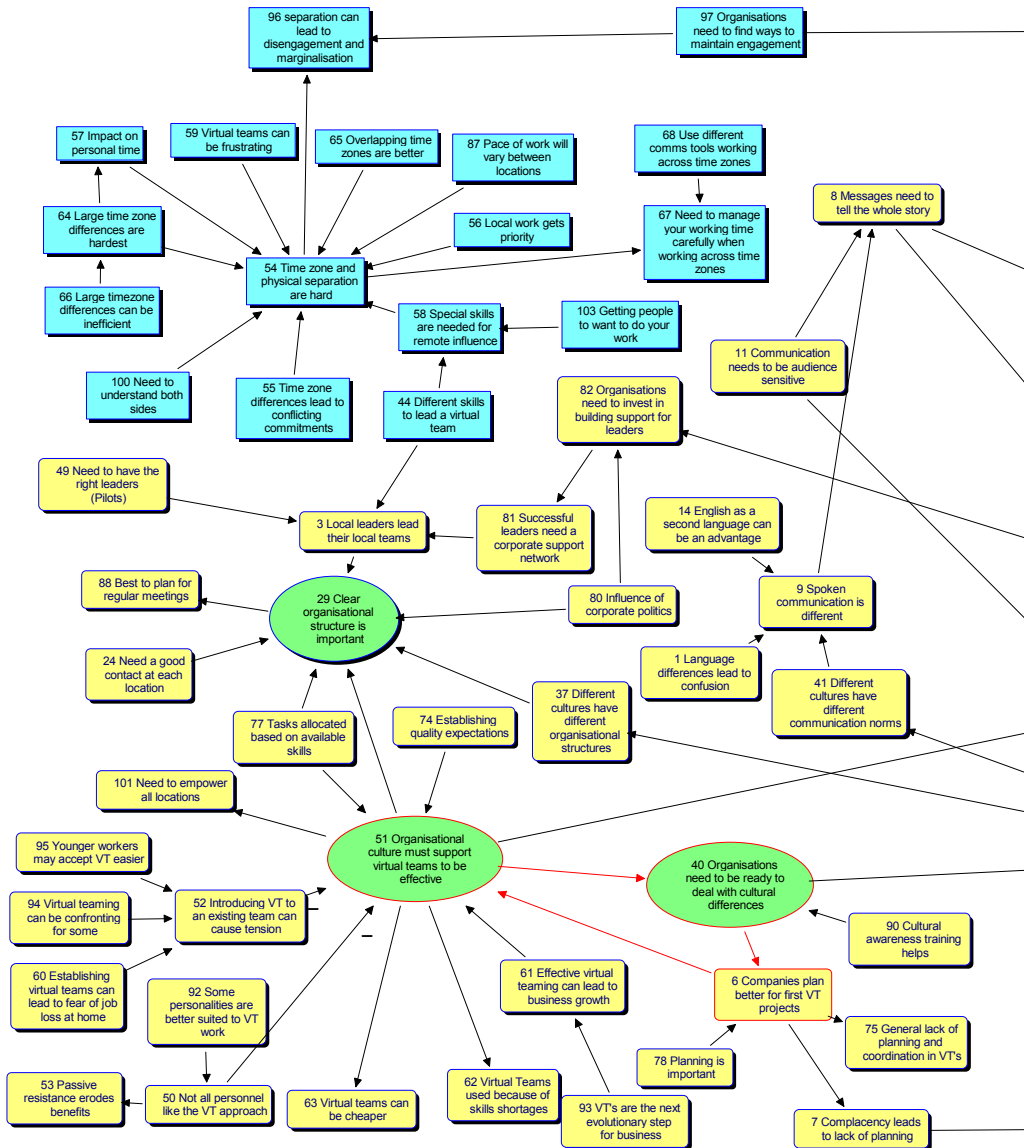
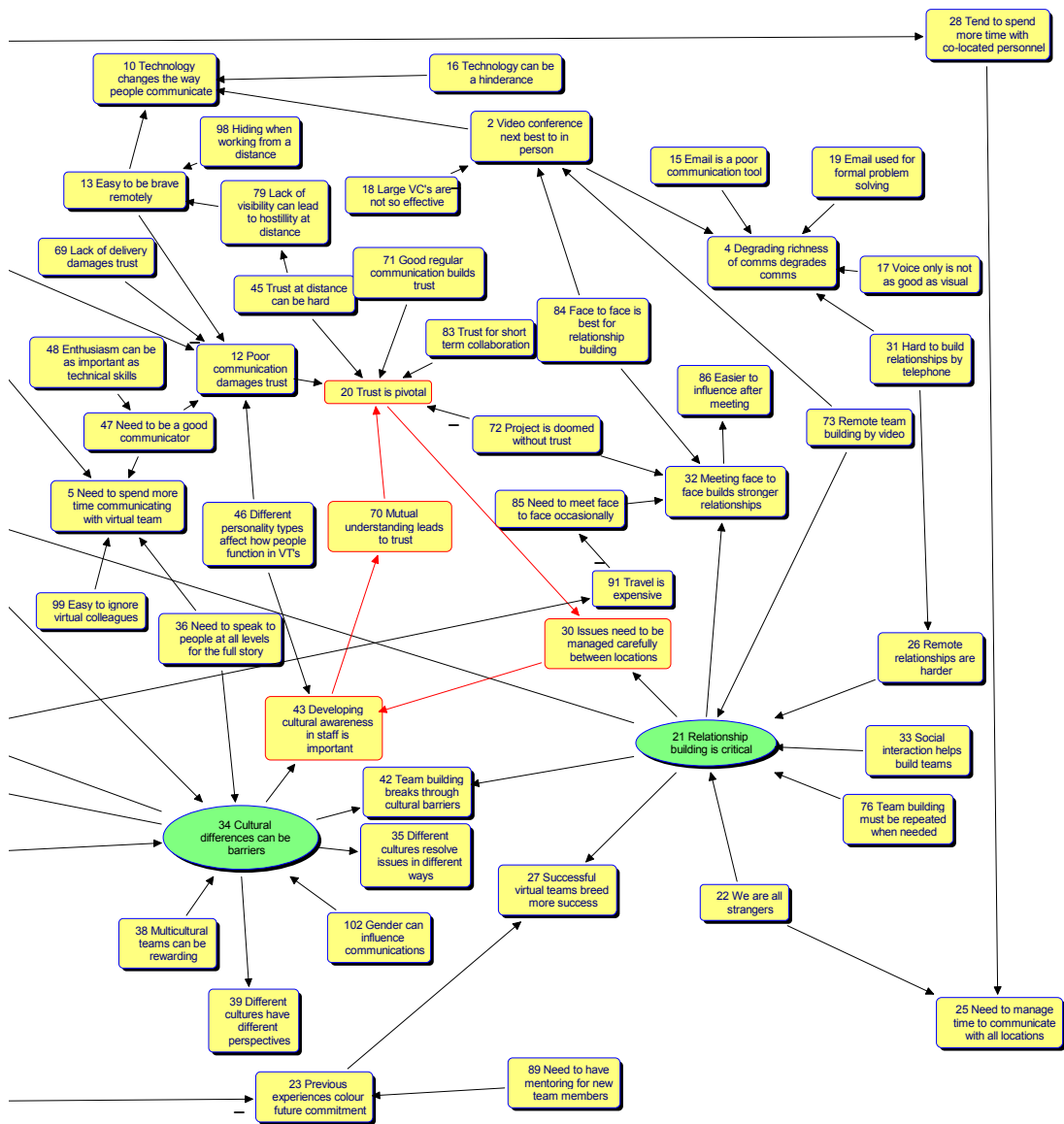


Figure 60: Cognitive map of independent participant data



### 4.8.2.1. Nodes

The central nodes in this map are highlighted through the use of green filled ovals.

The most influential node shown as Figure 61 is that **cultural differences can be barriers**. This node was influenced by nodes identifying that **organisations need to be ready to deal with cultural differences**, that **multicultural teams can be rewarding**, that **communication needs to be audience sensitive** and that **personnel need to speak to people at all levels for the full story** of how the project and team are functioning. It is also highlighted within this map that **gender can influence communications**. This node also influences other nodes, that **different cultures have different organisational structures**, that **different cultures can have different perspectives** and **different cultures resolve issues in different ways** but that **team building breaks through cultural barriers** and that **developing cultural awareness in staff is important**.

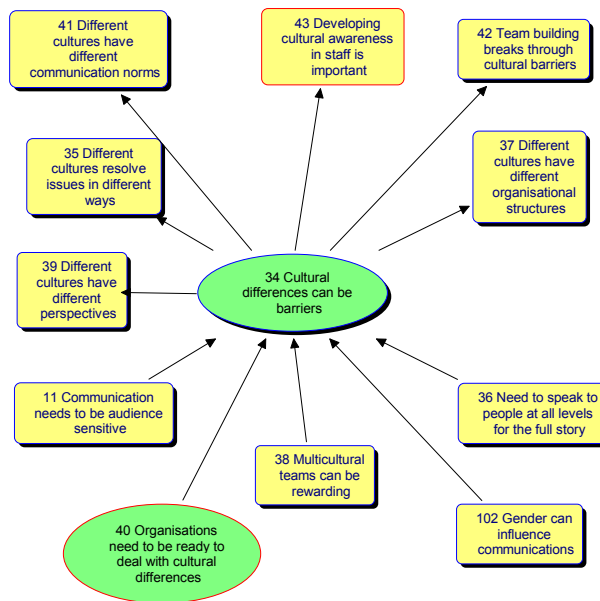


Figure 61: Node - cultural differences can be barriers

The second most influential node is one recognising that an **organisational culture must support virtual teams to be effective**. This node, shown as Figure 62, is influenced by nodes observing that **companies plan better for first virtual team projects** than successive ones, **effective virtual teaming can lead to business growth**, that it is important for organisations to **establish quality expectations when establishing a virtual team**, and that businesses must ensure that **tasks allocated based**

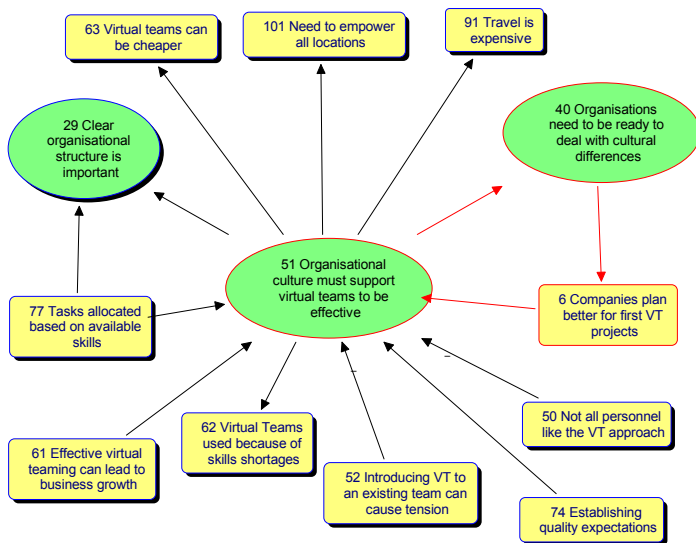


Figure 62: Node - organisational culture must support virtual teams to be effective



on available skills. This node was negatively influenced by the recognition that **not all personnel like the virtual team approach**. This node influences other nodes, that **virtual teams used because of skills shortages** and that **virtual teams can be cheaper**. There is a recognition identified that organisations **need to empower all locations** within their structure to be effective and that a **clear organisational structure is important**. That within virtual team organisations, **travel is expensive** and that **organisations need to be ready to deal with cultural differences**.

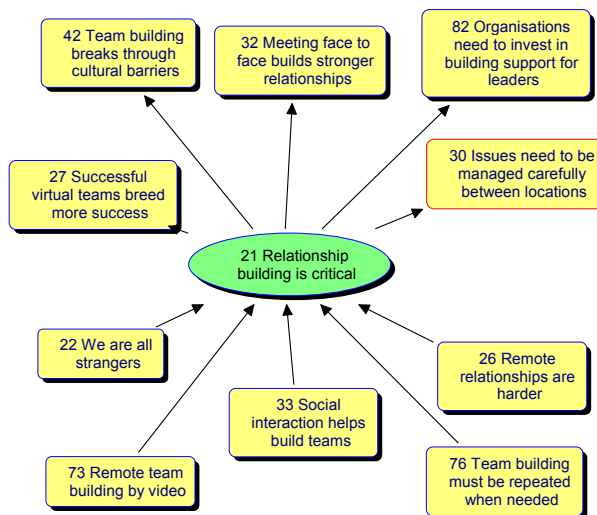


Figure 63: Node - relationship building is critical

Third most influential node found on this map and highlighted as Figure 63, is the identification that **relationship building is critical**. This node is influenced by observations that **remote relationships are harder**, that **social interaction helps build teams**, that **team building must be repeated when needed**, not only at the onset of the project. Ultimately, **we are all strangers** and need to learn to collaborate and that it is possible to undertake **remote team building by video**. This node also

influences the nodes coded with comments including **successful virtual teams breed more success**, that **team building breaks through barriers**, that **issues need to be managed carefully between locations** and that **meeting face-to-face builds stronger relationships**.

The fourth most influential node, highlighted in Figure 64, is that **organisations need to be ready to deal with cultural differences**. This node is influenced by nodes recognising that **organisational culture must support virtual teams to be effective** and that **cultural awareness training helps**. It also supports recognition that typically **companies plan better for their first VT projects** and that **cultural differences can be barriers** to effective virtual teaming.

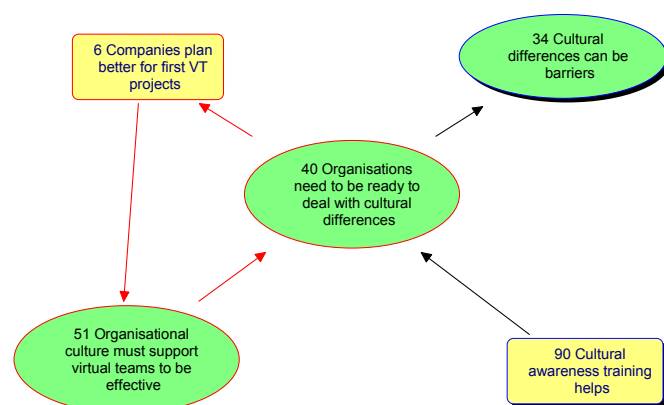


Figure 64: Node - organisations need to be ready to deal with cultural differences

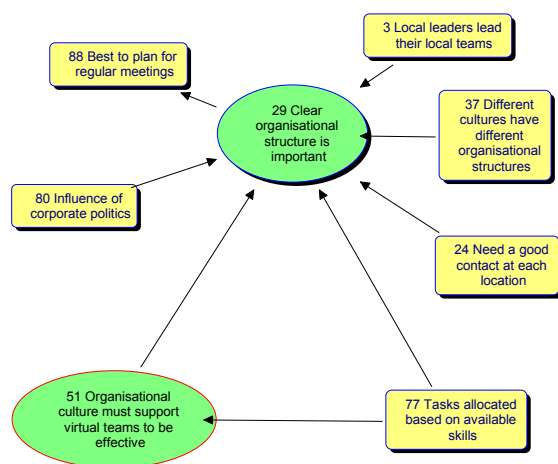


Figure 65: Node - clear organisational structure is important

Fifth most influential of the nodes in this map, highlighted in Figure 65, is that **clear organisational structure is important** in virtual team projects. This is influenced by nodes stating that **different cultures have different organisational structures**, an **organisational structure must support virtual teams to be effective**, that within a virtual team project **tasks allocated based on available skills** and that to be effective teams **need a good contact at each location**, that it is **best to plan for regular meetings** rather than only ad-hoc, that **local leaders lead their local teams** in a devolved leadership model and that virtual teams need to be aware of the

**influence of local politics on their ability to interact effectively.**

#### 4.8.2.2. Clusters

This map exhibited one distinct tightly grouped cluster, highlighted by blue rectangles on Figure 60 **Error! Reference source not found.** and reproduced as Figure 66. This cluster is centred on issues associated with **time zone separation**. This cluster incorporates items including how having overlapping time zones is better than a complete separation, that leaders need different skills to work, lead and influence in remote situations and, that the impact of physical separation can be personnel experiencing disengagement and a sense of marginalisation.

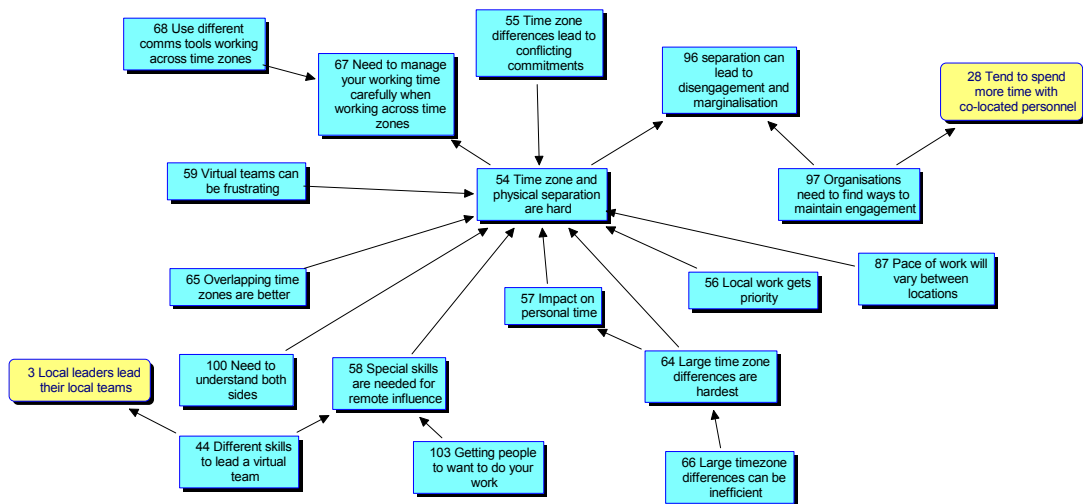


Figure 66: Cluster - time zone separation

### 4.8.2.3. Loops

There were two virtuous loops identified within this map, highlighted using red connecting lines and arrows along with red borders to the individual nodes on Figure 60. **Error! Reference source not found.** These loops are also reproduced below for clarity.

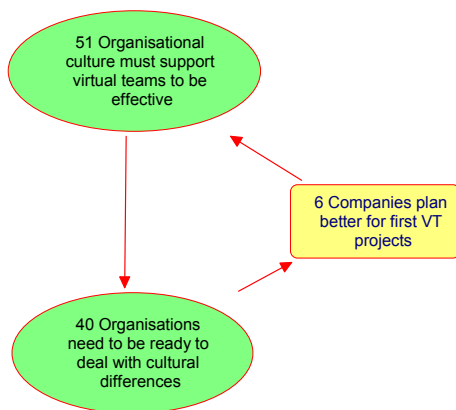


Figure 67: Loop - planning is important for success

One loop, shown in Figure 67, comprises the nodes **Organisational culture must support virtual teams to be effective** > **Organisations need to be ready to deal with cultural differences** > **companies plan better for first VT projects** and suggests that organisations typically experience better project outcomes if they plan in detail for the overall impact of virtual teaming on their work and are ready to support their personnel within these teams and address issues as they arise.

The second virtuous loop, highlighted in Figure 68, comprises the nodes **Trust is pivotal** > **Issues need to be managed carefully between locations** > **Developing cultural awareness in staff is important** > **Mutual understanding leads to trust**, this suggests that trust within virtual teams is dependent on a deep level of understanding between

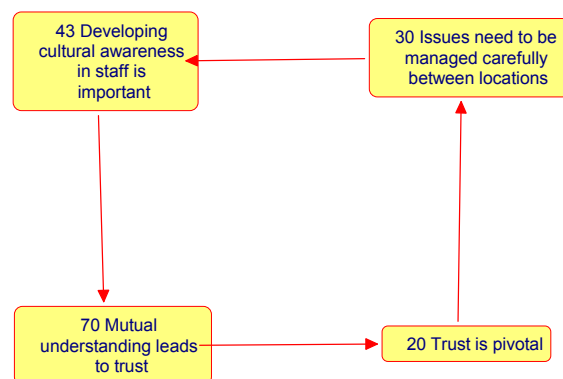


Figure 68: Loop - Trust and awareness

personnel that includes, among other factors, an understanding of all the facets of culture.

## **4.9. Initial comparison of cohorts**

While a detailed comparison of the views of the different cohorts is presented in the next chapter, an initial comparison of the data from each cohort reveals a number of strong similarities between the expressed beliefs of all participants as well as a number of differences between groups. There was strong alignment across the great majority of participants that the use of virtual teams for resources projects was a trend that was going to see increased adoption. While some participants described an ongoing preference for collocated teams, there was broad acceptance that project virtual teaming was the future for large engineering projects. There was also a recognition across the cohorts of the need for strong relationships and the development of trust between the personnel in the project's locations, this belief was most strongly expressed by those in the mid-level cohorts and the independents, with many of these participants describing in detail how they worked to build and maintain these relationships.

The alignment was less strong between cohorts in areas such as technology preference where the senior personnel described a desire to use the richer tools such as video whilst those in the most junior roles described themselves as being content with voice and desk top document sharing. The personnel in the non-Perth offices were those who had the strongest recognition of the impact of time zone differences, cultural differences and language differences. This perception is possibly a result of them being most exposed to different cultures and often having to accept meeting times initiated by the Perth office, sometimes without consideration for local time differences, resulting in meetings occurring outside of core working hours for some personnel.

## **4.10. Conclusion**

The findings set out above illustrate the complicated structure and complex interrelationships found within project virtual teams engaged in delivering engineering projects into the Western Australian resources sector. The data illustrate how the experiences and beliefs of members of the different cohorts of senior, mid-level and junior personnel located either in the Perth project home office or one of the remote offices participating in the virtual team differ from one another, and how those referred to in the data as independents, who have had the opportunity to reflect on their experiences provide yet another complementary though at times different range of beliefs.

Combining both thematic analysis and cognitive mapping in the depiction of these findings allows a multi-dimensional presentation of this data. The researcher is able to examine each theme in each cohort in isolation, while using the cognitive maps to visualise the complex interrelationships between different facets of project virtual teams impacting how members of

the team at each level experience and engage with the virtual team environment and perform their work.

These findings are analysed in the following chapter to build an understanding of how the views of members of the different cohorts compare and contrast to those of their colleagues. This activity allows the researcher to progressively build an overall understanding of the factors which impact interpersonal communications at all levels in project virtual teams, to understand how different roles are affected, and how these experiences impact the overall project. From this analysis, recommendations on how both the academic and practice communities can implement changes to improve the effectiveness of these teams will be offered.

## **5. Analysis, Interpretation and Synthesis of Findings**

## 5.1. Introduction

While no two virtual teams are exactly alike, it can be seen from the findings presented in the previous chapter that the lived experiences of members of these teams differ between individuals. However, while the teams participating in the study varied in structure, duration, size, project phase and location, many of the observations, from many participants, were similar, allowing the development of concepts which are well supported by the data.

In considering the specific questions being addressed by this research, with the major question being;

- How do interpersonal communications between virtual teams affect the performance of team members in delivery of engineering projects into Western Australia's resources industry?

Then, in addressing this question, the following associated questions are being considered;

- What are the attributes of a successful communicator and coordinator in engineering projects where the virtual team approach is used?
- How do beliefs and expectations of a project's virtual team members vary at different levels and roles within the project and between the project's teams?
- In what ways do current theoretical perspectives adequately explain the relationships between interpersonal communication and the factors that make members of a distributed virtual team feel engaged and committed to the project?
- How can interpersonal communication in engineering project teams be improved?

## 5.2. Analysis structure

In this chapter, the findings depicted in the previous chapter are analysed to answer the questions posed. The analysis is undertaken in stages.

- First, using data captured through this research, a model is proposed that demonstrates the fluid, complex and interactive nature of the environment which shapes and supports interpersonal communications in project virtual teams.
- Second, an analysis is undertaken of the findings to understand the beliefs and expectations of interpersonal communications in virtual teams of each cohort of personnel. These cohorts are then compared at a seniority of role level; where members of the senior home cohort are compared to senior away, mid home to mid away etc. then, the different seniority levels are compared to one another to understand **how the beliefs and expectations of a project's virtual team members vary at different seniority levels.**
- Third, drawing on the analysis of seniority levels above, the combined overall beliefs and expectations of the participants are examined to understand the **attributes of a successful communicator and coordinator in a virtual team.**

- Fourthly, the major question of **how interpersonal communication between virtual teams affect the performance of team members** is considered.
- Then, recommendations for **how interpersonal communications in virtual teams can be improved** are offered.
- The question of **how these findings fit into the broader research field of virtual teams** is addressed in the discussions chapter following.

### 5.3. A project virtual team communications environment model

From the data captured and analysed in this research it is now possible to develop a multilevel model depicting the organisational environment that defines and shapes interpersonal communications in virtual teams. The developed model uses as its basis elements, the ecological systems model developed by Bronfenbrenner (1977) along with the work on multilevel theory of Klein and Kozlowski (2000, p.7) who describe multilevel theory as enabling the “identification of the principles of more integrated understanding of phenomena that unfold across levels of an organisation”. From the findings of this research it is apparent that there are three primary levels to consider in the development of this model; the global or Macro level of themes and influencing factors including geographic locations of offices, time zone separation between locations, cultural and language differences between the locations; organisational or Meso level themes and factors which are defined and controlled at the level of the organisation including organisational norms, practices and procedures, the size of the team at each location, how work is allocated between the teams and the technology made available to the members of the teams with which to communicate, and; individual or Micro level themes and factors which exist at the level of the individual project team member and include their role within the project (both defined and experienced), the relationships and degree of trust with their colleagues, how actively and openly they communicate, the technology they choose for this communication, the experience they bring to the role, commitment to the project and the concept of virtual teaming and suitability for their specific role. These three levels are embedded one inside another, with the individuals working as part of their group and organisation which in turn operates in a global context. The higher level, Macro, systems then provide the contextual influences on the lower Meso and Micro systems, defining the environment in which the organisation, project, team and individual will operate. Conversely, the lower level system, the Micro system, is where many organisational phenomena emerge from, with much of a group’s culture determined by the beliefs and interaction of the individual members (Klein and Kozlowski, 2000).

The model developed from this research, shown as Figure 69, follows the Macro, Meso and Microsystem structure, with the Macrosystem encompassing the organisation level and broad geographic environment in which the organisation exists. The Mesosystem sits at the project level and includes both the overall project and the geographic project teams who make



up the contributing elements to the project. The Microsystem is at the level of the individual within the project. The ecological system developed exists as a nested arrangement of structures, where each is contained within the next (Bronfenbrenner, 1977). Such ecological models are dynamic and complex, reflecting the dynamic, complex and evolving environment of virtual teams themselves.

The model takes a triadic person-process-context approach (Bronfenbrenner, 1986) which considers the role and impact of the individual within the dyadic process-context paradigm. It recognises that the 'personal' in interpersonal is an important component in communications in a project virtual team environment, influencing the outcomes of a project alongside the traditional and more broadly researched project management activities such as control of scope, cost and quality.

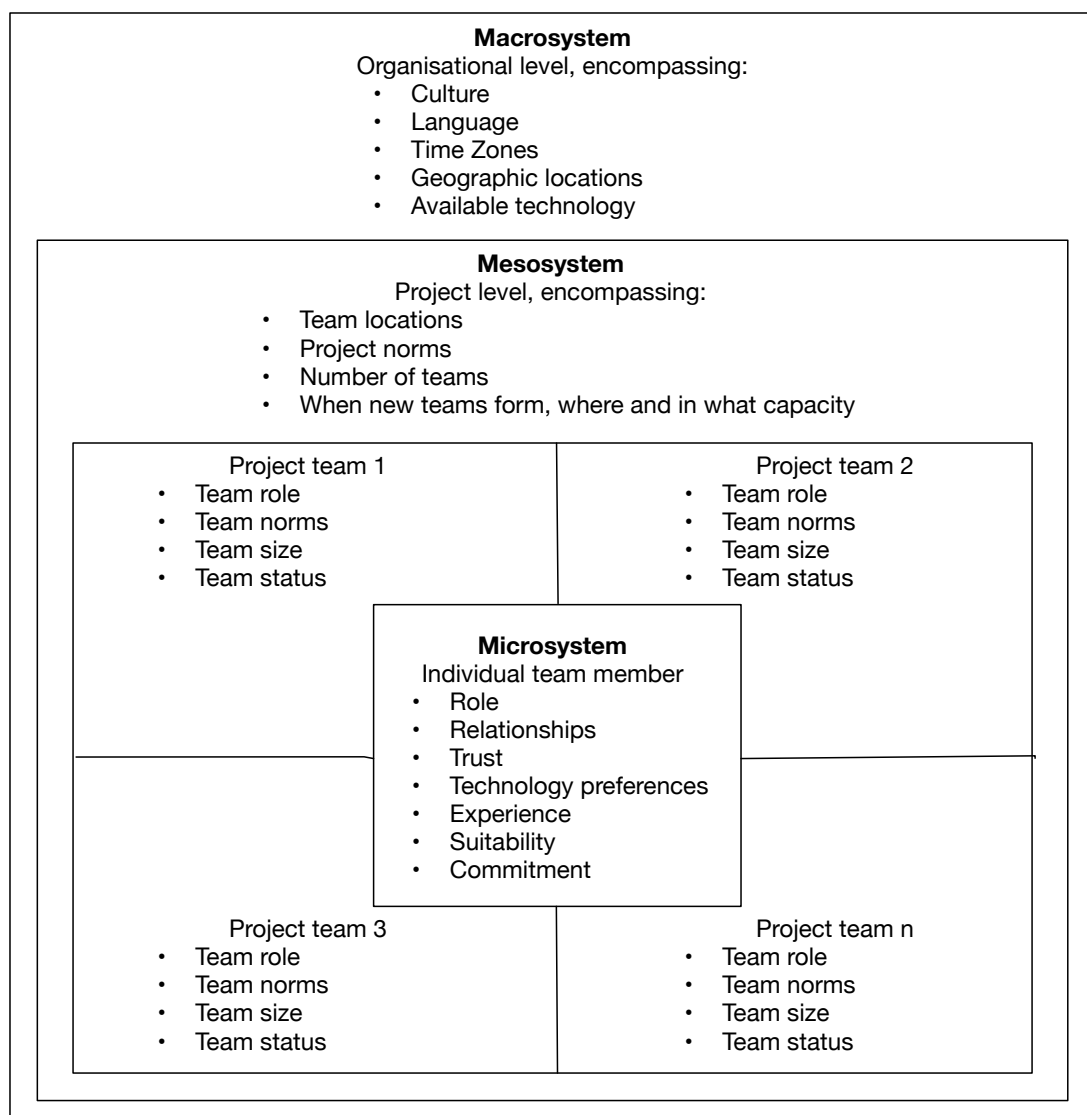


Figure 69: Project Virtual Team Interpersonal Communications Environment Model

This project virtual team interpersonal communications model places the characteristics of the individual at the centre of a series of layers. These represent layers within the

environmental system, radiating outward as microsystems, mesosystems and macrosystems. Each of these three systems contain a number of discrete variables which interact both with other variables within the system in which they exist and with variables in other systems.

Additional to the systems depicted in the model presented in Figure 69 is the chronosystem (Bronfenbrenner, 1986) which considers how the overall ecological environment changes with the passage of time. The changes to organisational phenomena change with the passage of time yet, as House et al. (1995) observed, time is rarely incorporated into such organisational models. However the impact of time on project virtual teams was observed frequently in the data in this research and as such must be present in any model that attempts to illustrate how these teams operate. The impact of time on project virtual teams is most accurately described using the concept of entrainment, the rhythm, pacing and synchronicity of processes linking different levels (House et al., 1995, Ancona and Chong, 1997). Entrainment is affected by temporary events and tasks that define organisational life, with the degree of interdependence varying significantly depending on the timing of tasks requiring synchronous or coordinated actions or responses (Klein and Kozlowski, 2000). In project virtual teams, the various individual teams and their members will experience different degrees of interaction as the demands of the project evolve. However, in project virtual teams these entrainment changes are not purely dictated by the passage of time but also by changes in location as the tasks within the project move from one location to another during the execution of the project. Through the use of the concept of the Chronotope “the intrinsic connectedness of temporal and spacial relationships” (Bakhtin, 1987, p.84), it is possible to describe the development of project virtual teams across the lifecycle of the project. The concept of a Chronotopic system in place of a Chronosystem allows for the consideration of development of interpersonal relationships as the overall project develops through the inclusion and departure of project sub-teams in the different geographic locations as they undertake their allocated portion of the project, the development of relationships between members of the various teams as their level of entrainment ebbs and flows and the changing demands on those tasked with communicating between locations through the projects evolution.

### **5.3.1. Macrosystems**

Macrosystems is described by Bronfenbrenner (1994, p.40) as “the overarching pattern of a given culture or subculture”. The macrosystems emerging from this research and depicted in Figure 69 are cultural differences, language differences, geographic physical distance separating project virtual team locations, the degree of temporal separation between the offices constituting the project virtual team (generally considered as time zones but including differences in core working hours), and, the available communications media technology from which the organisation and the individuals can select to facilitate their communications. These are the characteristics which are either static such as geographic distance or deeply embedded in social and work cultures such as language and culturally accepted patterns of work and communication.

### **5.3.1.1. Location**

The physical distance between locations in a project virtual team environment impacts how, and how easily team members communicate. Physical distance is not solely related to time zone differences, as latitudinal differences i.e. north/south distances between locations, will not substantially change the time zone difference between locations, while longitudinal differences i.e. east/west distances, will generally mean a difference of time zones. While, as observed by Allen (1984), as the physical distance between individuals increases the degree of communication declines exponentially, where even the distance between desks on a common floor or between floors in a multistorey building will impact the frequency of communications between personnel, it is the larger physical separation often found in project virtual teams that increasingly constrains how members will relate to one another and communicate.

### **5.3.1.2. Time**

In addition to any physical separation, geographic separation includes the impact of temporal displacement. While typically considered from the perspective of time zone differences between locations, it has been demonstrated in this research, differences can also occur because of the cultural variations in the standard working hours of a location. Difference is evident when comparing many South American countries with Australia where normal start and finish times differ substantially, potentially adding several hours to the physical time zone differences. Similarly, differences between the standard Australian work week of Monday to Friday compared to many middle eastern nations where the work week runs from Sunday to Thursday, place a full day's work displacement in addition to the time zone differences.

### **5.3.1.3. Culture**

Culture and cultural differences was a recurring theme in the findings of this research and, as a relatively fixed characteristic, it features in the macrosystem environment of any project virtual team. Working across locations exposes the team to the different cultural perspectives within each location. These differences impact how team members communicate, what they communicate and in what forums. As described by a number of participants, cultural differences mean that some personnel will expect to experience communications in ways that differ from those of their virtual team colleagues; both those with whom they are co-located as well as those working at distance.

### **5.3.1.4. Language**

Language differences was also a strong theme to emerge from this research. Language differences were identified by many participants as imposing a substantial barrier to effective communications, particularly in locations where the common project language is not spoken by a large portion of the professional workforce as several participants described. Those who described these differences as being most problematic were the native English speakers

working in the international offices of their projects needing to speak to colleagues who had little to no English while they themselves didn't speak the local language.

#### **5.3.1.5. Available technology**

As the enabler for much of the communication between team members in different locations forming a virtual team, communication technology was something many participants expressed views on. At the macrosystem level this manifests as the broad range of technology available for organisations to select from to provide the tools to their personnel. This is an ever-changing field with new variations of media emerging on an almost daily basis. While this research did not focus on any particular media type it is impossible to consider the entire ecosystem without identifying that communications tools substantially influence how personnel communicate.

#### **5.3.1.6. Macrosystem variable interaction**

The variables of location, time, culture and language all interact within the macrosystem, as the management of the project selects the locations to host the project teams, these locations will determine the time zone differences that must then be managed. Similarly, if the project management selects locations with different cultures and languages, those variables must also be incorporated into the communications considerations for the project.

Available technology is a variable that is broadly independent of the majority of other variables within the macrosystem. Exceptions to this could occur however where personnel may have different cultural approaches to how technology is utilised, or where their language skills may make it difficult for them to engage fully in discussions using some media. Additionally, the degree of time zone separation between selected locations will influence the range of suitable communications technologies available for selection by the project personnel.

### **5.3.2. Mesosystem**

The Mesosystem emerging from this research is set at the project level. As a system it sits within the broader macrosystem of the overall organisation and industry. Included at the project level are the holistic project with its defined aims and objectives along with each of the various project office locations that comprise the virtual team. Consequently, the Mesosystem is itself made up of two levels, the project and the project teams. At the project level it comprises the number of locations over which the virtual team is distributed, and the project norms which set out functions such as procedures, standards and communication expectations. At the individual project team level, where each team represents a geographic location within the virtual team, the Mesosystems comprise; the team size and composition at its location, the discrete team norms including expectations on the level and formality of interaction, the organisational and project culture, procedures, practices and norms and the technology made available by the project and readily accessible to project personnel.

### **5.3.2.1. Chosen locations**

The number of locations used in a project virtual team is largely a decision made by the management of the project and the organisation in which the project is undertaken. Participants described how the leadership of the project evaluates the available capacity and skills within their locations and allocates tasks accordingly. However, a number of participants observed how each location added to a virtual team substantially increases the complexity of project communications. Personnel at each active location must be appraised of the project progress, goals, schedule and tasks and need to communicate with personnel at other locations to coordinate activities and ensure the overall project objectives are achieved.

The number and locations chosen also impacts on cultural, linguistic, temporal and physical distances between team participants, discussed as part of the macrosystem, suggesting not only a system level interaction but interactions between system levels within the model.

### **5.3.2.2. Project norms**

In addition to the external cultural environment discussed as part of macrosystems, participants described how each organisation, project and office has its own norms. These norms are reflected in the procedures and practices defining how work is performed in that office, what is expected of individuals at all organisational levels and how they should perform tasks. This includes how roles are defined, how authority is vested in each role and the levels of accountability ascribed to each employee. As a number of participants described, these procedures, practices and norms can create challenges when sharing work between offices, even for offices within the same country, and must be accounted for in the establishment of the communication requirements of any project virtual team. For example, one office may require that a senior representative lead all communications with other offices in virtual teams while another office may assign this work to a junior team member, potentially leading to an asymmetrical power relationship between those with the communications roles.

Another consideration highlighted in this area is the project structure and lines of communication. Personnel from some cultures may expect, and indeed need to work in a structure with a clearly defined hierarchy, particularly for interoffice relationships, while those from other cultures may be more accepting of more organic and less heavily defined structures. Again, these matters must be considered when establishing the overall project environment.

### **5.3.2.3. Team role**

The role of each team comprising the overall virtual team will be set by the overall project leadership, with one team, most typically the one based where the project is headquartered (and referred to in this research as the home team) taking the overall leadership position and directing much of the other project activity. Each of the other teams then take a typically subservient role to the home office, as described by a number of participants in this research. These component teams work on allocated tasks as directed to meet the overall project

schedule and scope requirements. These component teams can be added to the overall project and then removed as required by the overall project leadership.

#### **5.3.2.4. Team size**

The organisational design of a project virtual team will include determination of the number of personnel at each location required to work within the team. This may result in a relatively symmetrical balance of team size, an asymmetrical imbalance or a mix of both dependant on the skills mix and capacity of personnel in each location and the number of locations. Participants described structures where the teams were of similar sizes between locations as well as situations where one individual may be working alone in one location within a project virtual team, while the rest of the team in other locations number in the dozens to hundreds.

Differing team sizes at locations imposes challenges in terms of communications and leadership structures which may be disproportionate for smaller teams and cause additional challenges for those team members. For example, a large team may have dedicated personnel able to coordinate all communications with other locations, leaving their co-located colleagues to focus on their technical delivery. A small team may not have such capacity, resulting in technical personnel spending less time on delivery and more on communications or the neglect of communications in favour of technical work.

#### **5.3.2.5. Supplied technology**

This system refers to the technology made available to the project personnel by their organisation and derives from the macrosystem discussion of available technology which considered the breadth of technological options available to the organisation and project. It includes whether project laptop computers and mobile phones are provided, and whether the project will pay personnel for the use of their personal internet connection, telephone plan or similar. It also considers what electronic communication tools are furnished by the project to its personnel. A number of participants described how supplied technology included access to videoconference equipment either at the desktop/mobile device or in a dedicated videoconference suite, along with matters such as the level of shared server access to allow personnel in different offices concurrent access to documentation for discussions and, whether instant messaging tools are available for staff to use if they wish.

Technology spans the three systems of macro, meso and micro in this model. The macrosystem considers the range of technology available on the marketplace, the exosystem considers organisationally provided technology, and the microsystem considers individuals preferred technology.

#### **5.3.2.6. Mesosystem variable interaction**

The interaction of the mesosystem variables occurs both within the mesosystem and between variable within the mesosystem and those in both the macrosystem and microsystem.

The role of each team will determine the size of the team as the volume of work required will establish how many personnel, of what skill set and for what duration is required. The selection of each team will be determined by the management of the project, taking into account the required and available skill sets, their relative proximity to other teams within the project, experience level at working within a virtual team and cultural and linguistic variables such as those identified in the macrosystem. Teams will join and leave the project as their tasks are initiated and completed, with each team assuming a different hierarchical status within the project dependant on the criticality of the work it is undertaking.

The project norms will be established by the project management personnel, based on the cultures of the organisation and dependent on the organisational culture. These may be established as a single. As described by a number of participants in this research, these project norms may be centrally established and mandated or may combine and accommodate the cultural preferences of each of the project locations.

### **5.3.3. Microsystems**

Microsystems are defined by Bronfenbrenner (1994, p.39) as “a pattern of activities, social roles and interpersonal relations experienced by the individual in a given setting with particular physical, social, and symbolic features”. It is within this system that the position and choices of the individual are most evident. From this research, the microsystem incorporates the role of the individual, including factors such as organisational and project seniority and how formally roles are recognised within the project structure, the individual’s technology preferences to fulfil their communications commitments, their relationships with co-located and virtual team colleagues and, the level of trust between individuals.

#### **5.3.3.1. Role**

The role of the individual encompasses factors such as their seniority within their organisation, project and profession, how much authority they have formally vested in them and how much authority they are able to assume informally. Much of the individuals’ authority and seniority within their project will result from the mesosystem considerations of organisational culture and norms and the macrosystem cultural norms from their society.

Whether the individual is in a senior role such as a project manager or technical lead, a mid-level or interface role with substantial responsibility for communications between the offices, or a purely technical role delivering designs to meet the project needs will change their function in project virtual team communications. It is also important to consider situations such as whether their role has little direct authority but requires them to assume a large degree of informal authority to, for instance, maintain communications on the status of work between locations to provide alignment of deliverables. As described by a number of participants, the individual’s role also influences the extent, complexity and required timing of the communications they are required to undertake, whether this is limited to a weekly teleconference, daily discussions over technical or administrative issues or ad-hoc, and

whether the timing of these communications falls entirely inside of or includes outside of core working hours.

#### **5.3.3.2. Relationship**

Relationships between personnel in project virtual teams was discussed as a significant factor by participants, with a broad reflection within the data that strong working relationships were critical to successful project delivery. Different participants described how they preferred to build these relationships. Some achieved this through social interaction alongside face-to-face meetings, and some through visits to other offices for extended periods, where they would interact with the local personnel. Some participants identified regular open ongoing discussions via various electronic media, where they described sharing personal details of holidays and social activities, while others described staying largely within the bounds of work related topics to allow the relationship to build through technical interaction. Whatever their preferred mechanism, building and maintaining relationships was clearly a major component of the role for many personnel, reflecting the requirements of their role and enabled by their personal choices of technology through which to communicate.

#### **5.3.3.3. Trust**

The final microsystem component in this model is trust. As with relationships, trust was a very strong theme in the data. Establishing a trusting relationship rather than simply a working relationship was something many participants described working toward and, spent considerable amounts of their working day fostering.

Participants described building trust through long term interaction, through pursuing opportunities to deliver work on time to the required quality, and of openly sharing accurate and at times painful or embarrassing status updates on assigned tasks to ensure their virtual team colleagues were fully aware of everything occurring in their offices and could adjust their own work accordingly. Participants also described how trust could be placed in jeopardy through micromanaging from a distance, where some individuals would demand detailed status updates and intermediate design reviews as a way to ensure for themselves the status of the work, demonstrating a lower level of trust in their virtual colleagues.

#### **5.3.3.4. Experience**

The level of experience at both technical delivery and participation in virtual teams was an important individual characteristic that emerged from the data. Having personnel, particularly at senior levels, with previous experience in project virtual team environments and strong pre-existing relationships with colleagues in other offices forming part of the project structure was described as a clear benefit. Incorporating these personnel into a project virtual team was believed to remove some of the risk associated with mobilising a new team, ensuring new personnel were comfortable with the pace and characteristics a virtual team project that differ from a co-located team. Such personnel were described as bringing previous learnings to the team and providing coaching and mentoring to their less experienced colleagues.



Experience in leading a virtual team was seen as a particular necessity for the project manager and their immediate reports, since these individuals need to be comfortable from the beginning in establishing the processes and expectations for both the technical delivery and communications within the team. A number of participants described the different characteristics required to lead a virtual team over those of a manager of a co-located project. These differences are discussed in more detail later in this chapter.

#### **5.3.3.5. Commitment**

Participants discussed the importance of having personnel within their virtual teams who were committed both to the project and to the concept of project virtual team delivery. Having personnel who either actively or passively resisted sharing work with other locations, either because they felt virtual teams threatened their own future work, or because they did not believe the personnel in the other offices could deliver to the quality they believed appropriate was identified as a destructive force to be avoided. Consequently, it is important that personnel at all levels within the project, and in all locations, are committed to the project virtual team model.

Additionally, for personnel most involved in establishing and maintaining communication channels between offices, it is important they accept the need to frequently work outside of their normal core hours. This can include travel in personal time to attend meetings and taking and making telephone calls early in the morning and late into the evening to ensure they are able to bridge the time differences between locations, avoid delays and maintain the flow of work.

#### **5.3.3.6. Suitability**

A further characteristic of individuals in project virtual teams identified in this research is their suitability to working in different roles. A number of participants described the characteristics required to be effective in a virtual team, most particularly focussing on the characteristics of a virtual team leader or an individual who has responsibility for leading much of the communications. These included being clear and open communicators, comfortable with delegation of authority and with ambiguity while also able to extract appropriate levels of detail on progress and challenges from their virtual team contacts.

Not all virtual team members have responsibility for running parts of the project and similarly not every virtual team member needs to communicate with personnel outside of their co-located environment. Therefore it is important that only those suited to virtual team specific roles be placed in those positions and that once there they be provided with appropriate support to execute the roles as needed by the project.

#### **5.3.3.7. Technology preferences**

The individual's technology preferences align with the exosystem discussion above of technology provided by the project and the microsystem discussions on the role of the individual. It became apparent from the data that individuals in different roles have varying

technology preferences to facilitate communications. For example, a number of design personnel in the junior cohorts expressed a preference for desktop document sharing and electronically mediated audio such as the telephone. Many mid-level participants performing interoffice interface roles, ensuring alignment between offices and disciplines, described being happy with mobile telephone and email, while many senior participants expressed a preference for either video conference, teleconference or face-to-face meetings for their communications. It is apparent that it is important for project managers to provide their personnel with an appropriate range of communication tools to perform their tasks to the best of their ability, rather than assuming that only a small number of tools are needed or that one set of tools will satisfy everyone's requirements.

#### **5.3.3.8. Microsystem variable interaction**

At the level of the microsystem, each individual's personal characteristics and variables will determine their assigned role both within their local team and the larger project. Individuals with deemed to have relevant suitability and experience, and who are seen as being committed to undertaking the project through a virtual team approach will be assigned to communications interface positions. In these assigned roles they will leverage their own and their colleagues preferred communications media to establish relationships and trust such that they can maintain open collaborative communications between the different teams. How they are able to undertake this function within the overall project will be dependent upon the geographic and temporal spread of the teams, the status of the team which they are a member of, the norms of the project and any language barriers they may encounter.

#### **5.3.4. Variable interaction model**

The interactions of the variables identified and discussed in the project virtual team communications environmental model occurring within the macro, meso and microsystems are then be depicted in a model that demonstrates their primary directionality and interconnections. This model, shown as Figure 70, illustrates the primary and most influential relationships between the factors which emerged from this research.

The model follows the same multi-level structure as the project virtual team interpersonal communications environment model shown in Figure 69 but depicts the primary interactions between the factors through the use of either single or bi-directional arrows. While the relationships shown capture the most influential relationships emerging from this research, additional, less influential relationships also exist within the model which are not shown for ease of interpretation.

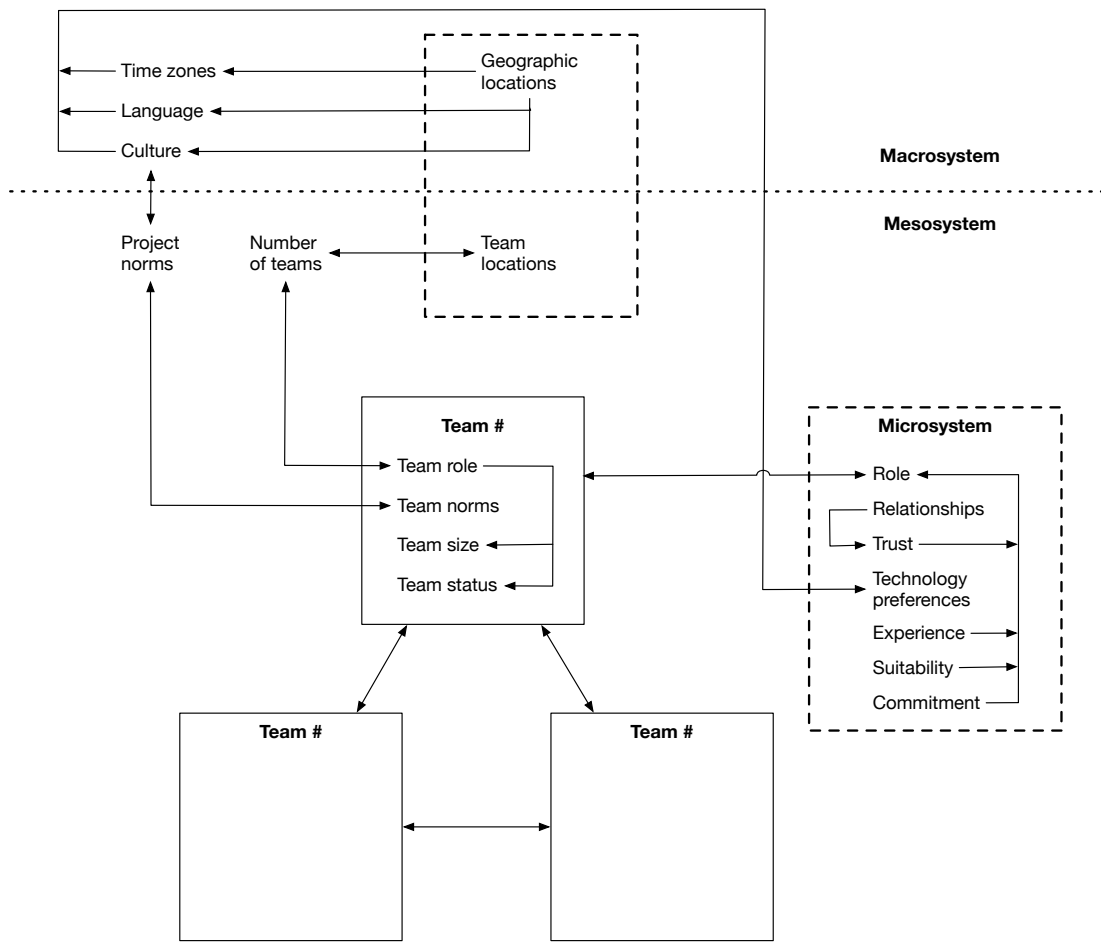


Figure 70: Variable interaction within the communications environmental model

### 5.3.5. Chronotopic systems and entrainment

The final system to be considered in the project virtual team interpersonal communications environment model is the chronosystem. Bronfenbrenner (1994) describes a chronosystem as extending the ecological system into a third dimension, encompassing changes or consistency within the overall system through the passage of time. Interpersonal relationships in projects, whether co-located or delivered by a virtual team, change over time. Consequently, recognition of the chronosystem is important to perceive the full complexity of how interpersonal communications between members changes. Day-by-day and more noticeably as projects move from one phase to another, team members join and leave, and, within project virtual teams, relationships evolve, and work migrates between offices, bringing different relationships and characteristics into play.

#### 5.3.5.1. Location interaction

As described by several participants, the degree of entrainment defined by the interaction between locations in a project virtual team will vary between projects, phases of projects, discrete tasks being performed and the skills profile and expectations placed on each location. Such interaction is indicated in Figure 70 by the arrows connecting the three project teams. Where allocated tasks require a high degree of interaction, such as sharing the design of a

complex package, the extent of interaction will increase to a commensurate degree. Similarly, if work is allocated such that there are few interfaces between packages then the interaction is likely to reduce. An increased level of interaction is reflected in an increased load on those tasked with the relationships, and where, as discussed above, the locations are separated by large time zone or other temporal differences. The intensity of communications, coupled with temporal differences can mean some personnel working extensively outside of core hours.

Some participants described how, within a single organisation it was uncommon to have a formal contractual agreement between offices for virtual team projects. This lack of formality exposes the organisation to unexpected costs should phases of the project be changed, tasks deferred etc. This level of formality must be considered when establishing a virtual team agreement to ensure equitable distribution of risks and benefits from the work.

### **5.3.5.2. Communication activity**

This aspect of the microsystem encompasses the frequency, formality, timeliness and accuracy of communications between members of the project virtual team. Considerations such as whether they rely solely on formal, calendared meetings or undertake organic, as needed discussions on the project; whether they share personal anecdotes and stories and build a personal relationship beyond the professional one required to perform their tasks or simply stick to the facts; whether they share information and task status as soon as things become evident, both for good and bad news or hold back things until specific reporting milestones, and how accurate, both in actual content and in perceived content the communications are between the parties are critical. Many of the findings of this research indicate that frequent informal, accurate and timely communications shared in a way that includes both work and social interaction supports the development of trusting relationships between personnel while relying only on formal, highly structured and work only meetings does little to establish more than a purely transactional relationship.

### **5.3.5.3. The role > relationship > trust > technology cycle**

The interconnectedness between an individual's role, relationships with their virtual team colleagues and the level of trust they are able to build and maintain is both a strong theme throughout the data and one specifically evident as a virtuous circle in the cognitive map of the independent cohort. This virtuous circle, shown in Figure 68, brings together the four nodes of **issues need to be managed carefully between locations, developing cultural awareness in staff is important, mutual understanding leads to trust and trust is pivotal**. These four nodes provide a powerful example of the combining of roles, relationships, trust and technology where frequently the role of the individual, particularly those tasked with interface management, in a project virtual team is to manage issues for the betterment of the overall project in a culturally diverse environment. To achieve this outcome, they use the communication technology tools they feel best suit their needs to facilitate the development of a common, mutual understanding which in turn should lead to trust between individuals in different offices.

While many of the factors such as language differences and physical distances between geographic locations identified in the macrosystem of the model will remain constant, many other factors are exposed to change over time. Examples components of such chronotopicsystems that emerged from this research are:

- **Tenure** – as described in the data, as a project progresses the personnel engaged in them build their experience with working in virtual environments and expand their relationships into other offices, making them increasingly effective and valuable members of the overall project team.
- **Trust** – trust was described by a number of participants as something which builds over time as personnel recognise how they each deliver work and the quality levels of tasks expected by their colleagues. Through the passage of time personnel and teams in the offices of a project virtual team have opportunities to build transactional trust through on time delivery of work to the required quality, and individuals have the opportunities to build their working relationships into ones of interpersonal trust.
- **Standards knowledge** – a number of participants described how it was challenging for new offices and personnel to work to unfamiliar standards, and that it takes time for familiarity with the different standards to improve. Through the passage of time, and potentially through multiple projects for one location, the collective virtual team will build a greater level of understanding of project, regional and legislative standards, making each task a little more predictable
- **Location changes** – as virtual team projects progress, different offices and different personnel will join and leave the project. As described by a number of participants, each time there is a change, even of a single individual, relationships and lines of communication will also change. These changes will manifest through the need to work across different time zones and with different cultural balances as well as numerous other changes in organisational composition over time.

The project virtual team interpersonal communications environment model developed and described above presents a comprehensive picture of the complexity and interaction within these project virtual teams and how this interaction changes over the lifecycle of a project. Without such a model, it is extremely difficult to begin to understand and further analyse project virtual teams. The model described provides a foundation for the balance of the analysis presented below.

#### **5.4. Beliefs and expectations of project virtual team members at different levels and roles**

Through considering the emergent themes and cognitive maps for each cohort it is possible to compare and contrast the views of each cohort with their peers located elsewhere. In

addition, these comparisons can also be reviewed alongside the environmental model of project virtual teams communications shown in Figure 69 to examine it for relevance.

Table 9 below sets out the relative importance ascribed to the key identified variables by each participant cohort. High is used where the variable is mentioned and described by multiple participants in the cohort in a similar manner; medium is used where the factor is mentioned by only some members of the cohort; low is used where the variable receives little to no mention by members of the cohort.

|                              | Home Senior          | Away Senior          | Home Mid                 | Away Mid          | Home Junior   | Away Junior   | Independent |
|------------------------------|----------------------|----------------------|--------------------------|-------------------|---------------|---------------|-------------|
| <b>Relationships</b>         | Low                  | High                 | High                     | High              | High          | High          | High        |
| <b>Language</b>              | Low                  | High                 | Medium                   | High              | Low           | High          | Low         |
| <b>Culture</b>               | Low                  | Medium               | Medium                   | High              | Low           | Low           | High        |
| <b>Number of locations</b>   | Medium               | Low                  | Low                      | Low               | Low           | Low           | Low         |
| <b>Time zones</b>            | Low                  | High                 | Low                      | High              | Medium        | High          | High        |
| <b>Marginalisation</b>       | Low                  | Medium               | Low                      | Medium            | Low           | Low           | Low         |
| <b>Travel</b>                | Medium               | Low                  | Low                      | Low               | Low           | Low           | Low         |
| <b>Trust</b>                 | High                 | High                 | High                     | High              | High          | Medium        | High        |
| <b>Communications medium</b> | Rich or face to face | Rich or face to face | Flexible or face to face | Flexible / verbal | Email / voice | Email / voice | Rich        |
| <b>Procedures</b>            | Low                  | Low                  | Low                      | Medium            | Low           | Low           | Low         |

Table 9: Participant perceived impact of identified variables

### 5.4.1. Comparison of Senior Home and Senior Away

#### 5.4.1.1. Senior Home

Within the Senior Home cohort, participants identified their belief in the need for open and collaborative communication and that, to achieve this, there must be an environment of trust and respect between personnel. They described adopting a consultative communications approach rather than a command and control leadership style frequently found in engineering projects. Where participants identified adversarial communications, they outlined how this is

destructive for teams and project outcomes. Where trust was threatened or no longer present in their teams they also expressed concerns of this leading to overall project delivery problems.

On modes of communication, these participants described a preference for 'richer' tools and approaches, particularly preferring to meet face-to-face, either once only at project initiation or, more commonly, regularly during the project lifecycle. This cohort also identified a preference for video-based communications for meetings and, where that was not available, teleconferences. However, regardless of their choices of synchronous communication tools, email was still the ubiquitous default communication tool.

This cohort made little direct mention of the role of relationships in their projects, although they did recognise that positive relationships were beneficial. Similarly, while the majority of members of this cohort recognised the value of culturally diverse teams, much of it was superficial, focussing on the multicultural make-up of personnel located in the other offices in their team with little reference to how multicultural teams would positively or negatively impact the project, nor how they may contribute to the overall project outcomes.

In considering the suitability of personnel for virtual team work, many participants observed that they believed there were some beneficial personality traits. In their opinion, personnel need to be open communicators, able to rapidly build strong working relationships and to both earn and establish trust with their virtual colleagues. Equally, with at least one participant, there was an observation of the traits that make unsuitable managers of virtual teams.

This cohort emphasised their belief in limiting the number of locations forming a project virtual team to no more than 2 or 3 major offices. They described how, as locations are added, the cognitive and administrative load placed on the leadership of the project increases substantially, making the leadership of such an endeavour increasingly difficult until eventually leaders are overloaded with the task of communicating to their various locations and have little time remaining for day-to-day project leadership. Similarly, these participants discussed the travel requirements associated with leading a virtual team, recognising that the physical demands and commercial cost of travel can add a high load to a project leader.

The impact of time zone differences was recognised by this cohort, describing how large time zone differences impose additional workloads on their participants and leaders as they communicate outside core hours, late into the night or early mornings.

#### **5.4.1.2. Senior Away**

The Senior Away cohort had similar and different perspectives on many issues to their Perth based peers. Their views largely reflect their different lived experiences of being subservient to the Perth project home office, along with being located either in a different Australian city or another country.

Challenges identified by these participants in ensuring efficient and effective interpersonal communication were language differences within their teams and with those with whom they need to interface, where many of their co-located personnel may not speak the project language of English or where English may not be a strong language for them. Participants

described seeking personnel within their teams, often technical personnel, to act as ad-hoc interpreters. This difficulty was described as eroding the participants' efficiency and ability to distribute information in a consistent manner among their personnel.

A perception of marginalisation was also described by this cohort. They outlined feeling that, as they are not located at the heart of the project, they missed much of the back story and side conversations that made team communications more effective.

Similar to their Perth located peers, this cohort expressed a preference for richer forms of communication and face-to-face meetings. They described needing to build strong relationships with their peers and that they believed richer forms of communication enable deeper, more effective relationships. This cohort described a high reliance on email for day-to-day communication, for sharing data and to follow up and confirm agreements. Participants described being regularly overloaded with email, and for some, this resulted in hundreds to thousands of unread and unactioned emails in their inboxes.

Building relationships through face-to-face meetings and long-term collaboration were seen as key attributes in their roles. However, one participant identified the possibility of becoming too friendly, where project governance is ignored in favour of friendship, resulting in questionable decisions not being challenged at times. Overall, participants in this cohort described the need for a trusting relationship with their colleagues, spending a large proportion of their interviews considering how they form trust, which was largely through transactional means.

This cohort described their belief in the impact of many facets of cultural diversity on their teams. They discussed how some cultural differences add to the complexity of leading their teams and how these differences can also make leading a multi-cultural virtual team a more difficult experience than leading a mono-cultural one.

Participants described the attributes needed for a successful and effective virtual team member and leader. Such a person must be accessible, gregarious, open minded and comfortable speaking to others. In addition, they believed, team members must be willing to be contactable from very early in the day, before normal core hours and well into the night, long after core hours have finished; essentially to be available from the time they awake until they go to sleep.

The overall impact of time zones was something these participants expressed a lot of views on. Every participant was working on projects with time zone differences from either the Perth office or other offices engaged in their project and, as such, were all exposed to the challenges time zone differences bring. In recognising these challenges, they raised issues around the extended working hours accompanying multiple time zones and how different technologies need to be deployed to enable effective communication in this situation. They also described how, if poorly managed, time zone differences can result in substantial lost time, with work delayed for a day or more while answers are sought from an office multiple time zones away.



### 5.4.1.3. Comparing Senior Home and Away Cohorts

Reviewing and comparing the data and mapping for the senior participants, the following differences became apparent;

- **Language skills** - Senior personnel located in remote offices expressed a belief that language skills were a strong contributor to the ability of personnel to communicate in their virtual teams. While some recognition of these needs was also expressed by Perth based participants, the strength of opinion of those remote to Perth and therefore often working in environments where language is an immediate and tangible issue, indicates it is not as well recognised and appreciated by home office personnel.
- **Trust** - Trust was a strong theme for both cohorts. They all described how a trusting relationship is essential to effective virtual team communications. Where the methods for forming trust were discussed, participants from both groups described transactional trust as being most prevalent.
- **Communication Tools** - Both cohorts expressed similar preferences for richer communication media such as videoconference and one-to-one video, also describing a strong preference to meet face-to-face at project initiation and regularly during the project lifecycle. They described how, regardless of the richness of their preferred person-to-person tools, they still relied heavily on email for any communication needing recording, with email also often being considered necessary to follow up on verbal agreements.
- **Skills for virtual teamwork** - Both cohorts identified there was a particular 'type' of person best suited to virtual teams and, in particular, to working as an interface or leader of a virtual team. Both cohorts described similar traits as valuable, including an outgoing and gregarious personality, approachable and of a stable temperament and someone comfortable being contactable outside of normal office hours wherever they are located.

### 5.4.2. Comparison of Middle Home and Middle Away

#### 5.4.2.1. Middle Home

A major challenge described by the Perth based Middle Home cohort was of communication channels; managing how information was shared, ensuring that it was shared with the those who needed it and that an excess of information did not lead to information overload. Many participants indicated that their organisations and/or projects had attempted to codify their communication structures and then became frustrated when personnel went outside of these defined channels, suggesting that this codification was either misdirected or causing problems for the project personnel.

Alongside the issues with dissemination of information, participants outlined difficulties with language barriers, describing how communicating can be challenging when not all personnel are fluent to the same degree in the project language. Language barriers were raised in the

context of difficulties in building relationships, where if individuals struggle to express their thoughts, they also find it hard to build trusting relationships. Overall there was recognition that alignment of understanding and objectives was essential to a successful project outcome, but that this was a major difficulty in virtual teams.

When considering communications technology, this cohort expressed a preference for rich platforms such as videoconference and, when video was not available, telephone. Videoconference had, for some, been corporately mandated to contain operating costs through reducing business travel. Despite this situation, their preference was still to meet face-to-face where possible. However, participants also described preferring to use text based instant messaging communications tools to monitor the availability of their virtual colleagues as well as to communicate with them.

Relationships rated highly in this cohort's described experiences. Many participants described relying on the strength of relationships with their colleagues to ensure work met project requirements, with no surprises resulting from communication breakdowns. Many participants described building relationships with their virtual colleagues over an extended period, showing and receiving respect from one another, and including social interaction when they had the opportunity through face-to-face meetings. As it was generally expressed, they believed they would work better with someone who would 'go the extra mile' for them as friends and trusted colleagues than with a stranger.

Participants described cross cultural challenges from both national and office perspectives. They saw different office cultures as being as challenging in some situations as national cultures, even when working with other Australian offices of the same company. They believed business cultures differ between cities or states.

The impact of time zones did not receive a lot of attention from these participants. The exception was one participant who had recently worked on a project split between Perth and South America, where he dealt with extreme time zone differences. This low level of discussion on the subject may be a result of home offices dictating the timing of meetings, generally to suit their own time zone.

#### **5.4.2.2. Middle Away**

Language differences were identified as a major issue by participants in the Middle Away cohort. Many, particularly those in international locations, were working in highly diverse teams, with personnel from multiple cultural and linguistic backgrounds, continually exposing them to the challenges of communicating with non-English speakers. They described non-verbal communication challenges through cultural differences such as personnel not challenging authority figures in meetings and not raising their lack of understanding when discussing tasks. Overall, this cohort considered cultural diversity to be both a benefit and challenge, recognising that cultural differences make for more dynamic and interesting workplaces while also introducing additional communication challenges.

Alongside communication issues, some participants described feeling isolated from the home office, feeling they were missing out on many home office-based discussions, only receiving information when others thought they needed to know. They described attempting to plug communication gaps with organisationally defined communication matrices, but also recognised that many individuals needed to be able to have direct conversations outside of any mandated, formal structure while also keeping the overall project leadership informed as necessary.

Most of this cohort expressed frustration at the volume of email they had to manage on a daily basis, including following verbal agreements with email confirmations of outcomes. Overall, this cohort expressed the view that while they preferred synchronous, verbal communication and videoconference where available, they relied equally on email for regular contact with their colleagues. Verbal communication though was specifically referenced by a number of this group as being the best way to coordinate day-to-day tasks, resolve disagreements and clarify uncertainty.

The value of relationships between personnel was recognised by all participants in this cohort. They described their belief that strong relationships need to be built and maintained. In the case of one project, relationships had been enhanced by secondments, with personnel transferring for weeks to months to work in another project office. These transfers allowed personnel to build deeper personal relationships with their virtual colleagues than are generally possible using electronically mediated communication.

This cohort identified a number of characteristics they considered important for an effective virtual team project manager. They considered that the individual must have a strong personality, not be afraid to speak up and raise issues, be an accomplished manager rather than a technical engineer, someone comfortable working under pressure and to the demands of a client, a team player rather than an individual and a self-sufficient self-starter. Members of this cohort described how these traits are not readily found in the majority of project managers and personnel, so one challenge they identified was to find ways to build these skills in the workforce.

Trusting that the required, agreed and expected work is being done when those performing it are out of sight of the other office was also recognised as a challenge by this cohort. They identified that a lack of visibility of progress can lead to distrust, and that following-up and pursuing status information is a time-consuming task, adding to the overall cost of performing the project.

Coordinating work across multiple time zones was described as a major challenge by many in this cohort. They described how communication planning needed to account for time differences so that other locations could respond in a timely manner without compromising the project schedule. They also commented on the impact of time zone differences on the personal lives of those working as an inter-office interface, where these individuals were frequently required to communicate outside core hours.

Alignment and integration of personnel was recognised by these participants as a major task in virtual teams. One participant observed how every new team brings new challenges, they outlined their tactics for team alignment, describing preferences for either a face-to-face meeting for all key members of the team or, at the minimum, a video meeting or conference call to align all members on the goals of the project. They also observed that, in their experience, when projects do not hold an alignment session, outcomes are typically poor.

Organisational culture was raised as a major contributor to the effectiveness of a virtual team and the ability of its members to communicate efficiently. At least one participant, referred to as FC34B, observed how their organisation had a “cult of procedure”, where the capacity of the individual and the abilities of those individuals to excel had been overtaken by the organisation’s desire to proceduralise everything, leading to a poor working environment, a siloed organisation and the emergence of a blame culture where one office sought more to blame others for issues than to build relationships that facilitate mutual success and better outcomes.

#### **5.4.2.3. Comparing Middle Home and Away Cohorts**

Reviewing and comparing the data and mapping for midlevel participants, the following differences became apparent;

- **Language skills** - The recognition of challenges working in a multilingual team were more prevalent in the away cohort of these participants and strongest in those in international locations. Their day-to-day exposure to language differences, where personnel are speaking not just their own native language, but the language of the host community made language differences a normal part of their working lives. Conversely, Perth based participants, even when working with co-located personnel for whom the project language (English) was not their first language, were still in an environment where English language skills are assumed and taken for granted.
- **Time Zone impact** – As with the language skills noted above, the impact of time zone differences appears to be more readily recognised by non-Perth participants. These participants self-identified as being prone to experiencing much of the negative impact of time zone differences and physical separation from the home office, experiencing marginalisation and isolation from home office discussions, being assigned work without context, and often being expected to participate in electronically mediated meetings outside of their core business hours.
- **Culture** - The away cohort described a strong perception of the impact of culture on their virtual team experience. Culture, and in particular national cultures were a day-to-day experience. Meanwhile, home office participants described culture more as something which colours their dealings with remote office personnel rather than part of their normal experience. For the home participants, culture is something to overcome while for the away participants it was part of who they are.

- **Relationships** – All participants described needing strong working relationships between personnel on each end of the virtual team structure, particularly those tasked with day-to-day work coordination. They identified requirements for team building and finding opportunities through face-to-face and ongoing regular discussions for relationships to be established, maintained and grown. They also recognised the value of pre-existing relationships, developed through previous projects as helpful in getting a team started more quickly.
- **Coordination** - It was apparent that many participants on both sides of the Home/Away relationship held responsibility for the majority of day-to-day coordination between offices. As such, this cohort was integral to much of the regular daily and weekly communications with other offices. These individuals had the late night and early morning calls outside of core hours and were tasked with disseminating information to their co-located colleagues. In this capacity, both the home and away personnel reported similar experiences of antisocial hours.
- **Trust** - Both cohorts identified trust as an important factor in establishing a solid working relationship. Away cohort participants recognised also that it can be difficult in a transactional trust relationship to maintain trust without being able to actually observe progress first hand. They described how relying on periodic updates and the receipt of deliverables made personnel in the home cohort uncomfortable, leading to a less than ideal level of trust between offices.

### **5.4.3. Comparing Junior Home and Junior Away**

#### **5.4.3.1. Junior Home**

The junior home cohort emphasised their belief in the need to have a single point of contact in each office responsible for day-to-day task coordination. They described these roles as separate from that of the Project Manager, with the specific role of managing day-to-day interpersonal interaction, rather than overall project leadership. The primary responsibility of this role of ensuring a reliable and consistent flow of information between locations was, they believed, extremely important to the effective use of a virtual team. The personnel assigned to this task are expected to be in almost constant communication with their equivalents in the other locations.

While this cohort outlined how they used e-mail for much of their communications, they also used tools such as telephone and where available, videoconference. They recognised that while email was the default communications tool, it is also prone to misunderstanding and miscommunication due to its lack of nuance. With the option to use videoconference however, while this was available to most of the teams, they appeared to only use it on rare occasions, observing that it was hard to book a room in all locations where the equipment was available.

Participants described a preference to deal with personnel they considered easiest to talk to. Some of these they had previously worked alongside in co-located teams, often through project-based company secondments. Building deeper, more trusting relationships was a

factor many in this cohort described as valuable in virtual team environments, with trust allowing personnel to be comfortable making suggestions for changes and to establish faith that their virtual colleagues would deliver on their commitments. Where pre-existing relationships were not present, some described believing the project would run more slowly while relationships were established, placing an increased emphasis on effective relationship building exercises being conducted at the outset of the project. A number of this cohort observed being more likely to work harder for a friend than someone they don't know.

Culture and its impact received little mention from these participants. They briefly discussed the need to understand the project culture and how to fit-in, with some observations on the negative differences some individuals had experienced when working with offices where a different national culture was prevalent, but overall it was not a strong theme.

Characteristics of an effective virtual team member received a high level of comment from these participants. They described how effective virtual team members need to be patient and work to understand their colleagues; agree rules and guidelines covering sharing of status information and progress; and be proactive, self-aware and enthusiastic communicators. This cohort also recognised that many of these traits are hard to find, describing a view that industry needs to find ways to develop these skills in personnel. Another trait considered important were a calm and controlled temperament. They also indicated the importance of having personnel who share updates and information honestly and are sociable when dealing with others. These individuals were also described as needing to be comfortable with ambiguity, not becoming suspicious, micromanaging or reacting when things may not run as planned or when plans need to change.

Another challenge identified by these participants was the difficulty for personnel in one office to understand the skills pool in other locations. They described believing that personnel become commoditised and categorised by their resume when they may have additional skills that are not recognised.

Working with complicated time zone differences was discussed by this group. Some participants were working with both time zone and working week differences. Specifically, one office worked a Monday to Friday week while their colleagues' week was Sunday to Thursday. This variation produced both advantages and disadvantages in delivery of work but, for those directly involved in coordinating the work between the offices it extended their 'on call' days from a normal five days made longer by time zone differences, to six long days to enable issues to be discussed on days when one office or the other was not working.

#### **5.4.3.2. Junior Away**

The Junior Away participants located in offices other than Perth, shared similar themes but contrasting experiences and observations to their Perth based colleagues.

These participants identified the risks associated with not communicating sufficiently between offices and consequently not sharing relevant information within the local team, as leading to the project potentially going off track. They expressed a strong belief for there to be

at least one appointed point of contact at each location tasked with sharing and disseminating information. Risks from individuals communicating between offices and not keeping the nominated contact person informed were discussed, with participants recognising this could lead to misdirected work, gaps and overlaps in effort.

Language was described by a number of participants as a challenge to overcome. With many of their co-located colleagues and many participants themselves having English as their second language, they described how messages become confused and miscommunication is a major risk to be aware of, to ensure messages are conveyed and tasks understood before work commences. They described how this can be difficult when the task is received by email with several hours' time zone difference between offices. This situation can mean a task is assigned to someone working in a virtual team at the same time as the person assigning the task is leaving for the day. Those receiving the task receive it early in their day, with the task poorly described such that the recipients may not fully understand their objectives. The recipients may start work on the task without fully understanding its specifics, expending a number of hours on it, possibly even completing it by the end of their working day, only to find they have been working on the wrong aspects of the task and have wasted a day's work.

Personnel being too busy to communicate with one another was also a challenge these participants identified. They described situations where task focussed personnel would not communicate with their colleagues, letting too much time pass before finally speaking, at which point the relationship is beginning to falter and work may have begun to go off track through lack of coordination.

When discussing communication tools, they described a mix between voice and email. A number of participants described using email as their preferred primary tool and following up with an audio discussion. Others described a preference to call first then follow up with an email to confirm the outcome. This cohort did not make any substantive mention of videoconference as being a part of their normal communication plans, though at least one described using desktop sharing tools so that both parties could review the same document in discussions.

This cohort discussed the role of relationships between personnel located in each of the virtual team offices. They described believing having deep, trusting relationships between key personnel was important to ensure projects ran smoothly. Many participants believed meeting face-to-face helped build relationships and that, once in place, these relationships strengthened collaboration. In contrast, some participants did not believe face-to-face meetings were of benefit, stating they could establish a good enough relationship through ongoing electronically mediated dialogue.

As with the junior home cohort, cultural differences received little attention from this group. This cohort presented as highly focussed on the technical abilities of their virtual team colleagues and less concerned with any cultural differences.

When describing the attributes of effective interoffice virtual team coordinators, they recognised they needed to be proactive communicators who would reach out to other offices and not wait to be contacted. They also believed these individuals needed to be technically proficient to discuss details with personnel from other locations, approachable team players who would not bring personal agendas to discussions.

The impact of time zone differences between offices was highlighted. Participants described their beliefs that while sometimes time zone differences could be used to the benefit of the project, such as when working between Perth and Dubai with both a 4-hour difference and a different working week, the physical separation also means it is not always possible to know if the other party is in the office and, even if they are, whether they are contactable. In describing the negatives of temporal separation, they outlined how sometimes it is not possible to contact the other party as they are uncontactable outside of core office hours, meaning questions may go unanswered for a full working day. Within this research, this situation was most clearly explained by the Sydney personnel who had, on occasion, to deal with their Dubai colleagues, a nine-hour, full working day separation where specific planning was undertaken to have synchronous discussions between the personnel.

While the concept of trust did not feature highly with this cohort, some participants described how they establish trust with their virtual colleagues. They described building trust through the transactional experience of working to demonstrate they can deliver the work as required on time. Once this transactional trust is developed they would then maintain it through reliably meeting expectations.

While the majority of these participants recognised the need for team building exercises between personnel within a virtual team, along with alignment over deliverables and project outcomes, the majority advised that it was rare for them to have face-to-face meetings. They described their normal experience as having an electronically mediated discussion to agree deliverables and responsibilities but not to get to know one another. Several of this cohort also commented that it was the role of their managers to ensue alignment, and that they believed their managers should establish both the goals and form for the relationships between personnel. In this they described their responsibility as the delivery of technical work only with no requirement to establish relationships.

#### **5.4.3.3. Comparing Junior Home and Junior Away Cohorts**

When comparing Junior Home and Away cohorts it became evident that many of the differences of perspective seen in the Senior and Mid-level cohorts were also present.

- **Coordination** – The junior level participants of both cohorts recognised the need for dedicated interface personnel at each location. These personnel would have primary responsibility for ensuring work performed is coordinated, all personnel are aware of the status of work being undertaken in other offices and how all the tasks are interconnected.



- **Time Zones** - both home and away cohorts described the difficulties of working across multiple time zones. They outlined how these differences often lead to unsocial working hours for those needing to speak to personnel in other locations. Those in the home group generally referred to time zone differences in the context of the difficulty of communicating with the personnel in the other location. Away group participants referenced these difficulties manifesting in delaying their ability to resolve questions on tasks assigned from the other office once the personnel responsible for the assignment have left for the day and are no longer contactable.
- **Communication tools** - There was a notable preference expressed by most members of this cohort for audio and email coupled with audio and document sharing for their discussions, in place of richer video technologies preferred by their senior colleagues. Within this cohort it appears the tools they prefer reflect how they are required to interact. This cohort's interactions are more tactical, discussing specific technical matters requiring the parties to access technical material shared either by email or through a shared server.
- **Relationships** - Each of these cohorts described relationships differently. The Perth based cohort outlined how they preferred to deal with people they knew, but that building relationships with new personnel to the point where the other person was a known entity could delay the progress of the project. In contrast to this, the non-Perth members, focussed on the need to have deep and trusting relationships between personnel in the various locations to allow them to collaborate effectively.
- **Interoffice coordinator** - The need for, and characteristics of, an effective interoffice coordinator were described at length by both cohorts. They expressed their desire to have an appointed individual within each office responsible for day-to-day coordination of work. Both groups described their belief that, while this individual should have general responsibility for ensuring information was shared between the teams, it should not be at the exclusion of individuals being able to communicate directly as needed, as long as the coordinator was kept apprised of matters with a broader project impact. There were differences in the level of detail used to describe the characteristics of these coordinators, with the away cohort believing the person needs to be technically proficient and both a proactive team player and approachable, while the home cohort did not raise the need for technical proficiency, focussing instead on them being structured, even tempered and balanced communicators, comfortable with the ambiguity in virtual team interaction.
- **Trust** - Trust between virtual team colleagues received only a small amount of discussion from each group within this cohort. They recognised the need for trust between colleagues, identifying trust as a mechanism for better and smoother interaction, allowing individuals to raise potentially contentious issues without fear and underpinning the ability to have faith that colleagues are delivering to the agreed dates and quality. Interestingly, both groups in this cohort described a very transactional form

of trust when considering its development in their teams, basing the development of trust on the predictability and repeatability of virtual colleagues to deliver on time.

#### **5.4.4. Independents**

The independent participants form a standalone, contrasting group to the other participating cohorts. Where other participants were interviewed while in active projects, providing observations on their immediate lived experiences which were visceral and at times painful, the independent cohort's perspective was very much one of reflection. At the time of interview, they were no longer part of an active virtual team project, but through their recent participation in such teams they had faced similar challenges and had then had the opportunity to reflect on their experiences. Their reflection allowed them to develop different, less immediate and reactive insights into communication in virtual project teams.

The independent cohort comprised predominantly senior with some mid-level personnel. The views of those in this cohort therefore relate most strongly to those of the senior active cohorts discussed earlier in this chapter.

##### **5.4.4.1. Independents observations**

Several independents commented on the reluctance of some personnel, particularly home office personnel, to support and engage in virtual team work. It was their view that these personnel felt threatened by sharing work they believed was theirs to undertake by right and, that through sharing this work, they were placing their own longer-term positions at risk. Within projects where this was encountered, support from the organisation's senior leadership was required to assure resistant personnel that the organisation believed that through virtual teaming they could build a stronger business, generating more work for Perth and remote based personnel alike.

Participants commented that one of the biggest challenges of running an effective virtual team is that, within the organisational structure, team members are often controlled at the local office level rather than centrally by project management. Consequently, when a local priority arises, whether part of the virtual team project to which the individuals are assigned or not, local pressures to address this issue can overtake the demands of the virtual team project. Personnel get reassigned for hours, days or longer and the virtual team project management may not be aware of this. Indeed, even if they are aware, they may not have the influence or organisational authority to ensure their project is not compromised by these actions.

These participants also commented on the impact of time zone differences on the ability of personnel to collaborate and execute work. They reflected that the concept of 24-hour work, which has been part of the virtual team ideal for many years, can become a 24-hour delay if personnel required to perform a task cannot obtain timely clarification from those who assigned the work. Work can be delayed waiting for clarification or performed only to find it has been undertaken on inaccurate assumptions and incorrect interpretations of instructions, resulting in wasted effort, rework and delays. One participant highlighted the challenges of getting other

offices to recognise and implement a sense of urgency when they're remote from much of the day-to-day project discussions.

While email once again was identified as the ubiquitous tool for communications, this cohort expressed preferences for richer tools. They described a preference for videoconference as the first choice of electronically mediated communication, followed by telephone. Video was considered their preferred platform as it provides a more complete perspective of call participants, giving body language alongside voices, allowing participants to gauge the commitment, engagement, agreement and dissent of those on the call. Email, while broadly used, was also considered a poor tool for communication. Respondents described email as being easy to misinterpret, too easy to receive a negative reaction from either the recipient or others seeing it out of context, as well as the source of overload in virtual teams.

Some members of this cohort discussed the challenges of building new relationships without the ability to meet face-to-face or have a video meeting. They observed that relationship building takes longer using only telephone and email, and that these relationships may not become as strong as those initiated through face-to-face meetings or video.

Establishing and maintaining strong relationships between personnel was a strong theme from this cohort. Every participant expressed their belief in the need to commit a significant portion of a leaders' time meeting with personnel in their base office and, when possible, with personnel in remote offices to build relationships. The amount of time suggested for this varied between participants, but at least two suggested that 50 percent of a leaders' time should be invested this way. Where it is impossible for the project leader to spend time in each office, there was a strong belief among this cohort that a delegate should be in place at each office in the virtual team to build and maintain relationships at a local level and interface between the project leadership and the local offices.

There was a strong discussion of the role, challenges and value of cultural diversity from this cohort. Participants commented on aspects such as the value of cultural diversity in gaining different perspectives on project challenges. They also discussed challenges of cross cultural communication when the dominant project cultures have very different power distances, where personnel from one culture are comfortable in speaking their mind in any setting while others are culturally limited in their ability to speak in settings where they may feel they are meeting with organisationally superior personnel. Some participants described working in a cross-cultural organisation to be an enjoyable and engaging experience. To them, learning to understand others' perspectives was as rewarding as the technical and contractual achievements of their projects.

Several participants expressed a belief that virtual team leader attributes were a specialised skillset not commonly found in traditional leaders and managers. They believed it was necessary to have a nominated leader at each location and not simply one project manager leading a team fragmented across multiple offices. They believed local leaders need to be open and active communicators, comfortable working autonomously with their local team to deliver their assigned work without day-by-day direction from the overall project manager.

One member of this cohort, who had been in such a role, described their function as being 'the funnel', ensuring messages were shared between offices and coordination was an ongoing and continuous function.

The impact of time zones on a virtual team member's ability to communicate was discussed by a number of participants. As with other cohorts, this group observed how, as time zone separation increased toward 12 hours the ability to hold meetings without inconveniencing at least part of the team diminished. Risks associated with an office starting work on tasks which arrive as the sending office is closing for the night were highlighted by a number of members of this cohort, where work could be started only to discover the following day that the requirements were not what was anticipated, and the time had been wasted. Participants recommended that the least inconvenient time needed to be found for discussions between large time zone separated offices, and that discussions should be held before any major new task were commenced to reduce risks of wasted effort.

As with all of the other cohorts, trust was considered by these participants as pivotal to the success of their team and projects. They described the development and maintenance of trust as a critical activity and the ability to build trust as a necessary strength for a virtual team member, particularly anyone required to interact regularly with remote colleagues. The form of trust discussed by these participants was once again transactional. Many discussed learning to trust their virtual colleagues based on their reliability to deliver quality work they had committed to on time. Some participants discussed more relational based trust, but these were relatively uncommon within the group. Where trust was acknowledged as present within their teams, participants believed it helped overcome issues that arose and, where the entire problem could not be addressed and resolved through trust, it was at least a contributing factor in managing and shortening the resolution process. They describe the problem in an environment where trust either is not present or is weak as not having the confidence that personnel remote to them are working on their job; personnel not doing the things correctly, or delivering late, leading to micromanagement and an ongoing difficulty in subsequently building trust.

Many participants described corporate culture as a difficult thing to address. Describing situations where two offices of the same company may have very different views of a project and how its goals are to be achieved, combined with different corporate cultures around distribution of information, allocation of blame for problems and technical ownership of work, were all issues, they believed, impeded the smooth execution of work.

#### **5.4.5. Level by Level Comparison**

From the above discussions of the views of each cohort within a seniority level, then the views of each combined level, it is now possible to develop an understanding of the how the principal themes emerging from this research are reflected in the views and experiences of each group of participants and to compare and contrast these views across the three levels of

seniority. This analysis will assist in developing an overall understanding of interpersonal communication within virtual project teams.

Following is a series of discussions of the differences and similarities of experiences and beliefs of personnel at each level.

#### **5.4.5.1. Seniority Levels**

There are three major levels of organisational seniority considered in this research, senior, mid-level and junior staff:

- The **senior level** comprises business leaders, project managers and directors holding primary responsibility for the overall delivery of the projects investigated along with, in some instances, responsibility for the day-to-day operation of their office.
- **Mid-level** participants have roles such as interface manager and engineering manager. They are generally responsible for delivery and coordination of work between locations to meet overall project requirements. They typically report directly to members of the senior cohort within their project and oversee the work of the junior cohort.
- The **junior staff level** comprises participants primarily undertaking day-to-day delivery of discrete project tasks. Their work is highly task based and they have little influence on the overall project strategy or business decisions. However, due to the task-based nature of their work, they have a requirement to communicate frequently with their virtual team colleagues on technical matters.
- Alongside these three hands-on cohorts, is the **independent** cohort who provide a reflective perspective from recent experiences with virtual teams and the interpersonal communication challenges encountered.

#### **5.4.5.2. Relationships and Trust**

The entire senior and independent cohorts were consistent in their belief that trust is a central theme in establishing a virtual team environment of open and effective communications. Their belief was that relationships build trust, that preferably, personnel need to spend time face-to-face, in an environment where they can agree the scope and distribution of the work, the manner in which issues will be raised and resolved, how overall project communications would be managed and undertaken and also have the opportunity afforded by their time together to get to know one another better, sharing both work and life experiences. It was through these relationships that these cohorts believed trust is established and maintained.

Both the mid-level and junior cohorts also placed a strong emphasis on relationships and trust. As their roles and communication requirements changed, from strategic, future focussed responsibilities of many mid-level personnel to the functional, task orientated roles of the junior personnel, so the nature of the trust they described changed from relationship based to

transactional, with junior personnel regularly referring to trust being dependant on their virtual colleagues delivering work on time and to the right quality.

This expressed connection between time spent communicating, professional and interpersonal relationships between members of virtual teams and the ability to build and maintain trust is depicted in the microsystem within the communications environment model shown in Figure 69. The discrete themes of communication activity, relationships and trust are shown interconnected as part of the broader mesosystem alongside preferred technology discussed below and the role of the individual.

#### **5.4.5.3. Communication Tools**

While the majority of participants in all cohorts identified email and telephone as their default communication platforms, there were some discernible differences in platform preference visible between levels. Senior level participants described a preference for richer platforms, most particularly video conference tools, for many of their meetings. Many of these senior participants stated how their absolute preference was for face-to-face meetings but, with time and budgetary constraints they were moving, either through personal choice or corporate instruction, to videoconference where available. Within the mid-level and junior cohorts, the use of audio (both telephone and tools such as Skype audio) was still their normal communication platform, supported by email and accessing shared documents on computer servers.

Many of these preference differences can be explained by participant's different roles and frequency and location of their communications.

- Participants in junior roles generally discuss technical documents which they 'share' or view concurrently via a shared server or email, discussing technical matters associated with these documents by audio while viewing them. They described these as technical discussions, occurring without the need for either a substantial pre-existing relationship or for any video. They considered these interactions as simply an appreciation of shared technical expertise relevant to the task.
- Mid-level personnel were typically coordinating activities across the team, necessitating a need to speak frequently, often outside core business hours. This cohort's work brings with it a need to build and maintain strong trusting relationships with their colleagues to ensure they can be confident work is occurring as agreed. They described a preference to build relationships through face-to-face meetings at the commencement of a project and via ongoing face-to-face and video interaction to maintain their relationships. They considered social discussions on subjects outside of work as important to relationship maintenance, but also described being comfortable using tools such as telephone and email as being most convenient and efficient for their needs.
- Meanwhile, the senior cohort had more strategic, broad ranging roles, requiring communication on a diverse range of issues. While they may communicate frequently

with those in other offices, much of their communication was via regular, structured and formally managed meetings. The regularity and formality of their meetings lends itself well to videoconference. They have the ability to make regular room bookings to secure access to technology and, being senior management within their offices, they have the corporate authority to occupy the boardrooms and major meeting rooms housing the videoconference equipment. Additionally, this cohort expressed a preference for personal contact as part of relationship building. Once again, this appears to result from their need to be part of more broad reaching discourse.

|            | Senior  | Mid level  | Junior  |
|------------|---|--|---|
| Usage      | <p>Strategic meetings held regularly and calendared. Typically using “board room” facilities within each office.</p> <p>Regular team meetings or one on one discussions with senior personnel from other locations</p>                                    | <p>Ongoing, regular, multiple instances per day of discussions with colleagues in other offices to coordinate tasks.</p> <p>Described frequently talking outside of hours from home or other locations</p>   | <p>Tactical one to one discussions over technical matters such as questions regarding content of drawings and other written material.</p>   |
| Preference | <p>Rich media and face to face meetings.</p> <p>Participants described a preference to meet regularly and where possible will use video facilities for their regular meetings. Where video is not available they will use voice via conference calls.</p> | <p>Telephone and email were the described preferences, these media provide flexibility and ease of use and can be used in practically any environment.</p> <p>Described a wish to have regular face to face meetings also to build and maintain trusting working relationships with their key contacts</p> | <p>Described a preference for telephone, email and document sharing.</p> <p>Participants outlined their use as being largely one to one and mostly occurring during office hours.</p> |

Table 10: Communications media usage and preferences

The role played by the availability, provision and selection of communication tools is depicted in the communications environment model shown in Figure 69. Available technology is placed in the macrosystem, supplied technology in the exosystem and the individuals preferred technology choices in the microsystem, forming part of the mesosystem of theme interaction within the microsystem environment.

#### **5.4.5.4. Time Zone Impact**

Benefits and challenges working across time zones were addressed by all participants. Primarily they discussed how increasing time zone differences between locations impedes effective synchronous communication; how it is possible to execute work on an extended day and potentially up to 24hrs a day; how communicating with personnel in different time zones can become increasingly anti-social, impacting the non-work time of those tasked with communications and how; when work is happening remotely during non-work time of the central office, it can easily go off track, with effort wasted in expended time and waiting for responses to questions.

In considering difficulties of synchronous communications over large time zone differences, there was a common recognition of this being problematic for all three levels. Senior participants had to carefully schedule meetings to find the least inconvenient time for all parties, and mid-level and junior participants found themselves frequently communicating outside of core hours. The alternate discussed, was to rely on asynchronous tools such as email, but the senior participants expressed a belief that while these platforms were ubiquitous and for many their default tool, they were not as effective as voice or video.

Several senior participants discussed how extended working days made possible by having personnel in different time zones could accelerate tasks, providing examples of work that had been executed in one day. However, they also cautioned on the risks of pursuing this to the detriment of product quality, explaining that, in their experience, things can go wrong quickly when pursuing fast responses. Work could be misdirected and, without explicit directions some tasks can become stalled, waiting until the home office reopens for personnel to respond to questions.

The negative impact of time zones on personal time was recognised as a common problem for virtual teams. Participants described how, as time zone differences increase, it becomes progressively harder for personnel to communicate synchronously within normal work hours, reaching the point at around 9 hours difference where one or both parties must either adjust their normal workday toward the time zone of the other party, work extended days, or communicate outside of work. Many senior and mid-level participants described communicating with other offices late into the evening or early in the morning, leading to fatigue and, as some described, frustration at being on-call during personal time. One participant described attempting to find an equitable time to hold a regular team meeting between two offices separated by 12 time zones. The first approach was to alternate between early mornings and late evenings for the two locations but that was quickly identified as a culturally difficult model as the practice in one location was to start work early and the other to work late. Consequently, the organisation agreed on a fixed time that was as convenient as possible for both. Figure 71 depicts the way in which time zones impact the selection and use of communications media in a virtual team environment.



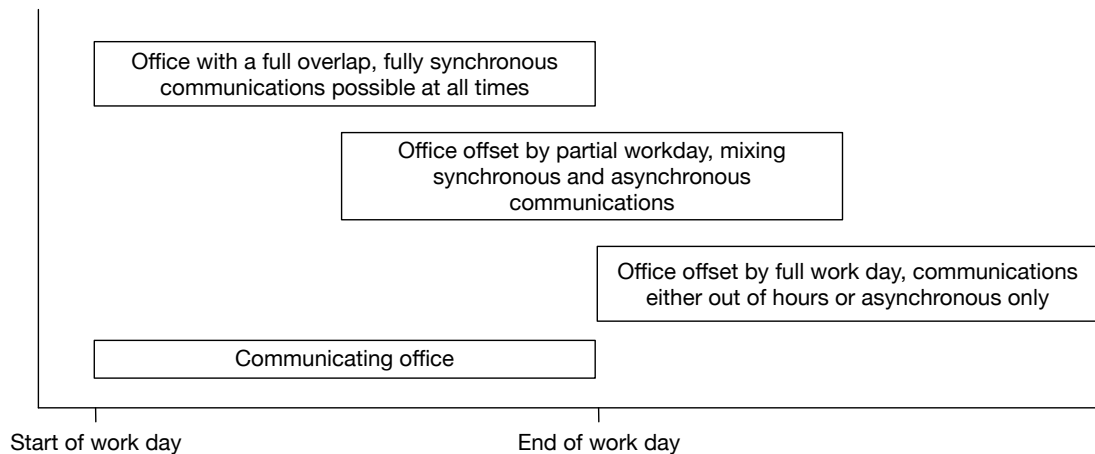


Figure 71: communications media use and time overlap

Time zones feature in the macrosystem of the communications environment model shown in Figure 69 where they are a combination of time and location, since the locations chosen for placement of the virtual team offices establishes the time zone differences between the locations. Chosen locations is therefore situated within the mesosystem of the model since this is a variable the project leadership can control.

#### 5.4.5.5. Culture

Culture was discussed in a number of different ways by participants. While some challenges of working in multicultural teams was described in the interviews, the principal focus on culture centred on the culture of the project organisation.

For many, particularly senior cohort participants, culture was associated with corporate and project culture. They described how corporate culture impacted their ability to communicate effectively and achieve the required project outcomes. They identified power differences between personnel in different offices, where a manager in one office may not be supportive of the project using their personnel in a virtual team structure, believing this put their office's ability to achieve its corporate performance criteria at risk. Consequently, these senior leaders believed some managers may withdraw personnel from the virtual team to use on a local project if the opportunity arose, allowing them to meet their corporate KPIs but potentially undermining the virtual team project in the process.

Additionally, participants identified situations where there may be a poor personal relationship, or even animosity between personnel at different offices. In this situation, they believed, these individuals may resist supporting a virtual team project controlled by those with whom they don't have a good relationship.

Participants discussed how some organisational procedures and practices may not reflect the reality of how the virtual team is expected to operate, placing barriers in the way of their own projects. One mid-level participant, FC34B, referred to a "cult of procedure", with the organisation so focussed on compliance to its own procedures it failed to recognise that these

procedures may be undermining its own effectiveness and, in doing so, limiting the ability of its personnel to interact effectively for their project to be successful.

Within the communications environment model shown in Figure 69 culture is situated in the macrosystem where it represents national, regional and professional cultures that are external to the culture within the organisation and project. Project and organisational cultures within the control of the organisation therefore form part of the organisational norms theme shown in the macrosystem.

#### **5.4.5.6. Coordination of Work**

Interoffice coordination was another common theme, particularly within the mid-level, junior and independent cohorts, all of whom identified a need for a dedicated and potentially single point of contact at each office within the virtual team. The perspective of the senior participants was of overall project leadership and the challenges of interfacing with personnel in other locations. They discussed the demands of coordinating work between offices at a strategic level, maintaining open and honest discussions and exchange of information, keeping key personnel informed of the status of work and issues that arise as the project progresses. In this capacity, these senior personnel described their role as one of coordination and strategic control of the project, often coordinating work through their control of others.

The role of single point of contact identified by the mid-level, junior and independent participants was seen as very important to the success of a virtual team project. Many discussed specific attributes of a successful incumbent of such a role including approachability, willingness to work extended hours to support the needs of the overall project, and being even tempered and comfortable dealing with the ambiguity often present in a virtual team environment. Junior away participants also believed that this person should be technically proficient in the industry of the project to enable them to deal more effectively with the other offices, but this requirement was not reflected by members of any other cohort.

The coordination of work within the communications environment model depicted in Figure 69 is shown as communication activity within the microsystem, where it is enabled by that system's mesosystem interaction. It is also depicted at the organisational level as location interaction in the broader exosystem.

#### **5.4.5.7. Suitability for Virtual Team Working**

Participants in all cohorts outlined their belief that some personnel are better suited to key roles in virtual teams than others. They pointed out that in large virtual teams, with groups of personnel at each location, many personnel have no direct involvement with their virtual colleagues, but that in small teams such as some who participated in this research, many or possibly all members may have substantial levels of interpersonal communication with those in other offices. Consequently, dependant on the size of the team, it may be possible to allocate personnel to different roles depending on their suitability and personal preferences. Several members in each cohort described how being required to interface frequently with virtual colleagues requires that individuals be more extravert than introvert and comfortable

with reaching out to relative strangers frequently to ensure all personnel are fully aware of project progress and ongoing requirements.

On the negative side, some participants in the senior, mid and independent cohorts observed how some personnel were resistant to virtual teaming, believing that it could undermine their future job prospects.

The suitability of an individual to their project virtual team roles is depicted in the communications environment model shown in Figure 69 within the individual core of the model. Many of the attributes that emerged from this research are further described below.

#### **5.4.5.8. Language**

How language skills impact interpersonal communications in virtual teams was primarily discussed by the 'away' participants in all cohort levels, particularly those in overseas offices where the local workforce had English as a second or third language or, in some cases not at all. These participants, exposed to the challenges of working across linguistic barriers on a daily basis, described having to find colleagues to act as interpreters, or being limited to only communicating with local personnel proficient in English.

As part of the broader external environment to a virtual team language is situated in the macrosystem of the communications environment model shown in Figure 69 along with location. While many project teams are becoming increasingly multicultural, language barriers feature strongly in some findings from this research and remain part of the overall virtual team landscape to be navigated.

### **5.5. Effective project virtual team communicator and coordinator attributes**

The senior participants expressed belief was that effective virtual team communicators need to be open communicators who do not pursue their own agendas over that of the project. Participants also believed these individuals must be technically proficient with the particular focus of the project to afford them credibility within the broad project team. They also believed that these individuals need to be outgoing and proactive communicators, who will reach out regularly to their virtual team colleagues rather than wait to be contacted.

With pressures to work extended hours to maintain the required communication between offices identified by the participants, effective virtual team communicators, whether formally designated single points of contact, or simply a member of the project virtual team, must accept that there will be occasions they need to be available outside of their core working hours for electronically mediated meetings with their colleagues. This could be weekends, evenings, early mornings or, in the case of some projects, late into the night or very early mornings. However, for those working in Western Australia on projects where the other offices are located in the same time zone or displaced by only 1 to 3 hours, such as colleagues based overseas in locations such as Singapore, China or The Philippines or domestically in one of

the Eastern States, this temporal displacement is lessened, even where virtual team colleagues may be separated by many thousands of kilometres.

The effective virtual team communicator needs to be culturally sensitive and aware, able to situationally adjust the messages they send and how they process the messages they receive. They need to see the message not just at face value, but also identify the culturally filtered messages contained within. At the same time, they need to be forceful enough to articulate their message and ensure they are heard and, where appropriate, their instructions will be followed, without being so forceful that they alienate their colleagues. While this requirement to be influential without alienating colleagues is a balancing act, participants believed effective communicators must develop this skill or risk losing their ability to influence, or destroy the trust needed to influence outcomes in the long term.

Many participants identified the need for effective virtual team communicators to be comfortable with ambiguity and uncertainty. They noted that it was frequently necessary to accept that work was progressing in other locations even though you could not actually see it and that, sometimes, this work may happen at a different pace or in a different sequence from that originally assumed, but that the virtual team coordinator often needed to accept that the other personnel knew what they were doing and would deliver as promised. Failing to accept certain levels of ambiguity on the part of other offices would lead to micromanagement and the breakdown of trust between personnel and offices, which, according to many participants, would lead to future issues with the project.

To be effective virtual team communicators and coordinators, respondents described how they must be able to build and maintain trust with their virtual team colleagues. The majority of participants, particularly in middle and junior roles, described trust in transactional terms, where personnel working in their virtual teams develop trust based on the reliability of their colleagues to deliver work on time, to the right quality and within budget or failing that, to at least ensure no unpleasant surprises occur. In the senior roles represented by the senior and independent cohorts, trust was described in more relational terms. These participants still described a requirement to maintain the transactional delivery of work, but their relationships, built through sharing face-to-face and rich, electronically mediated meetings such as videoconferences where experiences and personal lives are shared and compared, appear to become as important to the development and maintenance of trust.

## **5.6. Conclusion**

As can be seen from the analysis above, interpersonal communications in project virtual teams is a complex and multi-faceted challenge to visualise and understand. Each project and every organisation is unique, with no common single structure, culture or organisational plan. As several participants described, even repeat projects undertaken by the same organisation for the same client using the same delivery solution have unique challenges requiring unique solutions and have resulted in different outcomes. The differences in experiences and needs

between participants at different levels within a project are shown to manifest in different ways; in how personnel are required to interact and the different levels of richness of communication tools; in the different ways they build trust and the value they ascribe to the establishment of trust between personnel; and, at the different schedules and calendar of communication at different levels, with the senior personnel communicating on relatively fixed calendars in set piece meetings, compared to the almost constant communication between mid-level personnel tasked with day-to-day work coordination, to junior personnel who communicate as required on technical and tactical issues.

All these differences and complexities describe a highly unpredictable environment for those working within them, and, consequently a highly complex organism to understand academically. It is, however a very fertile environment for future study as is discussed in the conclusion to this thesis. The majority of academic work to date has focussed on defining and describing virtual teams as a broad concept and testing largely pre-existing theories for fit in a virtual team environment. There is a substantial need and opportunity for academia now to move to examine in detail the complexities of project based virtual teams in the real world, spending time within the teams and with those living the challenges daily.

For practitioners, there remains an absence of an accessible substantial body of knowledge to use in the planning and development of engineering project virtual teams, yet these projects represent substantial capital investment and risk. Getting the settings and design of virtual teams' right from the onset would reduce the execution risks inherent in their work, making the projects more predictable. Academia could readily work to fill much of this need through focussed, integrated and collaborative research, contributing to both the academic body of knowledge while simultaneously helping improve the outcomes of practice. Initially, sharing the findings from this research in both the academic and practice communities will be of substantial benefit, closing some of the knowledge gaps and identifying appropriate paths for future researchers to explore, but there is much yet to examine and understand.

In the closing chapters of this thesis the findings of this research are firstly reviewed against existing research to better understand how these findings support or refine existing knowledge, as well as identifying where the findings from this research differ from that of earlier work. This thesis then closes with conclusions, contributions and a future research agenda. This final chapter highlights areas where this research is contributing to the academic knowledge of how project based virtual teams differ from both conventional co-located teams and operational virtual teams, shows how interpersonal communication in project virtual teams can lead to improved outcomes through building trust via strong working relationships, the role and nature of leadership in these teams and the role of those tasked with managing the communications interface between team locations. The final chapter also sets out a future research agenda, highlighting the many areas still to be investigated before a full understanding of these teams critical to the economic success of so many businesses and industries can be achieved.

## 6. Discussion

## 6.1. Introduction

In this chapter the findings from the current research are reviewed against previous research. It serves to understand where this current research contributes to the overall body of knowledge of virtual teams, both in the broad understanding of virtual teams and specifically the use of virtual teams in engineering projects or the Western Australian resources sector.

While there is a steadily growing body of knowledge related to the effective use of virtual teams, there remain many gaps worthy of addressing. These gaps primarily exist in terms of the differences between project based virtual teams as well as those in operational business environments and enhancing the understanding of how these teams function in 'real world' project environments. Much of the existing virtual team literature for projects and ongoing businesses has been developed through 'laboratory style' research, with the findings awaiting testing in practice environments 'real world' environments. Similarly, the field of virtual teams' research is muddled by the variety of understanding of what is a virtual team. Virtual teams are recognised as ranging from two individuals working remote to one another, through to large teams in similar situations. Equally virtual teams can operate in practically the entire range of organisations from education and medicine through space travel and, in the case of the current research, the engineering delivery of resource projects. Each of these forms of team may have its own characteristics and idiosyncrasies needing to be investigated to facilitate a full and complete understanding of the phenomena

This work aims to expand the understanding of how interpersonal communications between personnel in project virtual teams varies and how the personnel at different levels within the teams undertake their communications. The work was undertaken in real world, practical environments where it is harder to control for variables and where the rewards for success reach beyond the grades achieved for an academic unit. In particular, this work has examined project virtual teams working on engineering projects in the resources sector, where the projects themselves are being undertaken for Western Australian clients. The work has resulted in the development of a project virtual team interpersonal communications environment model shown in Figure 69, as well as identifying a number of specific findings related to how virtual team members interact and how they select and utilise the tools and media necessary to communicate at distance. This research establishes a framework that can be used to build future research into interpersonal communications in engineering project virtual teams and also to provide an accessible tool that can be used in the training of future leaders of project virtual teams.

Table 11 presents a summary of the literature reviewed as part of this discussion, indicating how the results of the current research relate to the findings from these earlier works.

| Theme                                       | Author   | This research relationship to findings |
|---|--|--|
| Trust                                       | Costa and Peiró (2009, p.135)                            | Confirms                               |
|   | Rico, Alcover, Sánchez-Manzanares and Gil (2009)         | Confirms                               |
|   | Germain and McGuire (2014)                               | Confirms                               |
|   | Jarvenpaa and Leidner (1999)                             | Confirms                               |
|   | Aubert and Kelsey (2003)                                 | Confirms                               |
|   | Martínez-Tur and Peiró (2009)                            | Confirms                               |
|   | Germain (2011)   | Confirms                               |
| Leadership                                  | Barnwell, Nedrick, Rudolph, Sesay and Wellen (2014)      | Confirms                               |
|   | Maduka, Edwards, Greenwood, Osborne and Babatunde (2018) | Confirms                               |
|   | Gibbs, Nekrassova, Grushina and Wahab (2008)             | Modifies                               |
|   | Duarte and Snyder (2001)                                 | Modifies                               |
|   | Helms and Raiszadeh (2002)                               | Confirms                               |
|   | Eissa, Fox, Webster and Kim (2012)                       | Confirms                               |
| Inter office coordinators                   | Carte, Chidambaram and Becker (2006)                     | Modifies                               |
|   | Pearce, Yoo and Alavi (2004)                             | Modifies                               |
|   | Ziek and Smulowitz (2014)                                | Confirms                               |
|   | Yoo and Alavi (2004, p.40)                               | Modifies                               |
| Formal and informal communications channels | Beranek, Broder, Bruce A. Reinig, Romano and Sump (2005) | Modifies                               |
|   | Berry (2011)   | Contradicts / modifies                 |
|   | Otter and Emmitt (2007)                                  | Contradicts / modifies                 |
|   | Morgan, Paucar-Caceres and Wright (2014)                 | Modifies                               |
|   | Gaan (2012)  | Confirms / modifies                    |
|   | Martinic, Fertalj and Kalpic (2012)                      | Innovates                              |
|   |  |  |



| Theme                            | Author                             | This research relationship to findings |
|----------------------------------|------------------------------------|--|
| Selection of communication tools | Morgan et al. (2014)               | Confirms                               |
|                                  | Beranek et al. (2005)              | Innovates                              |
|                                  | Bélanger and Watson-Manheim (2006) | Modifies                               |
|                                  | Wilson, Straus and McEvily (2006)  | Modifies                               |

Table 11: Discussion literature summary table

### 6.1.1. Putting project virtual teams in context

The temporary nature that separates a project from an operational business places the current research into a subset of the overall virtual teams' literature. The scale of these projects and the numbers of personnel involved then further separates the organisations and projects investigated along a continuum of project sizes. Many engineering projects workforce number in the high hundreds to thousands of personnel during the design and procurement phases where the virtual activities are at their most prominent.

There are two primary definitions that are relevant when working to define these teams and separate them from both the broader virtual team and project management literature. The early and still relevant definition of virtual teams as "groups of geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organisational task" (Townsend et al., 1998, p.18), and the Project Management Institute's widely accepted definition of a project as "a temporary endeavour undertaken to create a unique product, service or result" (PMI, 2017, p.5) are applied in the current research. These definitions can be combined through replacing 'task' in the definition from Townsend et al. (1998) with 'project' and in the case of the further subset of engineering projects, insert 'engineering' in front of 'project'. The industry the project is within can be used to establish or segment the field into further subcategories such as major projects, resources projects, infrastructure projects etc. to differentiate between any specific characteristics that make such subcategories unique. Consequently, a definition for a project virtual team could be 'groups of geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organisational project'. Without such a working definition it is extremely difficult to categorise different virtual team structures and understand in depth, not only the general concepts of virtual teams, but the differences and similarities of the various forms of such teams. Without such specificity it is difficult to study virtual teams in full and to gain the necessary insights into how the range of such teams operate and can be optimised

### **6.1.2. Trust within project virtual teams**

One of the clearest and strongest themes emerging from the current research was the role of trust in supporting effective communications in project virtual teams. Associated observations including how relationships can lead to trust, how trust is formed and how trust is maintained through the life of the project as personnel join and leave are considered. A number of participants described working to build both professional and personal relationships with their virtual team colleagues through face-to-face meetings, social functions and ongoing communications, discussing both technical matters pertinent to the project and sharing personal experiences to build a relationship of mutual understanding which they believed led to trust and a better project outcome. They considered trust as a critical factor in binding the team together toward the common goal of a successful outcome and how, once trust was in place, personnel would work beyond their contractual commitments, often communicating outside of core hours simply to maintain a steady and timely flow of information between locations. Costa and Peiró (2009, p.135) identify three main benefits of establishing interpersonal trust in an organisation; reducing organisational transaction costs; increasing spontaneous sociability leading to altruism and extra-role behaviours and; facilitating adaptive forms of reverence in hierarchical relationships. While the third of these points did not surface to any substantial extent in the current research, a number of aspects of the first and second were evident. When considering transaction costs, a number of participants observed how establishing and maintaining strong, trusting relationships made them more likely to communicate freely with colleagues and helped ensure open lines of communication which, in turn, led to more open sharing of information and a commensurate reduction in rework and abortive effort. Similarly, the spontaneous sociability and extra-role behaviour described by Costa and Peiró (2009) could be observed in personnel willing to work outside of their core hours, communicating with their virtual team colleagues during times when others may not be willing to contribute.

The findings from the current research strongly reflect those of Rico, Alcover, Sánchez-Manzanas and Gil (2009) who found that trust in early phases of a virtual team project is associated with enthusiastic communication demonstrating involvement and attachment, building a sense of “social gravity” (Rico et al., 2009, p.233) and those of Germain and McGuire (2014, p.357) who stated that “virtual teams must learn how to quickly and effectively coordinate their efforts and work cooperatively”. They used the term ‘swift trust’, first coined by Meyerson, Weick and Kramer (1996) to describe the formation of trust in short term virtual teams where no previous team member relationship was in place. Germain and McGuire (2014, p.359) identified a number of barriers to this swift trust formation, categorised into; individual barriers including a lack of attachment and the individual’s willingness to take risks; organisational barriers including control structures, conflicting loyalties and a lack of structures to embed virtual teaming within the organisation; team barriers such as national cultural differences and a lack of clear leadership and; technological barriers such as the complexity

of technical interfaces and a lack of richness from online communication. Virtually every one of these factors was reflected in the findings of the current research.

In examining the concept of swift trust in their research, which explored interaction between a number of university academics in different institutions, Jarvenpaa and Leidner (1999) posed the questions; a) from where do virtual teams import trust and b) how do they use electronic media to maintain trust. Jarvenpaa and Leidner (1999) suggested that trust is imported from similar settings to which the virtual team will be familiar, and maintained through action, and team members demonstrating they can be relied upon to manage uncertainty through delivery of work. This view of trust being maintained through the delivery of promised work is shared by Aubert and Kelsey (2003), who also found integrity (delivering what is promised) and ability (the capability to work at the required level of competence) to be two key antecedents to trust. Within the current research it is evident that participants imported trust through common parallel experiences of team members, they had typically all worked on projects requiring the delivery of similar outcomes such as mine sites or oil and gas facilities in their past, though they may not have worked on these together, and they had similar backgrounds as practicing engineers in the resources sector, establishing them as professional colleagues rather than simply as a group of individuals with little commonality in their past. Additionally, when considering the maintenance of trust through action, a number of participants described how they grew to trust their virtual team colleagues through consistent, reliable delivery of work, on time and to the standards required by the project.

In exploring the implications of trust in organisations, Martínez-Tur and Peiró (2009) describe how virtual organisations cannot rely on technology alone, but also need trust, which they refer to as a social lubricant, to facilitate the formation of what Crossman and Lee-Kelley (2004) describe as the fruitful relationships necessary to transfer information, ideas and knowledge. In their model of an organisational trust episode, reproduced as Figure 72, Martínez-Tur and Peiró (2009, p.148) identify proximal and distal sources and context stemming from their research that closely resembles those identified in the current research and set out in Figure 69 of the characteristics of the individuals involved and the norms and role expectations of the system, as well as how individuals within the relationship categorise one another, such as by professional or contractual status. Indeed, their entire episode model strongly reflects the described experience of a number of participants in the current research. Martínez-Tur and Peiró (2009, p.148) identified both proximal sources for trust such as the characteristics of the individuals involved in the relationship, and distal sources such as the organisational norms including role expectations as well as proposing private consequences of trust such as performance, willingness to share information and well-being at work alongside public consequences such as enhanced exchange of ideas and knowledge, innovation and cooperation.

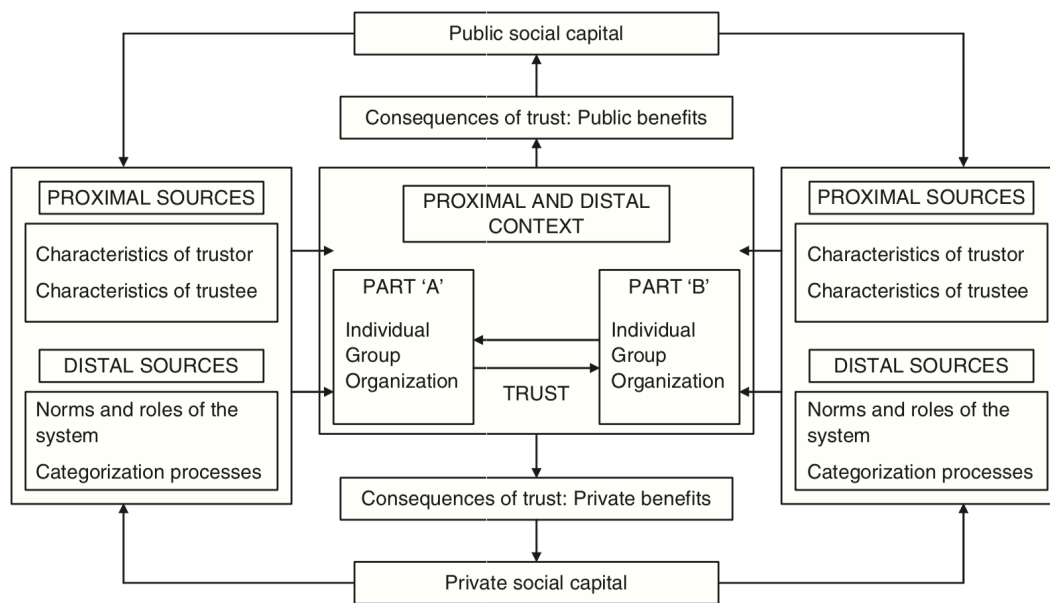


Figure 72: Episode of trust in organisations, from Martínez-Tur and Peiró 2009, p.148

It is suggested by Germain (2011) that in the early stages of establishing trust in a virtual team it is necessary to suspend uncertainty. Once again, this view is reflected in the observations of several participants in the current research who described having to caution colleagues against prejudging the future performance of their virtual team colleagues based on rumours from other projects. The willingness to accept increased levels of ambiguity also emerged from the current research as something that members of project virtual teams must accept. Historically ambiguity has been something most project leaders and team members would work to eliminate, so becoming willing to accept increased levels of ambiguity is clearly a challenge for many.

It is worth noting that the majority of the literature considering the formation of trust in virtual teams considers the teams themselves to be static units without any changes of membership. Much of the existing body of research was conducted as short-term observations of real-world teams or university teams. In these environments team member tenure and churn of personnel would be either extremely difficult to simulate or consider, leaving the majority of research considering the development of trust as occurring in a static but new team. The current research study includes a number of situations where participants were part of teams whose membership was changing on a daily basis. Their observations suggest the formation of trust to be an ongoing challenge to be continually assessed and addressed rather than something which would grow then remain in place as the project progressed.

While it could be considered likely that the findings of much of the pre-existing research would apply to project virtual teams of the type investigated in the current research, there remains a need to undertake further research into the formation and maintenance of trust at all levels in these teams. Additionally, such research could consider the impact of trust at the

peer to peer level between personnel at the various levels of seniority identified within the current study and the impact this trust has on the effectiveness of the team and its outcomes.

### **6.1.3. Leadership skills for virtual team projects**

Also featuring heavily in the data from this current research is the need to reconsider leadership skills for those running project virtual teams. In their excellent review of leadership of international and virtual project teams Barnwell, Nedrick, Rudolph, Sesay and Wellen (2014) identified a number of points which align well with this current research, namely; that leaders must be in contact frequently enough to stay in the consciousness of the members of their teams; their communications must be clear and concise; solid, trusting relationships must exist between the leadership and the team members and between individuals within the team; the team must be empowered to make the decisions they need to maintain the progress expected of them without continual reference to the overall project manager; and; all team members must achieve a level of cultural and emotional sensitivity to the needs and views of their virtual team colleagues. These five points sit well alongside the findings from this current research with participants describing the amount of their day spent communicating with virtual team colleagues, the need for them to ensure clarity in messaging, often using both written and voice communications to test their accuracy, the strong need for trust discussed above and, from some participants at least, how key personnel become empowered to undertake substantial levels of communication and coordination between offices within their teams.

The work of Barnwell et al. (2014) was more recently supported by that of Maduka et al. (2018) who, while only surveying a small sample size of 14 respondents within an African organisation establishing a new virtual team to expand its business, were still able to identify a number of traits specific to successful leadership in virtual teams. The most powerful finding they identified was that the more successful and effective virtual team leaders are transformational not transactional in their leadership style, use effective communication to provide constant feedback, provide task clarity and reliable clear directions while building an environment of trust within the team.

Similarly, many attributes identified in the current research that promote effective project virtual team leadership, such as having key personnel in each location tasked with leading their portion of the work and having key personnel tasked with ensuring communications run effectively, align strongly with the concepts of shared leadership. Shared leadership, as described by Pearce and Conger (2003), takes the historical model of a single individual acting as the sole 'hero' leader and instead considers leadership to be broadly distributed among a group of individuals, with individuals emerging for short periods to provide leadership before stepping back and allowing others to lead such as was seen strongly in the current research through the emergent role of interface coordinator.

The skills required to successfully manage virtual teams go beyond what Gibbs, Nekrassova, Grushina and Wahab (2008) refer to as developing prescriptive instructions, and are more complex than those required for teams which are co-located (Berry, 2011). From the

work of Duarte and Snyder (2001) onwards, researchers have been indicating the need for specific skill sets for leaders to be effective in guiding their virtual teams. While Duarte and Snyder (2001) identified these as communication, establishment of expectations, resource allocation and the modelling of desired behaviours, Helms and Raiszadeh (2002) extended that thinking and suggested that the starting point for leadership in virtual teams is trust and that trust building needs to be a strong focus of the leadership and membership of any virtual team. While the attributes proposed by Duarte and Snyder (2001) were all reflected to some extent in the current research, the emphasis on building trust as a leadership attribute from Helms and Raiszadeh (2002) is the one that was strongly reflected in the findings from the current research with a substantial number of participants identifying it as one of their top priorities.

The findings from the current research would also strongly support the position of Eissa, Fox, Webster and Kim (2012) that organisations need to find ways to train their current and future leaders to be more effective in leading their virtual teams. While Eissa et al. (2012) focussed specifically on the use of virtual tools and environments to achieve this, the findings from the current research suggest that there is little such training being offered at present and as such, whether future training is offered in traditional environments or virtually would seem to be less significant than to offer it at all.

The need, which was clearly articulated both in the existing literature and the current research for leaders with specific skills suited to virtual team environments and, by extension, project virtual teams would suggest that there is both an opportunity to further the research to fully understand the nature of these skills and how they can be developed. Once such understanding is developed, curricula can be reviewed to incorporate the appropriate educational and training materials such that new personnel entering the workforce are pre-equipped to actively participate in these virtual teams.

#### **6.1.4. Role of inter office coordinators**

Amongst the roles and relationships that have been explored in virtual project teams, one which has seen little to no previous specific examination and which was clearly visible in the current research is that of the individuals tasked with the day-to-day management of communications within their projects. These personnel roles were largely mid-level participants, their contribution to the effectiveness and health of an engineering project virtual team appears to be substantial, yet they have been largely overlooked by researchers. In many instances, the roles fulfilled by these mid-level personnel appear to be one of informal leadership, leading by default in environments such as those described by Carte, Chidambaram and Becker (2006), where not all teams have assigned leaders.

The closest areas of research to help understand the inter office coordinator roles are in emergent leadership (Hollander, 1961) and shared leadership (Pearce, Yoo and Alavi, 2004). Emergent leadership, where those in leadership roles who were not assigned to specific leadership positions but who have been selected into leadership roles by members of a

leaderless group, roles where their actions and contributions underpin the overall leadership of the project, is considered a common trait in many virtual teams (Carte et al., 2006). Similarly, when considering shared leadership, Pearce et al. (2004, p.185) suggest that traditional vertical models “may not be as effective in virtual teams as they are in face-to-face environments” with shared leadership taking the place of traditional co-located single leadership (Mankin, Cohen and Bikson, 1996). These observations would appear to be substantially reflected in the findings of the current research. In a virtual team context, the role of the interoffice coordinators may well be to act as part of a shared leadership model, supporting the activities of their co-located colleagues and providing connectivity to the overall project leadership.

The views of Ziek and Smulowitz (2014, p.106) that “The better emergent virtual team leaders are at communicating to team members the more effective the team will be in completing tasks and projects” align well with the findings of the current study. While as is the case for so much of the research in virtual teams, Ziek and Smulowitz (2014) performed their research with a group of students, many of their observations align well with the findings from the current research. The manner of emergence is likely to be different between those in exploratory research and those in practice environments. In the existing literature in this area leaders appear to emerge organically from a team of peers, where in the practice environments in the current research such leaders were largely personnel appointed for one role, that of communicating between offices, but who through their communications role fulfilled many of the requirements and features of emergent leaders.

If, as Yoo and Alavi (2004, p.40) state “Leaders in virtual teams send more messages than other members”, whether these messages are, as many participants in the current research discussed, simply keeping in touch and maintaining regular discussions or task specific for alignment of work, then many of those in the mid-level cohort of the current study should be considered as leaders in their own right. They should be recognised as such within their organisations and their role given sufficient academic research focus to better understand the contribution their roles make to help frame future research agendas. As Yoo and Alavi (2004, p.41) point out, these emerging leaders in virtual teams also enact the three roles of initiator; kicking-off communications at both transactional and relational levels; communications scheduler, establishing the “temporal rhythm of the project” by coordinating communications, and; of integrator, integrating the work of a number of team members into the overall project. With integration being regarded as one of the key focus points of successful project management (Zwikael, 2009), this would serve to further reinforce the potential role played by these individuals in the delivery of successful projects.

These mid-level inter office coordinators, serving as integrators between personnel in the various locations that comprise a project virtual team have, prior to the current research, largely gone unrecognised in the academic literature, with the researcher unable to identify any literature explicitly exploring their role or contribution to their projects. It is also likely that these coordinators may well make-up the future generation of overall project managers, with

several commenting during their interviews that they did act as project managers on some work. The insight of identifying personnel in these roles within the academic literature helps to explain how interpersonal communications flow within virtual teams in general and specifically project virtual teams. It adds additional depth to academia's ability to perceive and understand relationships within projects and also identifies a potential training ground for future project leaders.

For those working in practice, the contribution of those filling these roles needs to be recognised and these personnel provided with the support they need to perform their role to the best of their ability.

### **6.1.5. Formal and informal channels of communication**

The findings of the current research reflected a high reliance and use of informal communications within the virtual teams, particularly between personnel in the roles of interoffice coordinators. These coordinators discussed at length the volume of ad-hoc communications they undertook, often outside of core hours and typically one-on-one by telephone or email, clarifying minor points of uncertainty, sharing insights and generally maintaining the flow of communications between locations. These informal discussions supplemented the more formal, calendared, set piece meetings where groups of personnel from each location would gather for telephone or video conference calls to discuss the formal recorded progress of the project. Their informal discussions provided supplementary mechanisms to the formal distribution of tasks between offices, filling in the knowledge gaps between locations as personnel worked to understand their assigned scope.

Much existing research, such as that of Beranek et al. (2005) proposes or potentially presupposes that communication should be a formally structured activity, with calendared meetings and a strictly defined formal structure. Berry (2011) went as far as to propose the imposition of sanctions on team members who stray outside of the defined communications processes. Similarly the great majority of research in communications within virtual teams, typified by that of Otter and Emmitt (2007), only considers formal versus informal communication from the context of the tools and formats of meetings, not the choices of the individuals. Researchers such as Beranek et al. (2005) appear to regard communication as a 'means to an end' within organisations, focussing on the mechanics of virtual team communication such as pre-agreed agendas, turn taking and prompt responses to questions, rather than considering the needs of the individuals to build and maintain comfortable, trusting relationships with their virtual team colleagues. More recent work, such as that of Morgan, Paucar-Caceres and Wright (2014), recognises the challenges of communicating by distance using electronic media, including the need to carefully and accurately decode messages, made harder through the absence of direct personal contact such as is provided through face-to-face discussions. However, they do not consider the value of informal communications both checking decoded messages for accuracy or for the building of relationships. While some of the findings from the current research concur with these observations there was also a strong



thread through the findings toward the role of communications acting as a glue to bind together the members of these distributed teams toward a common objective

### **6.1.6. Selection of appropriate communications tools**

This current research presents a different perspective on the role and use of communication tools in virtual teams, beginning to identify that different personnel within these teams will self-select the tools they prefer to use for their communications. To date, the majority of research has focussed on how specific tools can be used. This includes early work such as that of Huber (1990), exploring the impact on organisational design of the introduction of computer aided communication tools, through to more recent studies such as Ebrahim, Ahmed, Rashid and Taha (2012) who investigated how emerging tools can be used to support decision making, and Olson, Appunn, McAllister, Walters and Grinnell (2014) who examined the use of web cams on virtual team communications. This 'tool centric' research has been helpful in identifying the uses of the tools examined but has not considered who may want to use them, how or why. As Gaan (2012, p.15) points out in one of the rare pieces of research to consider selection of tools "Sometimes the organisation policies forbid employees to use some collaborative tools", in Gaan's research the restrictions were as a result of a lack of organisational trust in their employees and suspicion from managers that their personnel could abuse some technologies for personal benefit.

The findings from the current research contrast with that of Martinic, Fertalj and Kalpic (2012) who attempted to match different communication methods to project phases. Their work, which was tested on a single software project team of six members, makes no mention of how the communication approaches (face-to-face, video conference, telephone conference, instant messaging and asynchronous communications) were selected or by whom, leaving only their attempt to match tools and phases without this very important context. Similarly, while Morgan et al. (2014) found that meeting face-to-face at the start of a project, then maintaining communications through various electronic media such as email, telephone and video conference was largely sufficient in the pharmaceutical business their research focussed on, they do not consider the personal preferences of any participants. The determination of technology to be used within a virtual team was discussed by Beranek et al. (2005) and, while they identified that different technologies may be needed by different team members they defaulted to the team leaders determining the choice of tools available, disregarding the need or ability of the individual employee to select the tools they need seen in this research.

Perhaps the closest research to recognise the use and selection pattern surfaced in the current research was that of Bélanger and Watson-Manheim (2006) who found that individuals use multiple media platforms to communicate beyond simple message transmission such as acknowledgement of messages, building mutual understandings and participating in multiple communications in parallel. The findings from the current research appear to align with the use of what the researchers refer to as 'Communication media repertoires' (Watson-Manheim and Bélanger, 2007). That is, individuals will self-select what they believe to be the best media

available to them for any given message, whether that is face-to-face (where possible), video meeting, telephone, email, or instant messaging. The mechanisms to support these selections are portrayed in the model offered by Bélanger and Watson-Manheim (2006, p.309) and reproduced in Figure 73. In this figure, the input of availability and capability of communication mode aligns with the findings of this research and the project virtual team interpersonal communications environment model shown in Figure 69. The strategic goal input would be the objectives set out in the roles of the individuals and contextual factors would include time zone impact, linguistic challenges and the sizes of the teams needing to participate in the communications.

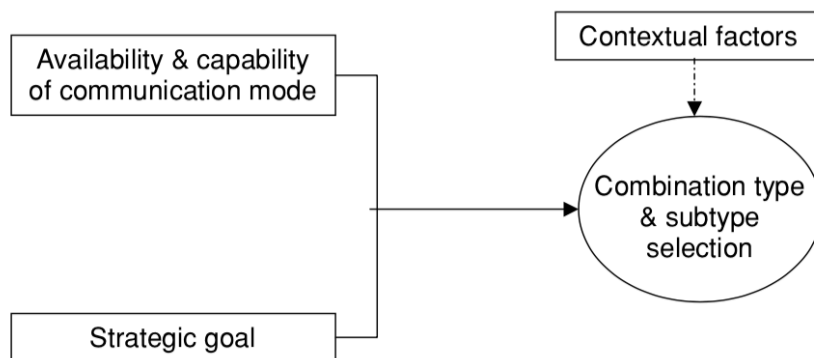


Figure 73: Factors affecting media combination selection, from Bélanger and Watson-Manheim (2006)

The role of different communications tools in supporting the interaction of members of virtual teams and the team members' ability to build and maintain trust through the use of different technologies has been the subject of substantial investigation. However, how these different media support the rate of establishment of trust in virtual teams has been less investigated. One interesting piece of research in this area was that of Wilson, Straus and McEvily (2006) who found that while trust started lower in teams where communications was computer mediated, over time it would increase to similar levels to those of face-to-face teams, asserting that "the communication medium alters the rate at which trust develops, but does not produce fundamentally different levels of trust in computer-mediated versus face-to-face teams" (Wilson et al., 2006, p.29). While the work of Wilson et al. (2006) helps with understanding how technology affects the rate of development of trust, their work only compared face-to-face and web-chat. As additional digital media have entered the communications landscape it is important to continue to examine them for potential use by such teams.

In referring to the earlier work of Daft and colleagues (Daft and Macintosh, 1981, Daft and Lengel, 1986, Daft, Lengel and Trevino, 1987), Penley, Alexander, Jernigan and Henwood (1991) began to identify how managers need to be sensitive to the media they choose to communicate with their personnel. While the work of Penley et al. (1991) clearly predates the broad use of internet enabled technologies, their work suggested managers preference for richer media such as face-to-face to communicate difficult or equivocal messages.

Overall, the findings from the current research appear to underline the observations of Watson-Manheim and Bélanger (2007); that while the influences of institutional conditions, such as those forming part of this research, any limitations on the suite of media provided or endorsed by the project organisation will influence the selection available, any situational conditions in which the communicating personnel find themselves will ultimately drive the selection of media utilised. However, as new technologies become available it is incumbent on researchers to continue to work to understand how the evolving suite of technology available to team members can best be used to build and support the communications between members of project virtual teams, to establish and maintain relationships and enhance the delivery of future projects.

### **6.1.7. Complexity of interpersonal communications in project virtual teams**

The findings and analysis in the current research demonstrate the overall complexity of interpersonal communications in project virtual team environments in ways much of the previous research has not shown. It is apparent there is no single factor which can be considered the central issue, but rather that the entire project and organisational ecosystem in which the project is undertaken combines to influence how, when and how effectively interpersonal communications are undertaken.

This perspective places the current research in a different position from much of the previous work in virtual teams, placing the challenge to build a full understanding of virtual team communications into a different light. The majority of existing research has focussed on individual, discrete facets of virtual teams, whether in project or broader organisational environments, with little consideration for the overall situational context in which the individuals and their project exist. However, the current research clearly identifies that none of these discrete facets act alone but instead form part of a greater whole.

It appears that project interpersonal communications can be regarded as complicated and more commonly would appear to be complex when considered against the Cynefin framework (Snowden and Boone, 2007, p.72-73). Snowden and Boone (2007) characterise complicated contexts as discoverable cause and effect relationships, known unknowns and fact-based management, while describing complex contexts as characterised by unpredictability, no right answers and unknown unknowns. In short, complicated contexts can be understood and interpreted immediately after the fact, while complex contexts are frequently only able to be interpreted after substantial reflection and investigation. From the results of the current research it is conceivable that some participants' experiences of interpersonal communications within their teams could be considered as chaotic within the Cynefin framework. Chaotic contexts are defined by Snowden and Boone (2007) as high turbulence, no clear cause and effect relationships to the point where it is not worth looking for them and where leaders are faced with many decisions to make but no time in which to make them. Snowden and Boone (2007) describe the characteristics of effective leaders in these complex

environments as being patient, able to tolerate failure and rather than trying to impose order, will wait for patterns to emerge then determine which are desirable for success.

Similarly, the environment and the teams themselves can be considered highly dynamic. Many participants in the current research described their teams experiencing regular and frequently unplanned changes of both personnel and scope. The impact of these changes appears to be most strongly felt by team members away from the project home office. Changes that appear rational and sensible in the home office are either poorly communicated to the remote office personnel or result in postponement of portions of scope. This postponement happened in at least one project examined. Work was stopped, the team was reassigned to other tasks then, when the work resumed, it was difficult to reform the team as many members were unable to be released from their new roles. These changes over time are contained in the Chronosystem which forms part of the project virtual team interpersonal communications conceptual model outlined in Figure 69. This inclusion establishes the current research as surfacing the overall complexity of the context of the phenomena.

The multidimensionality in the project virtual team communications environment demonstrated by the current research is shown in Figure 69. The figure demonstrates that there are multiple influencing levels, each closely intertwined with their neighbours, many with complex interactions within themselves. Additionally, the level of entrainment changing with the evolution of the project needs and the passage of time make these teams a challenging and at the same time fascinating and rich area for research. Since each team, even within the current research, is different in its own ways, it is impossible to reach a single set of solutions. That said, the project virtual teams environment model set out in Figure 69 presents a series of common variables to be explored further by researchers, both as discrete components and to further understand their interactions. The model could also be utilised by practitioners as a basis to work within their teams and organisations to build strong, effective future project virtual teams. The current research study therefore establishes a common framework through which interpersonal communications and interaction within these project virtual teams can be understood.

### **6.1.8. Methodology for future research**

The methodology adopted to undertake the current research is a novel approach to interpreting qualitative data. Where historically researchers would undertake an either/or approach, using either thematic coding or cognitive mapping, the researcher combined the two to provide both the deep thematic insights facilitated by coding along with the insights into the interconnectedness of the data made possible through cognitive mapping.

Coding can lead to the data becoming decontextualized (Glaser and Laudel, 2013), with the development of codes, categories and themes resulting in the story behind the codes, and therefore some of the answers to the research questions, becoming lost in the data. Similarly cognitive mapping offers a way of representing a person's assertions regarding a domain (Axelrod, 1976), with the mapping process described as "designed to capture the structure of

the *causal* assertions of a person with respect to a particular domain” (Armstrong, 2005, p.21), and Narayanan (2005, p.2) referring to these maps as “representing thought as a network of causal relations, representing concepts through nodes and causality through links between nodes”. Without the depth provided by the themes captured from the coding process, the maps could appear disconnected from the data. As such, combining the two allowed for the development of a more nuanced, interconnected outcome; an analysis that seeks to identify both key themes and issues as well as exploring the interrelationships and dependencies in which they exist.

Additionally, by combining the two techniques it was possible to provide a far greater level of traceability to the content of the cognitive maps than is generally possible, with many maps being produced elsewhere in direct consultation with participants who may have no experience in their development and who are acting alone with only the researcher to assist them. In the process used for the current research the cognitive connections used to develop the maps were derived as direct extracts from the narrative passages captured in the participant interviews, collected into the groups identified through the research. It is important to note however that the links and directionality in the maps generated in this research only infer directionality and are cognitive not causal.

## **6.2. Conclusion**

This research study represents the first time interpersonal communications within virtual teams in resources projects being performed within Western Australia has been studied, and may be one of the first times such research has been undertaken in a similar industry anywhere in the world. These teams are transient by nature and driven by financial pressures, making them potentially hard to access to undertake such academic work. They do, however, represent a major shift in the way businesses and particularly the projects they initiate are organised. Working to build a full understanding of the challenges members of these teams face in their roles and the solutions they utilise to overcome them and identifying ways to share those learnings across the academic and practice communities should be seen as high priority activities for future research.

Through the investigations described in this thesis, the original contributions of this work are; a) the identification through rigorous analysis of the data acquired through interviews with team members of the key themes influencing the effectiveness of interpersonal communications within these teams and their integration into the model presented in Figure 69, the first such model to be offered around teams of this form; b) the identification of the key layers of responsibility and roles found within these teams as exemplified by the senior, middle and junior cohorts described in this research; c) the further reinforcement that leadership of project virtual teams requires a different or possibly supplemented skill set to the leadership requirements of a co-located team; d) the identification that much of the communication that binds these teams together occurs at the mid-level or responsibility between what may on occasion be relatively junior personnel; e) that personnel in different roles within these teams

have different communications requirements, and as such will choose different media to achieve their ends, and; f) through the development and use of the methodology used, combining thematic coding with cognitive mapping, this research has offered a new and potentially valuable research methodology to those undertaking similar forms of investigation, either within virtual teams or elsewhere.

The current research surfaced and explored a number of areas within communications in project virtual teams that, to the researcher's knowledge, had received little to no previous investigation. It places the challenges of building trust in a virtual team in a different context to much of the previous work, in that the participants in this research were engaged in long-term projects where they had seen substantial turnover of personnel and the long-term evolution of relationships between individuals and teams in different offices. This situational context highlights the challenges of building and maintaining trust as the project matured and personnel transitioned in and out of the project.

The current research identified a previously almost unconsidered group within the overall project virtual team structure, that of the mid-level interoffice coordinator. These personnel have little external visibility because their roles are not as project managers or other senior personnel, yet as can be seen from the analysis, they may be one of the most critical in a project virtual team. These are the personnel who are frequently faced with long periods of communications outside of core working hours, working early in the morning and late into the evening to ensure a smooth flow of accurate and reliable information with their peers in other offices, then disseminating that information amongst their co-located team members. Many participants in these roles in this research were early to mid-career professionals, with little if any formal communications training and little formal responsibility within their project teams, yet their roles contributed substantially to the overall project coordination.

Additionally, the current research examined some differences in skill sets between a leader of a conventional project, where all of the personnel are co-located with the project manager, and those of a leader of a virtual team, where many key personnel and much of the workforce are located remote to the project manager. It identified how an effective leader of a project virtual team must be comfortable with increased levels of ambiguity, able to trust the personnel to perform their tasks as required but that they will report any difficulties faced in a timely manner and that they must be able to work through a distributed leadership structure, allowing the managers and leaders in each location to control the work in their offices to ensure the overall success of the project.

Also, the current research considered how communication media are selected and deployed within a project virtual team. The analysis highlighted the need for the project leadership to provide and support a range of different communications media for their personnel but not dictate what tools they must use. Rather, project leaders must allow individuals to select the tools they prefer, and which best allow them to undertake their communications. This may include senior personnel adopting video conference alongside telephone and email, mid-level personnel, particularly those in the interoffice coordinator roles,

to use mobile and fixed telephone alongside email and other media, and technical personnel to use desktop sharing via common servers supplemented by telephone to undertake their work. There is no single solution and while, in the world of 'bring your own devices' many may choose to do just that, organisations must ensure they provide their personnel with the equipment needed to do the work expected of them.

Through the methodology adopted and the access obtained to a broad array of practitioners it has been possible to see how complex, multidimensional and dynamic these teams are and, from these insights, frame a different, more nuanced picture of how interpersonal communications occur in project virtual teams. These insights identify a number of areas where previous research can be supported and also a number of gaps in academic understanding. The conceptual model of project virtual team interpersonal communications in Figure 69 can now be used as a mechanism to help explain the subtleties and nuance of the phenomena, as well as for future researchers to test and build an increasingly clear picture of this complex environment. For those in practice environments, whether embarking on a new virtual team based engineering project or delivering one, the current research builds on the frequently fragmented existing knowledge base with a holistic conceptual model that can be used to frame and understand the environment their teams occupy.

## **7. Conclusions, Contributions and Recommendations**



## **7.1. Introduction**

This closing chapter brings presents the conclusions of the research along with identifying the limitations of the research in the context of the large, complex field of project virtual teams. It describes how this current research contributes to existing knowledge of virtual teams and how it contributes to future academic study, teaching and practice, and it proposes a future research agenda that could be considered to continue the acquisition of knowledge into how project virtual teams function and how the interpersonal communications practices of members of these teams contribute to the outcomes of their projects.

## **7.2. Conclusions**

This research, designed to better understand interpersonal communications in virtual teams delivering engineering projects into the WA resources sector, has attempted to address the question of how interpersonal communications between virtual teams affects the performance of team members in delivering engineering projects into the Western Australian resources sector. The findings from this work indicate that interpersonal communications are a significant contributor to the overall performance of these teams, serving a number of purposes: the communications can be used to build and maintain relationships between individuals in the teams which, when properly managed lead to trust, with trust showing as a vital contributor to effective teamwork; these interpersonal communications, when managed in a timely, open and accurate manner, were considered by many participants to be vital in ensuring alignment of personnel and tasks within the team, this alignment enables better overall goal achievement of delivering successful outcomes for all involved, and; effective interpersonal communication on the part of the project manager was considered critical by many participants in minimising any sense of marginalisation that may be experienced by team members located outside of the project's home office.

The research has revealed that the ways in which personnel communicate, their reasons to do so and the methods they choose are influenced by a number of factors. No single factor was found to be the most influential, rather the interaction of a number of key factors combine to support effective project virtual team communications.

### **7.2.1. Role of interpersonal communications in achieving project outcomes**

Whether a successful project is one delivered on time, to budget and to quality or whether it delivers the required performance expected by the stakeholders, little can be achieved by personnel working in isolation, without effectively sharing information on project progress and goals. Design activity shared between locations cannot be effectively completed in a safe and timely way without communications regarding technical matters. Personnel lacking mutual trust and a commitment to openly sharing information will be less likely to communicate on these technical matters. Schedules, no matter how simple or complex, cannot be met without

coordination between locations. Budgets cannot be developed or maintained without personnel sharing information. Equally, project quality standards will never be achieved without all project personnel being aware of expectations. The all-important stakeholder expectations will not be known to all project members if they are held tightly in one location and not communicated to the whole team.

In the event of a communications breakdown between offices and between key personnel at each office, schedules come under pressure, budgets are exceeded, and quality suffers, all of which results in dissatisfied stakeholders. At the individual level, passionate project personnel become fatigued and marginalised from the project, their willingness to communicate with their colleagues deteriorates and their performance along with those around them suffers.

For many engaged in the academic examination of project management, the field is one of statistics, Gantt charts, cost estimates and risk registers, with the majority of published work exploring these areas. Students are taught how to estimate a budget, develop and structure a schedule and define quality standards. Similarly, as was apparent from the data collected in the current research, technical prowess is highly valued in project delivery environments while communications skills are frequently considered to be non-core attributes rather than core requirements. In work by Zwikael (2009) who surveyed 783 project management professionals in a number of different countries to ascertain the importance assigned to each of the nine areas of competence defined in the Project Management Body of Knowledge, the author found that integration “the processes and activities needed to identify, define, combine, unify and coordinate the various processes and project management activities” (PMI, 2017, p.71) ranked first among the engineering cohort, with cost and human resources second and third, while communications ranked fifth. In considering these findings Zwikael stated that “Integration and Cost Knowledge Areas have the highest importance in meeting schedule and cost targets” (Zwikael, 2009, p.100). As such, if interpersonal communications in project virtual teams is considered to be the key process for combining, unifying and coordinating processes and activities by those working in the engineering profession, the findings from the current research should serve to indicate to academics working in the field of project management that they would be well served to refocus some of their energy to better understand how communication within the teams occurs and the crucial function of integration can be improved. The findings from the current research should also be of value to those working in the profession as they attempt to deliver their global projects.

Communication was variously described by participants in the current research as the glue that holds a project virtual team together or the lubricant that ensures the team works smoothly. Whichever metaphor is used, effective interpersonal communications is clearly a crucial component to achieving the integration recognised by the majority of participants in the current research as critical to the overall success of their projects.

### **7.2.2. Need for trust**

The findings from the current research serve to reaffirm the findings of previous work that trust is an important contributing factor for members of virtual teams to openly communicate and share information (Pinjani and Palvia, 2013, El-Kassrawy, 2014, Pangil and Chan, 2014, Breuer et al., 2016). Participants at all levels indicated that trust played a significant part in their willingness and ability to communicate with their virtual team colleagues. They described how their level of trust in those in other locations could be influenced by how those personnel responded to requests for information, delivered on agreed tasks and met project schedule and quality requirements. In many instances, participants described the ways in which transactional trust is formed and maintained between colleagues, whether co-located or otherwise.

The participants outlined how they would begin to establish trust, both at the start of a project and during its execution. Many described preferences to meet face-to-face to begin to build relationships, both within and external to the pure work environment and, where face-to-face was not possible, to explore the richest forms of electronically mediated communication available to them. Participants described spending additional time communicating with their distributed team counterparts, discussing family, social lives and lifestyles in an effort to build a more nuanced and multi-dimensional understanding of one another, reinforcing their work relationships with personal understandings and shared knowledge.

How the formation of trust varies between professions when working in virtual teams, and particularly in large project based virtual teams as distinct to ongoing virtual teams is a relatively emergent area where ongoing study could be of benefit. Given that the current study indicates the high importance of trust, now would be a good time for this work to progress.

### **7.2.3. Importance of building relationships**

The relevance and importance of relationships between personnel in each location was a very strong theme to emerge from the current research, one which again served to reinforce findings from work such as that of Siakas, Nisioti and Voutsas (2006). The belief was stated numerous times that relationships serve as a precursor to building trust and that, without trust, these virtual team projects would falter. Many participants described spending considerable time and effort building and maintaining relationships with their virtual colleagues and the value they placed on securing personnel for their teams with pre-existing positive relationships with personnel in other locations who would also be part of the project.

Many participants, most particularly those in the senior cohorts, described spending up to 50% of their working time building and maintaining relationships with their virtual team colleagues. In addition, many members of the mid-level cohorts described spending considerable time relationship building through sharing of personal stories and experiences with colleagues in other locations. The recognition by the practitioners that these relationships add value is a finding of great value in the context of project virtual teams. Relationship building in a virtual environment was recognised as a challenging undertaking by those who discussed

it. The majority of senior and mid-level personnel described a wish for face-to-face meetings to initiate their relationships, with ongoing maintenance occurring through regular discussions and, where this initial face-to-face was not possible, either due to project or business constraints, they described believing that relationships took longer to establish and may not be as robust as those built through an actual face-to-face meeting.

As with other themes in this research, the academic exploration of the contribution of interpersonal relationships between members of virtual teams and, the nature of relationships in supporting trust and ongoing communications between team members has, to date, largely been unfocussed, treating virtual teams as a generic area rather than one made up of a number of different subgroups. The current research has identified the criticality of project virtual team members being encouraged to establish and maintain interpersonal relationships with their distant colleagues so that open and effective communications can occur.

#### **7.2.4. The role of the project leadership and management**

Many of the participants described the need for the leadership of a project virtual team to take a different approach to how they control their project to how they may control a project which is co-located. Participants described the need for leaders to delegate authority to team members close to tasks; to be accepting of increased degrees of ambiguity; to avoid perceptions of micromanagement; to be excellent communicators, both to those with whom they are co-located and also to those located elsewhere in their project; and to support and enable as far as possible the development of relationships and trust between personnel in the different locations comprising their project virtual team.

Participants described situations where project management personnel may require frequent review of the work being performed in remote offices, leaving the personnel performing the work feeling untrusted and potentially defensive. The consequences of these demands is often the erosion of existing or developing trust between personnel. Participants described projects where travel to other offices within the virtual team had been limited, forcing personnel to try to build relationships using electronic media only, which they believed not to be as effective as the opportunity to meet even once face-to-face.

The need to identify and train future project leaders in these different or supplementary project skills strengthens previous research including that of Anantatmula and Thomas (2010), Ziek and Smulowitz (2014) and, most recently (Maduka et al., 2018), all of whom have contributed to the recognition that not all project managers are suited to lead virtual teams. There remains a need, however, for academia and business alike to continue to identify and build the appropriate skills in current and future generations of project leaders to equip them to run these complex distributed teams.

Within the management approach to project virtual teaming, participants described how having a consistent and appropriate set of procedures and practices was important to their ability to work effectively, with some participants describing how such commonality was

lacking in their organisation. Similarly, in the quality control activities, it was apparent from a number of participants that quality standards and expectations were potentially poorly defined within the projects and may have been used as an opportunity to micro manage remote team members. While achieving appropriate quality outcomes from any engineering project is critical to the success of the project, the described experiences of many participants indicate that the procedures and processes may not have been appropriate for a multi-centre endeavour.

The allocation of personnel by the management of the organisations into these projects was something that arose in a number of participant observations. While the use of a matrix management approach was common across the projects, clarity of different roles and responsibilities of the organisation and project management appeared to be lacking in some instances. This manifested itself through participants describing difficulties retaining personnel during periods of change in project priorities, and in disputes over the allocation of risk and reward within the offices associated with the costs of the personnel and any profits achieved from the project. Establishing a clear set of agreed conditions at the commencement of a virtual team undertaking could therefore be of value for future projects.

Many participants described working extended hours as a result of the structure of their project virtual teams. Maintaining communications with their other offices outside of core working hours and even on weekends was described as resulting in fatigue, potentially jeopardising both the health and wellbeing of the personnel themselves and the success of the project. As such, there is a need for the management of both the organisation and the project to put in place processes to balance this need with the care of their personnel, ensuring there are sufficient personnel allocated to these tasks to allow them a balanced working environment and also that they are provided with the tools needed to work effectively.

### **7.2.5. The contribution of interface personnel**

This research identified a cohort of personnel who have not previously been considered in research exploring project virtual teams. This group comprises the individuals who, either through formal appointment or informal commitment have responsibility for the day-to-day tactical communications between sub groups within the overall project. The role and contribution of these interface personnel became evident during the data collection and subsequent analysis. They are the team members who are in almost constant communication with their peers in other offices, acting as a conduit between teams in different offices, coordinating day-to-day activities and ensuring ongoing alignment between the different teams in a way that was not evident from the more senior or junior personnel.

These interface personnel were most evident in the mid-level cohorts of participants, though some members of both the senior and junior cohorts described similar activities. Regardless of their formal status within the project hierarchy, it appears likely from the data that these personnel may well form a major part of the glue that holds the interpersonal communications of these project virtual teams together. Through their day-to-day active

communications they are building strong and trusting relationships with their colleagues in other locations and ensuring project information is shared in a timely manner.

Having identified this potentially significant cohort of project virtual team personnel it is important that it is examined in more depth to understand their role more fully; how they integrate into the overall team; how they build and maintain relationships with those located in the other offices and; the personality and skills traits needed for them to be most effective in their roles.

### **7.2.6. Impact of physical displacement**

The essence of virtual teams is contained in the physical displacement of work colleagues; research, particularly that focussing on the establishment of innovation clusters, found that personnel separated by even a floor in the same building can begin to experience the characteristics of working in a virtual team (Allen, 1984, Allen, Raz and Gloor, 2009, Allen, Gloor, Colladon, Woerner and Raz, 2016). Within this current research, participants were separated by, at a minimum, the distance between two Australian cities, and at most by multiple time zones, great physical distance and, in the case of those working between Perth and Dubai, different standard working weeks. Therefore, participants all described how they adapted their communication methods, patterns and habits to work effectively across these distances and time zones.

Physical displacement within the virtual teams involved in the current research occurred in one of two ways. Three projects featured personnel working in teams displaced East to West across multiple time zones, the smallest of which was Perth to Adelaide with a 1-1/2 to 2-1/2 hour difference, followed by Perth to Sydney at between 2 and 3 hours (both separations impacted by daylight saving), then Perth to Dubai with a 4 hour time zone difference (the Perth to Dubai project separation was further extended by the addition of Sydney as a third location, with a 3 hour difference between Perth and Sydney, 4 hour difference between Perth and Dubai and 7 hours between Dubai and Sydney). The fourth project featured a North to South displacement between Perth and Singapore where the locations were in the same time zone but separated by several thousand kilometres.

These different degrees of separation produced differing communication profiles for those involved. The personnel in the three projects separated by time zones typically restructured their communications schedules to maximise the overlap between the offices for synchronous, verbal and video-based communications, moving to email and other asynchronous media outside the overlap. Where the overlap was small, or there was a need to communicate through the entire working day of one location, personnel reported communicating outside of core hours, either through extended time in their offices or by taking calls and responding to email when home. This was especially evident of those working between Perth and Dubai where there was both a time zone difference and a different standard working week, placing a greater expectation on individuals to be available on their respective weekends.

Where participants were separated only by distance and not time zones, as in the project operating between Perth and Singapore, the challenges of time zone ceased to be an issue and did not feature in interviews with personnel on this project. For this group, time zone issues were confined to their dealings with subsidiary offices in Europe which fell outside of this research. Within the Perth to Singapore relationship, participants reported that they comfortably maintained synchronous communications between offices through everyone's work day.

Beyond the needs for communication to coordinate activities, many participants, particularly senior personnel in the Perth offices, described feeling concerned about the lack of visibility of work being performed remotely from their location. They described needing to be continually reassured that work was happening and provided regular proof of progress, such as opportunities to review drawings while they were being drafted and frequent progress reports. This was described by personnel in other locations as a tendency toward micromanagement resulting in erosion of trust between parties. The person executing the work felt untrusted and the one for whom the work was being performed felt both frustrated and exhibited a lack of trust.

Some participants in the remote offices, described experiencing sensations of marginalisation and isolation. They felt they missed out on day-to-day information on overall project progress and general organisational chatter, instead having to rely on formal updates and whatever information they were able to obtain through discussions with their home office based colleagues.

### **7.2.7. Use of technology**

Results from the current research, it is apparent that personnel in different roles, whether in senior positions including project directors and regional managers, in mid-level roles including interface managers, or in the junior level roles including technical engineers, have different communication requirements. The senior personnel communicate less frequently, typically weekly or bi-weekly in conference calls and video conferences. Those in mid-level roles communicate daily and multiple times a day through one-to-one voice such as telephone and in conference calls using telephone and where available, video conference. Those in junior roles communicate as required to address technical matters, typically using voice technologies and sharing of documents via common servers. Participants, at all levels described, how they found email to be a ubiquitous communication platform, though some expressed concern over its overuse, describing being flooded with emails, many of which were simply copies from other personnel. Consequently, it is important that project personnel are provided with access to the communications technology best suited to the needs of their roles and, to a certain extent, their personal preferences.

### **7.2.8. Significance of Culture in this research**

While much of the previous research into virtual teams, such as Rodrigues and Sbragia (2013) who examined cultural challenges in managing global project teams from a Brazilian

perspective, referenced the impact of national cultures on the interaction and effectiveness of a virtual team environment, the current research found little specific national culture reference. However, a number of participants referred to corporate and project cultures rather than national cultures as factors that impacted their communications. In reviewing the demographics of the current research, the absence of references to national cultures may result from the teams both in Australia and internationally being multicultural rather than mono-cultural. In each of the international offices, the participants, and indeed the balance of the workforce, were drawn from a number of different nationalities and cultural backgrounds, where in other research, the virtual teams may have been more mono-cultural in makeup. The multicultural makeup of the teams involved with the current study may have diluted any issues in regards to cross cultural work.

There was, however, substantial level of reference from participants to the influence of corporate culture on their ability to communicate effectively in their virtual teams. All participants in each of the four projects who comprised the active cohort were working on projects where all personnel were employed by the same company, working across multiple offices inside of one business. In this regard they were not exposed to inter-company cultural differences, only intra-company ones. Even so participants reported a number of barriers imposed by their organisations which they believed were inhibiting their abilities to communicate and operate effectively in their virtual teams. Participants described experiences such as working within a “cult of procedures”, where complying to company and project prescribed procedures took organisational precedent over active and organic conversations and relationship building. Participants believed following guidelines was considered more important than achieving the project goals. Many discussed how they believed corporate travel restrictions hampered their ability to meet their virtual team colleagues for even a single face-to-face opportunity. While they acknowledged the desire for organisations to control costs, the limited access and artificial environment of video conference was not, in the opinion of these participants, as effective as meeting in person to establish a working relationship that would benefit the project.

### **7.2.9. Recognising the Uniqueness and Complexity of Virtual Teams**

Early academic endeavours such as attempting to define virtual teams, where the assumption is that all such teams are similar, have resulted in a belief that the virtual team is a transferable concept. The findings from this current research on four organisations, all of which were undertaking engineering projects for the Western Australian resources sector, indicate that even in such a relatively similar industrial sector, each virtual team is unique. Each virtual team has unique features, strengths, weaknesses and personalities. With every characteristic that changes inside each team, the character and nature of the team itself changes. Some virtual teams will be mono-cultural, with equal sized teams of personnel from similar cultural and professional backgrounds in each location collaborating toward a common



outcome, others may comprise radically different sized multi-cultural teams drawn from different ethnic, social and professional backgrounds.

As such, it should be recognised that while there can be broad definitions of virtual teams such as that developed by Townsend et al. (1998), these definitions attempt to capture the general features that separate a virtual team from a traditional co-located one. However, each virtual team is unique and must be considered as such when being studied and managed. Many features and findings may transfer readily from one team to the next but, equally, many may not.

It was further confirmed through the current research that virtual teams are complex, dynamic organisational structures. They are structures where, unlike traditional co-located teams, changes are occurring in multiple locations concurrently, work is being performed in different ways in locations that are not always completely visible, and personnel establish ways to build and maintain relationships and communicate using electronic media as the principal platform rather than face-to-face as is the case for traditional organisational structures. Consequently, it is necessary for researchers to carefully frame and understand the form and nature of each virtual team they study, and to describe them so that other academics following their research are able to compare and contrast findings in meaningful ways into the future.

### **7.2.10. How interpersonal communications affects team member performance**

To contextualise participants' views of how interpersonal communications between virtual teams affect the performance of team members in delivery of engineering projects, it is appropriate to recognise the different views of what are considered successful and unsuccessful projects.

In considering the differentiation between project success and project management success, Ika (2009), described project management success as of primary interest to the project team and being measured by objectivist metrics such as cost and schedule, while he considered project success to be measured by both long and short term metrics and of concern to all interested parties. When examining project success in large complex undertakings Shenhar, Dvir, Levy and Maltz (2001) identified four major distinct dimensions of success; efficiency within the project; impact to the customer; direct organisational and business success and; preparation for the future, going on to state that "success means different things to different people" (Shenhar et al., 2001, p.702).

Work by Davis (2017) also found that there are a number of different opinions on what constitutes a successful project. The most common description is that a successful project is one that is completed within the prescribed schedule, meets the approved budget and is to the appropriate quality. This view meets the typical expectations of engineering companies, such as those that participated in this research, tasked with the design and delivery of projects. The second, alternate view of a successful project identified by Davis (2017) considers stakeholder interests in the desired outcomes of the project, such as the production of specific

tonnes per hour of product as would be the result of a new mining project, or the provision of certain civic facilities such as a new building. This second perspective is one often taken by the client and their shareholders and, while this second method of evaluating project performance is often valid for those businesses, it is not as applicable for the organisations and individuals who participated in this research. For the research participants, a successful project is one that is completed on time, on budget and to the agreed quality, where their organisation makes or exceeds the planned profit or better and which may result in follow-up work for their business.

A review of the many factors influencing the success of complicated and complex undertaken by Crosby (2012) found, in order of importance, success drivers to be; robust project management procedures and practices; clear project definition, scope, and objectives; mature project communication; top management support and alignment; effective project estimates and reviews and; project management and leadership with a motivating and socially capable project manager. When considering project communication, Crosby (2012) references a report on project management by the Mars Climate Orbiter Mishap Investigation Board (NASA, 2000), finding that inadequate communications within the project team resulted in a lack of cross discipline knowledge, that management did not develop an open communications environment within the project and that weaknesses in communications inhibit or prevent project success.

Poor performance within a project team is considered to result in delivery issues. Often, project documents and equipment are delivered late, design standards and quality do not meet project requirements, budgets fail to be met and there is a continual atmosphere of discomfort, tension and distrust within the team. Good performance would be characterised by deliverables being completed on time, to the required quality and within budget, and where this is not possible, the members of the project proactively share advance notice of any issues which could put this in jeopardy so that the project leadership could put mitigating strategies in place to address issues before the problem became too large.

In investigating the relationship between communication norms, role clarity and trust in global virtual teams, Henderson, Stackman and Lindekilde (2016, p.1729) found that “effective communication norms help establish and sustain role clarity alignment and interpersonal trust. And, high interpersonal trust, once established among project team members, helps sustain communication norm alignment and role clarity”. Effective communications enables the timely sharing of information and thereby avoids unnecessary delays and quality issues which would impact the successful outcomes of the project.

### **7.3. Limitations of the study**

This research focuses on engineering projects being delivered into the Western Australian resources sector, with data collection taking place during the end of the peak of an unprecedented boom in demand for these services. Consequently, the research specifically

examined engineering organisations engaged with this form of project. This necessarily limited the available sample size of organisations and project teams on which the research could be conducted which in turn imposes some limitations on the broader transferability of findings for immediate application to other fields, industrial sectors or geographic locations. However, as both the engineering and project management professions are conducted in a broadly similar manner globally, it is believed that this research could be readily adapted for use in other locations.

During the course of data collection, analysis and subsequent interpretation of this research, it was apparent that the issues faced within the organisations investigated were not restricted to one geographic location. While the structures of the projects investigated centred around Western Australian projects, and the central offices for all projects were located in Perth, few, if any research participants identified issues beyond those related to location as specific to this geographic structure. It follows that it is highly likely that many findings from this research may be directly applicable to similar project types being performed under virtual team structures for and in other geographic locations.

During the Western Australian resource project boom, with which this research coincided, the demand for skills substantially outstripped supply. With substantial client pressure for projects to be completed on time, the management of many projects were left little choice other than to access whatever skills pools they could. Organisations and projects accepted whatever quality of skills they could access, spending as much money as was necessary to deliver their projects on time. The results of this reaction to pressures included frequent duplication of efforts, excessive expenditure of unproductive labour, and frequent scheduling conflicts such as paying a premium for equipment manufacture to be accelerated then paying for the same equipment to be stored once it was available due to other activities not being completed on time. This created a working environment where many activities were not occurring in their normal manner, where waste was considered a by-product of acceleration and where many members of both co-located and virtual teams were placed in situations they had neither trained for nor had the experience to perform at their best. This abnormal environment, had two consequences for this research. A positive consequence was that some projects had tried and tested a number of different approaches to running their virtual teams in this high-pressure environment, experiencing a form of accelerated learning where they had quickly seen the good and bad of different approaches and learnt from those experiences. The negative aspect was that some experiences described in this research may have been outliers resulting from the pressures of the business environment at the time of the research.

The transferability of the findings to other industries is less clear. Resource projects such as those being performed by the organisations who participated in this research, and the engineering professionals who deliver them, have some specific practices and requirements that make the interaction of the individual and corporate participants different to other industries that use virtual teams. As a result of this, while the research findings described in this thesis may have some cross-industry applicability, they would need to be tested in those

industries to determine specific relevance. Some of the characteristics of a resources project that may be specific to that sector would be the level of interaction at a discrete, technical level; the number of procured items being sourced from external suppliers; industry, national and international standards that mandate the deliverables being produced; the lengthy overall life cycles of the projects and; the financial scale of these projects, with many resources project ranking in the billions to tens of billions of dollars.

For these reasons, it is believed this research will be readily transferable to large engineering projects in other locations executed using virtual teams, regardless of industry sector. This could include, for example, infrastructure projects, resource projects or defence projects in Europe the Middle East or the USA. However, this research may not transfer directly to technology projects such as in the IT industry, where the project cycle times are much faster and the mode of interactions inherently different to those of industries such as the resources sector covered in this work.

## **7.4. Contributions**

The current research makes its primary contributions in three distinct areas;

- Firstly, a deeper understanding of virtual team communications in engineering project teams with a focus on the Western Australian resource sector. This understanding can then contribute in the three areas of academic research, education and training, and practice. Understanding is further supported by the development of a significantly comprehensive environmental model for project virtual team communications and an accompanying model indicating the most influential relationships between the factors identified therein. The environmental model is shown above as Figure 69 and reproduced as Figure 74 for reference, and the relationship model is shown above as Figure 70 and reproduced below as Figure 75 for reference.
- Secondly, establishing a better understanding of the complexity of interpersonal communications in project virtual teams. This outcome has been achieved through research focussing on identifying and discussing the major themes within interpersonal communications in these project virtual teams, as well as analysing the complex interactions between concepts and themes that go to make up the overall communications landscape.
- Thirdly, the current research utilised a novel research methodology, combining the traditional rigour and process associated with coding of qualitative data derived from interview transcripts with the insights into complexity of phenomena of conceptual mapping. This has facilitated the development of a three-dimensional picture of the research area. This methodology may prove to be of value for future researchers in this field and others.

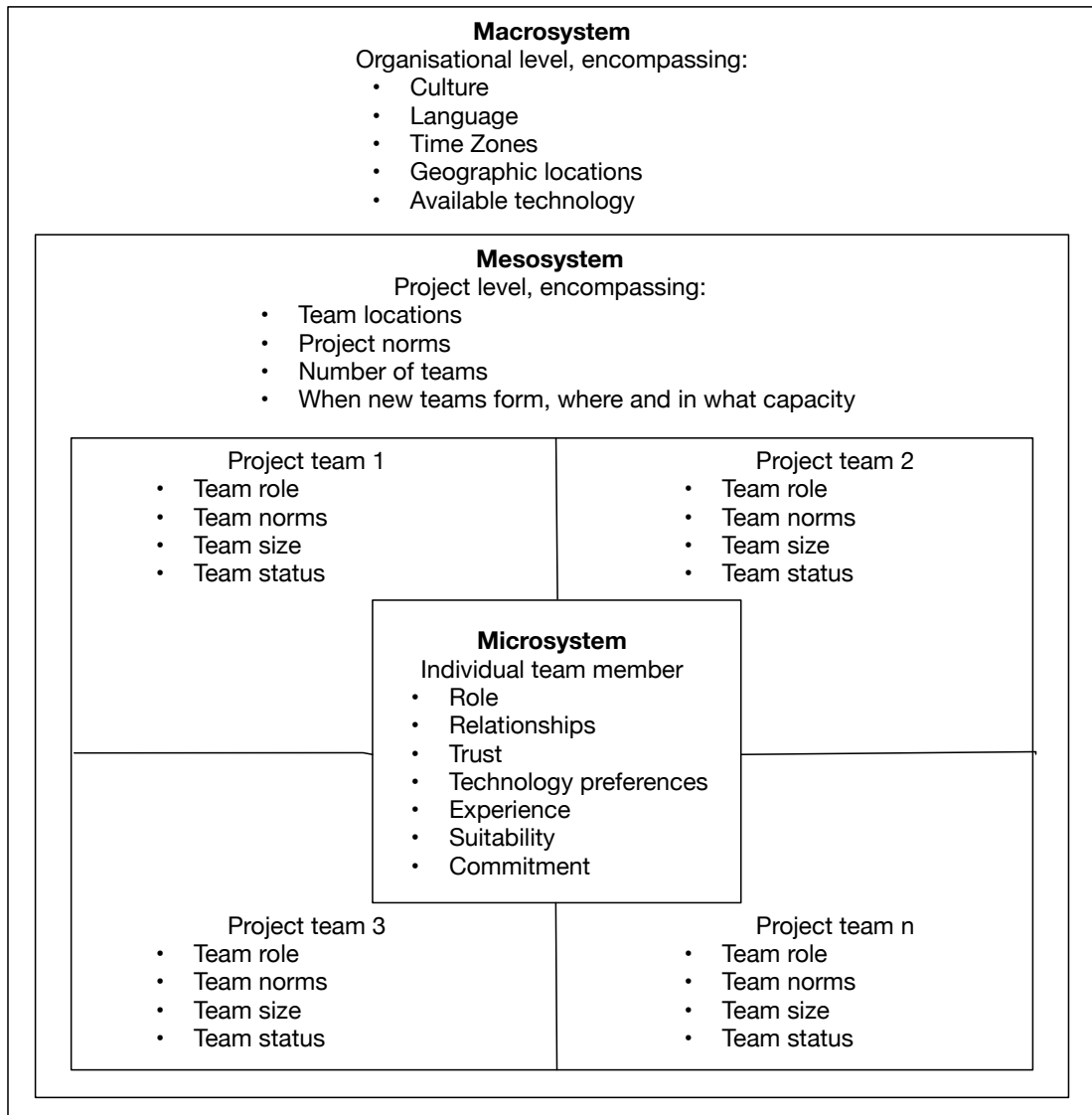


Figure 74: Project virtual team interpersonal communications environmental model

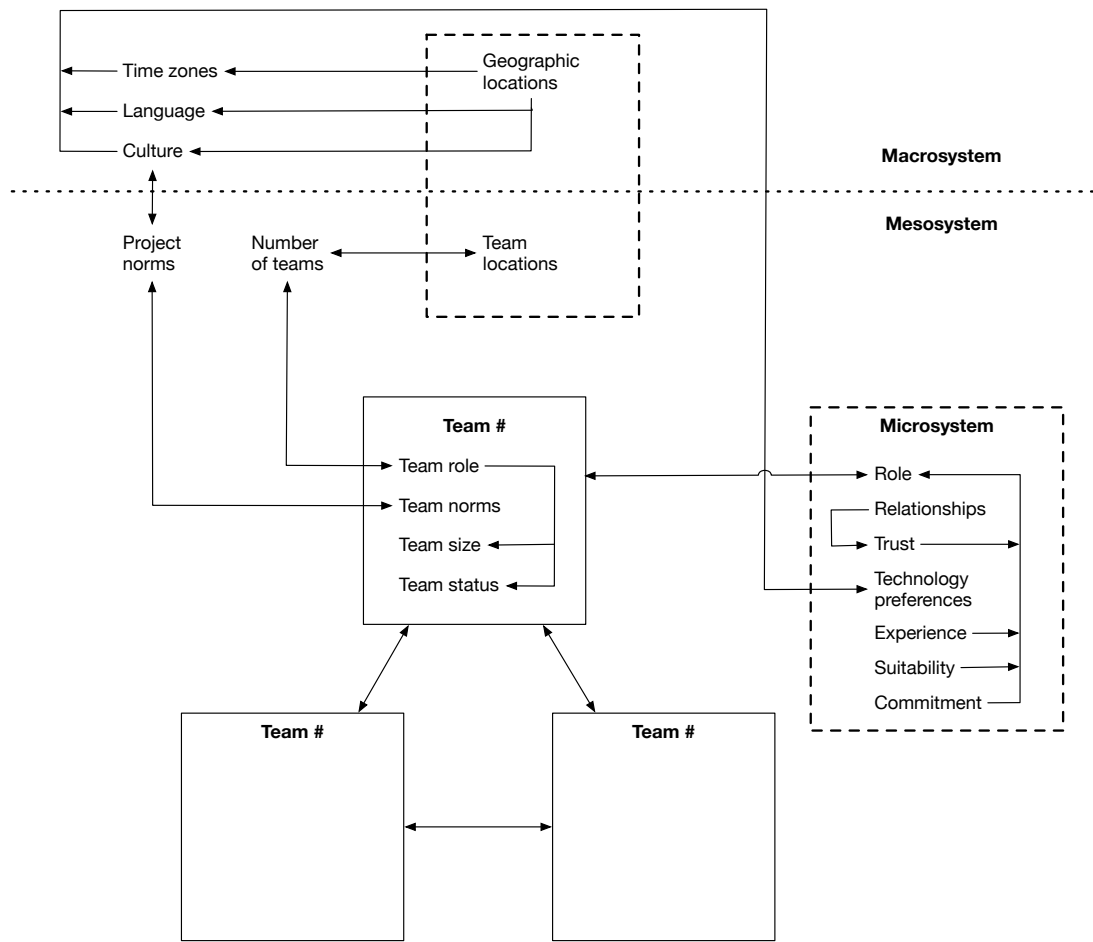


Figure 75: Interaction of variables from environmental model

The specific contributions of the current research to knowledge within each of the three paradigms are discussed in detail below.

## 7.4.1. Virtual team communications in resource projects

### 7.4.1.1. Academic research contribution

Through investigating interpersonal communications within virtual teams delivering engineering projects into the WA resources sector, this research has developed a deeper understanding of the way these teams communicate and operate and, through that, a better understanding of how virtual teams in such environments interact more broadly. Despite the volume of project activity in recent years, the use of virtual teams within the engineering sector had received very little academic investigation. At the time of data collection, the WA resources sector was nearing the end of a globally unprecedented investment boom. This boom placed enormous pressure on those delivering the projects included in the study. Projects were regularly reporting substantial cost and schedule over runs and were subsequently plagued with quality issues stemming from rushed and poor-quality work. These circumstances make the activity of particular interest for research since focussed research can add great value to industry and generate many valuable areas for future academic exploration.

The findings from this research help identify a more detailed area of research for future academic exploration; that of the project virtual team as distinct to a more generalised virtual team. Project virtual teams have now been in use for over two decades, but as yet have received little specific academic attention. Future researchers can test the assertions from this research in other geographic and industrial areas, explore findings from this research in longitudinal studies of specific projects to build a more detailed and nuanced understanding of the field and, researchers can continue to explore the various ways projects deploy and operate their virtual teams as experience with the phenomena grows.

#### **7.4.1.2. Teaching and training contribution**

The current curricula for leadership and management training for project managers and engineering managers largely utilises material drawn from the general business literature. It teaches project managers and team members general skills that often do not translate well into project environments. As projects are increasingly becoming virtual team efforts it is important that virtual team leadership skills become part of the base material, taught alongside the standard project management skills of schedule, cost, quality, and risk management. In this capacity, the Project Virtual Team Interpersonal Communications Environment Model shown as Figure 74 in the analysis of this research can be utilised to support this training. The model brings together all facets of project virtual teams identified through this research into one clear, easy to understand image, one that can then be used to help project personnel conceptualise their virtual team working environment.

#### **7.4.1.3. Practice contribution**

The findings from this research can be used within the area of practice to help organisations better understand and plan their project delivery structure to make their virtual team based projects more consistent and predictable. Variability of results and an inability to accurately estimate cost and schedule impacts of virtual teams was something that emerged from the analysis conducted in this research as well as the work of others. Organisations planning to undertake such projects need to be able to predict with a reasonable level of accuracy and confidence the final costs and likely overall schedule of their projects during planning and sanctioning so that they can determine the relative merits of each project against others the organisation is considering. For businesses, getting these estimates wrong can result in lost opportunities, new facilities that will struggle to be economically successful and unanticipated strain on organisations. Even a fraction of a percentage improvement in project cost management through more predictable delivery could save each major/mega project millions of dollars.

Potential contributions to practice could take the form of contributing to the development of a set of project virtual team recommended practices, guidelines or a body of knowledge to sit alongside existing technical bodies of knowledge such as the Project Management Institute's PMBOK (PMI, 2017). At a more basic level, checklists for new projects and for those embarking on virtual team projects for the first time could be developed from this research.

Such checklists could be used to highlight areas requiring specific focus in the planning for such projects. An exemplar of such a checklist is included as Appendix E which, while not intended to be exhaustive, sets out many of the questions an organisation planning on undertaking a project using a virtual team should consider.

#### **7.4.2. Complexity**

It became apparent through the process of conducting this research that interpersonal communications in project virtual teams is a very complex undertaking. To best understand how these teams function requires the full triadic approach of exploring people-process-context (Sparrow, 2009). Multiple factors affect how individuals are required and motivated to communicate with their project virtual team colleagues. Personnel in different roles and seniority levels within the team have different aims and expectations of their communications. The findings from the current research regarding the level of organisational complexity impacting project virtual team communications differ from the general position of the majority of literature in the field. Current literature is largely silent on the internal complexity of virtual teams, instead focussing on individual themes and their impact. It should be noted also that much of this same literature makes little to no distinction between virtual teams in continuous organisational structures and those formed for projects such as examined in this research. Therefore, examining these virtual teams from a broad perspective rather than focussing on one individual theme, adds to a greater understanding of the complexity of interpersonal communications in project virtual teams. The findings highlight a focus on the manner in which personnel working within the complex environment of multicentre project teams communicate and interact and how these interactions differ between organisational levels.

Much of the previous research examining virtual teams and communications amongst team members has followed what Ernst Poppel refers to as a 'monocausotaxophilia' approach, seeking one single cause to explain everything (Turner, 2012). Previous work has either tested theories developed for traditional co-located teams to determine their transferability, such as that of Staples and Webster (2007) and Weinkauff and Hoegl (2002) or, as is the case with researchers such as Bergiel et al. (2008) and Peters and Manz (2007), examined a single specific influencing factor in an attempt to understand the role it plays in the organisation and running of virtual teams. They also variously proposed themes and factors such as trust as the single explanation for effective interpersonal communication. The current research, however, proposes that there are a great number of different factors interacting in complex ways, each with its own level of influence and each exerting that influence in different ways and over personnel in different roles within the virtual team. Further, the current research proposes that, unlike conventional co-located teams, where many different teams may be similar, with similar issues and features, each project virtual team is unique. Each project virtual team will be influenced by its own specific geographic, cultural, organisational, societal and industrial variables and, while this work finds that there are a number of common factors influencing how such teams function and communicate, there is no single answer or theme that will describe collectively how they all function or which fully explains project success.



### **7.4.3. Methodology**

The current research utilised a novel approach to the analysis of qualitative data from such investigations, by firstly coding the interview transcripts to build themes then taking the coded data and using it to construct cognitive maps. This approach enabled the development of insights in both the deep thematic and cognitive interrelationship of these themes and concepts while maintaining a rigorous, repeatable and traceable quality.

Through employing this approach, described in detail in Chapter 3 of this thesis, it was possible to develop the principal emergent themes from the coded transcripts and then use the linking text found in many of the same codes to build a series of cognitive maps. Examination of each theme in isolation allows for the development of a deep understanding of how each theme influences virtual team member communication. By examining the cognitive maps constructed from the same codes it was possible to visualise how the complex interaction of factors influences the experiences of those involved.

Utilising these established techniques in a novel combination generated a much deeper and more rounded understanding of the phenomena than would have been possible with either method used in isolation. The same approach could be considered for exploration of similarly complex research areas in future studies.

### **7.4.4. Contributing factors from this research**

Analysis of the data in the current research indicate that personnel within project virtual teams need to have both technical and interpersonal skills to be effective. The technical ability of engineering personnel to deliver work to the quality required is clearly a major requirement. Equally, the ability of personnel across the project to coordinate their activities such that they are working in an aligned way to a common objective, completing tasks to meet both their own needs and those of their colleagues is one of the key enablers of overall project success.

The ability for personnel to form and maintain working relationships, founded through common technical achievement and personal interaction, leading to mutual respect and trust was the strongest theme to emerge. Participants described how successful communicators leveraged electronic media to maintain the communications channels required to openly share accurate and timely information on their work, and through this sharing, maintain trust. Participants also described how the opportunity to meet face-to-face was an important way to accelerate the building of relationships, spending time in social settings getting to know one another in ways they found more difficult and slower via electronic media.

Achieving alignment of personnel was also a challenge highlighted by many. There was a clear belief that an alignment session held at the start (kick-off) of a new project and including as many of the project personnel as possible was important. Participants described the impact of not holding such an exercise and how their project struggled to achieve the efficiencies it needed while personnel worked out what was required of each of them.

Distance and more importantly time zone differences were also a major barrier many participants worked hard to overcome. Separation of team members by multiple time zones resulted in a need by those undertaking project coordination to increasingly use asynchronous media such as email in place of synchronous tools such as the telephone. Additionally, many participants described working outside of their core hours, making phone calls early in the morning and late into the evening to maintain a consistent and timely flow of information between these temporally separated locations.

The commitment and suitability of personnel involved in communications between locations was also a key theme from this research. A number of participants described the various attributes required to work as an effective project virtual team communicator – openness, acceptance of differences between individuals, an acceptance of ambiguity but a drive to pursue accuracy of information, a commitment to timely reporting and a willingness to work outside of normal hours, often on the priorities of other groups in the virtual team. Participants explained that when these attributes were missing communications began to break down and the project suffered.

The final aspect with a substantial impact on interpersonal communications in project virtual teams emerging from this research was the culture and commitment from the organisation undertaking the project. While national cultures were considered a minor influence, the culture of the parent organisation and the project were seen as having a substantial influence. If the organisation was supportive of virtual teams and structured such that personnel were recognised and rewarded for their contribution to the project rather than their home office, the belief of participants was that communications, particularly around critical matters such as availability of personnel needed to maintain progress, would be effective. However, if the organisation was structured to recognise and reward personnel for their contribution to their home office rather than a virtual team project which may be 'owned' by another office, participants believed communications could become more confrontational and personnel may be withheld or deployed onto other work, placing the project in jeopardy.

## **7.5. Future research agenda**

Despite over 20 years of research into the use of virtual teams it is still a young, emerging and fertile ground for future research. As each year passes, organisations continue to evolve the way in which they use their virtual teams, exploring new methods to operate and control the projects executed through their use. With the high rate of growth in the nature and use of virtual teams, it is a major challenge for academia to keep pace with developments while maintaining a relevant and insightful perspective on how these evolving forms of teams can best be optimised for future use.

As project virtual teams continue to grow in popularity, it can be anticipated that there will be a stabilisation in their development. Organisations will reach the natural limit of their deployment and the functionality of the enabling technology will begin to plateau. Once such

stabilisation occurs, research will have the opportunity to catch up and potentially begin to take the lead in understanding the use of virtual teams in project environments. Researchers will be able to explore how to get the best from the teams and provide the best work experience for the participating personnel. In the meantime, it is incumbent on the academic community to continue to follow the evolution of the use of virtual teams, to probe and examine them as they develop, and to work closely with industry to maintain as current an understanding of how virtual teams are being deployed in projects as possible.

The principal recommendations emerging from this research are therefore;

### **7.5.1. Test and develop the environmental model**

The current research has developed the first comprehensive environmental model to understand project virtual team communications (Figure 74). However, this model represents only the views and environment examined through this study and it must be tested for validity and transferability and refined to be more broadly utilised through ongoing research.

Establishing a model such as this will help the research community in building its broader understanding of how members of project virtual teams communicate and interact as it begins to place the various themes into relative context within a multi-level model. The model also recognises the temporal and geographic evolution of these teams with the incorporation of the chronotopic system as well as including the changing communications load placed on team members through the variation in the degree of entrainment that occurs as project tasks change.

Without a model such as this, one that attempts to capture the overall dynamic complexity of project virtual teams, there is an ongoing risk that future research will revert to focussing primarily on discrete components of the phenomena. These teams must be examined holistically as well as in components to fully comprehend their organic, evolving characteristics; characteristics which place them apart from more traditional organisational structures.

### **7.5.2. Continue to develop and understand the definitions of virtual teams**

Without an agreed working palette of definitions of virtual teams, it will continue to be difficult for academia to progress in the overall research of the structure. It may be that teams need to be provided with a range of new names or sub names to allow for consistent description and explanation. It is apparent from the current level of virtual team research that simply referring to all forms of virtual team under one umbrella title is a source of confusion and may lead to a belief that the field is defined and has no further capacity for meaningful research.

It is clear that even now many researchers do not distinguish between ongoing and project based virtual teams in their work, leading to confusion and an imprecise examination of many of the phenomena. Similarly there is little clarity in the majority of published work around the

sizes of teams, their constituent membership and their tenure within the overall endeavour. For future researchers to fully understand how these teams function they need to have this level of clarity in both their own work and in the work to which they refer.

With the use of project virtual teams becoming increasingly common, there is a clear mandate for more meaningful research to frame and define the major forms of virtual teams for future researchers to use as a basis for their more detailed work. Even within the confines of the current research, several different terms were observed, with some participants referring to their virtual teams as workshare, others as distributed teams and others again as virtual teams. For consistency within this work, virtual teams in projects are referred to as project virtual teams or derivatives of this terminology. The isolated term 'virtual teams' has largely been used to refer to the broader concept of the organisational structure.

### **7.5.3. Work to better understand how personnel at different levels within virtual teams communicate**

Much of the existing research conducted on virtual teams has considered team members as having equal or very similar needs, expectations and requirements. Similarly, much of the published research has focussed on either the team leadership or the team members with no clear distinction between the various roles of the team membership. The current research has revealed that, particularly in the teams investigated, there are many different roles and that the personnel in these different roles have varied communications requirements and expectations. Researchers must consider these variations in roles when future work is being planned, performed and documented.

Recognising these different needs, it is recommended that future research be undertaken to further investigate these varied requirements and characteristics to build a better, more inclusive picture of the demands of participating in a virtual team. How personnel at different levels within a team see their roles and how they interact, with both their virtual and co-located colleagues are important considerations. Without exploring these individual characteristics and needs, ongoing research will fail to understand the specific team structural demands.

### **7.5.4. Better understand how available media can best be used within virtual teams**

The focus for the current study has been on interpersonal communications, where the communication media have been considered from the perspective of whether they enable or hinder the act of communication as required by the participants. Ongoing research into optimising and streamlining the use of different electronic media to facilitate communications in virtual teams is essential. New technologies and tools are constantly emerging and, while fundamentally they will offer either text, voice or video as their platform, there are also advances in virtual reality under development which could offer more immersive and engaging ways for virtual team members to communicate. Similarly, there are several bespoke tools

available for document sharing which may fill a specific need in the transactional exchange and sharing of technical information required by some members of virtual teams.

Historically much of the work into communication media has been undertaken by researchers within the areas of IT and computing with a particular interest in the communications hardware and software applications. Such research has predominantly examined how personnel use each new tool as it emerges, for example comparing various technologies for desktop video conferencing. Technology research must continue so that the academic community can fully understand the tools and their applications. In parallel with this research there needs to be ongoing research into the motivations of personnel choices to employ these different tools and their applicability at different levels within the virtual team structure.

### **7.5.5. Better understand how virtual teams can enhance project delivery**

As the enabling technology continues to mature, the use of virtual teams in project delivery is moving from the unusual to the normal. Over the past decade it has become increasingly common place for engineering projects to utilise personnel from multiple offices for their project teams. Personnel may be situated in the same city, state, country or internationally to ensure the necessary skills and workforce needs are met. The current research forms only a small part of the overall jigsaw of understanding how these teams can be optimised to deliver the best possible value to project owners and stakeholders and, to provide the best possible working experience to the personnel involved.

Continuous, focussed ongoing research in how project virtual teams function, and how the personnel working in these teams interact is essential for academia to build a comprehensive picture of this evolving and maturing work structure. Through sharing this research, academics will support industry practitioners establishing tried and tested norms for how they lead and manage their virtual teams. Such research must be conducted in real world environments, in different industries, businesses and project types, rather than in the relatively artificial environment of the classroom. Research must continue to move beyond comparing virtual teams to co-located teams and testing theories developed for these co-located teams for fit in virtual environments. It is critical to move to the point where virtual teams, with project virtual teams as either a subset or a standalone research area, are recognised as a unique field, with their specific theories and practices. Only then will future breakthroughs be made, and only then will those involved recognise the need for specific skills to participate and lead such project teams.

### **7.5.6. Better understand how relationships and trust can be formed in virtual team environments**

One of the strongest themes to emerge from the current research was the recognition of the value and role of relationships in the formation of the interpersonal trust necessary for

virtual team communications to be effective. While there has been a substantial volume of research completed in the organisational context over many years on how individuals build relationships, how they value these relationships, how they maintain their relationships, how relationships assist in the formation of trust, and how that trust then supports team efforts, translation of this work into the context of virtual teams in general and project virtual teams specifically is still largely incomplete.

As was discussed above, virtual teams are still evolving, having been made possible by the broad availability of high-speed internet and the technologies it supports. Project virtual teams are a relatively new concept. Consequently, further investigations into how relationships in project virtual team environments are best formed and maintained, and how these relationships convert into trust within the project environment is required.

### **7.5.7. Continue to investigate virtual teams in practice environments**

As is highlighted throughout this thesis, much of the existing research into virtual teams has been performed in classroom environments. In these environments, the pressures and expectations are very different from those faced by practitioners. While many of the findings from previous experiments can be transferred to practice situations, many others may not work well when applied. Few have been tested outside of the confines of a university environment. Since virtual teams in the broader business environment are now increasingly common, it is beholden on academia to extend research on these teams to investigate, test and hypothesise. There are many lessons to be gained from the experiences of those in practice. Those learnings can be analysed and the best of them deployed back into practice to help build more predictable and productive future virtual teams. Similarly, since the use of virtual teams in the delivery of projects is an increasingly common approach it should be increasingly easy for academia to work alongside industry to continue to better understand how to make the best of these dynamic, evolving social organisms.

### **7.5.8. Recommendations to improve virtual teams**

A number of recommendations to improve the efficiency and productivity of engineering project virtual teams can be drawn from the analysis of data gathered in the current research. Personnel need to be supported in the development of their communication skills and building of relationships; project managers and those leading project virtual teams must be selected and trained on their potential and proven ability in similar environments, rather than for their co-located project leadership skills; project teams need to consider how relationships form in their teams and place as much value on members abilities to form relationships as they do on an individual's technical prowess; personnel in roles that require extensive interaction with those from other offices should be provided with opportunities to build their relationships, including opportunities to meet face-to-face; projects should, wherever possible, have face-to-face alignment meetings, both at project commencement and at major milestone events.

When arranging these meetings sufficient time for personnel to engage socially and build the personal relationships that will support their professional ones must be allowed, and; project leaders need to carefully consider how interfaces between locations in their virtual teams function and, where appropriate, appoint and empower personnel to act as points of contact between offices.

- **Supported development of communication skills** - A number of participants indicated that there was little to no training available to them in interpersonal communication and cultural awareness but that they believed it was something that should be provided. While many participants described how they had learnt to work with their virtual colleagues on the job, much of this was through trial and error; an inefficient way to build knowledge in a pressured and time constrained environment such as major resource project delivery. With the almost ubiquitous adoption of virtual teams for large engineering projects that has occurred, worldwide, over the past decade, it is recommended that Universities incorporate formal education in working in virtual teams into their engineering curricula to prepare the next generation of engineers for this environment. In addition, organisations should offer such training for their existing staff.
- **Support workplace virtual team relationship development** - It was identified extensively in this research that strong working relationships between personnel working in virtual teams is one of the major contributors to successful communications and interactions, leading to stronger teams and, potentially, better project outcomes. Consequently, it is recommended that organisations recognise the value of such relationships and seek ways to facilitate their development between key personnel. Potential mechanisms could include scheduled and extended face-to-face meetings, incentives for personnel to find ways to strengthen their working relationships. It would be beneficial to identify and select personnel with strong cross cultural and virtual team communications and relational skills for their potential contribution to the project, regardless of their formal status or seniority within the organisation or their technical expertise or proficiency.
- **Virtual team managers and leaders need appropriate skills** – Project managers and those in leadership roles in project virtual teams must be selected for their abilities to lead such teams, either through previous demonstrated skills in similar roles or through identified potential. As some participants described, there are a number of skills specific to leading a virtual team that are not typically required for a manager of a co-located project team. These include the ability to work in a highly ambiguous environment, the ability and willingness to delegate substantial authority and control and, an ability to influence others from different cultures from a distance. Where personnel with these skills are not readily available, suitable training and development opportunities must be developed by organisations and education providers. In addition coaching and mentoring should be provided to support personnel in their development.

- **Identify and appoint coordinators at all locations** - this research has highlighted the importance of the role of interface personnel, points of contact or communication leaders. Participants voiced a strong belief that this role is critically important to the effective running of a project virtual team and to project outcomes. In recognising the value of the role these individuals fill, it is also important that the personnel filling these roles are selected and developed to ensure they are as effective as possible. These personnel need to be able to build strong and trusting relationships with their colleagues in other offices; they need to be able to communicate openly and effectively on all matters impacting the project, both inwardly to personnel within their own location and outwardly from their location into the rest of the project team; they need to be continuously appraised of the genuine status, challenges and progress of the overall project and; they are often required to perform their work over extended hours, working outside of the normal core project hours, taking calls at home and elsewhere both early in the morning and after the completion of their normal office day. This role is not one for all staff and as such those filling these roles need to have appropriate recognition and support for their contribution.
- **Hold face-to-face alignment meetings** - the value of alignment meetings at the commencement of a new project was broadly recognised by the research participants. However, several participants described how those leading their projects either truncated these meetings or cancelled them when the schedule or the budget was tight. Without a face-to-face meeting at the commencement of these projects, team members are denied the opportunity to form personal bonds that lead to trust and more open and effective communications. Without this level of early trust projects can struggle to start in an effective manner, leading to more pressures on the schedule. Also, as some participants observed, it is important to hold similar alignment meetings at major points within a project, such as when it transitions from a study into execution, from design to procurement and from procurement to construction. Each of these milestones are accompanied by large changes in personnel, exposing the project to additional risks as new relationships are negotiated. Such meetings should include sufficient unstructured free time for personnel to have ad-hoc conversations, meetings and social interaction to facilitate the development of stronger interpersonal bonds. For example, an additional day could be included in the meeting plan. It is therefore recommended that wherever possible these meetings are maintained regardless of any project pressures.
- **Provide appropriate communication tools for different needs** - From analysing participant responses it is evident that there are different preferences for electronic communication tools across the roles within a project virtual team. Senior personnel expressed a greater preference for richer, more synchronous tools such as video conference, one-to-one video meeting platforms, telephone and instant messaging. Those in mid-level roles described relying almost exclusively on voice via telephone



and platforms such as Skype along with email. Those in junior roles described how they used document sharing and email alongside voice for many of their tasks, placing a lesser reliance and interest on richer platforms such as video. Consequently, it is recommended that organisations consider providing a full suite of communication tools and allowing their personnel to select those most effective for their specific needs.

### **7.5.9. Recommendations into action**

While the core skills needed to deliver a project using a virtual team are common to those in a co-located project, the primary differences reside in how the team communicates. The development of these skills has been overlooked for too long. The current research has helped to fill many of the knowledge gaps regarding these skills and the findings need to be converted into tangible tools to reduce the haphazard nature of many current attempts at structuring virtual teams and support future projects.

#### **7.5.9.1. Incorporating virtual teams into education**

With project virtual teams likely to constitute a large part of the working environment for many future engineers it is important that many of the facets highlighted in the current research be transferred into education. The findings and model developed provide an overall model that brings together the multiple factors influencing the way such a team works. This model could readily be incorporated into the development of curricula and course content such that future engineers and project managers are prepared to work in these environments from graduation. This integration could be achieved through actions such; including training on virtual team skills in management units within educational courses and; structuring course work and assignments so that students have to work remotely with one another on their assignments but are given appropriate support and guidance in doing so.

#### **7.5.9.2. Train current and future project personnel in virtual teams**

Within the findings from the current research it is apparent that many leaders of projects have little experience of how to optimise the structure and functionality of their project to get the best from their virtual teams. Consequently, there is a real need and opportunity to develop specific training material for those in, and aspiring to, leadership positions. This could take the form of a series of short units building from virtual team member to interface communications leader to senior project leadership team member to project manager or director. Each unit would provide the specific skills needed to navigate the specific role environment as well as preparing those undertaking the training to assume greater responsibility into the future. Any such training must be accompanied by the provision of coaching and mentoring for the participants to help them deal with evolving challenges.

#### **7.5.9.3. Educate business leaders in the challenges of virtual teams**

While many individuals involved in the delivery of complex projects may relatively quickly grasp the required skills to improve their virtual teams, those running the organisations the

teams work for, being more remote to the actual team challenges, may need specific support. Training and education should be provided through appropriate channels to help business leaders recognise that many of their business practices can be optimised to ensure better outcomes for their projects. This could include areas such as aligning the reward structure for regional managers so that they are rewarded for supporting virtual teams from elsewhere in their business as much as for delivering local work. To ensure that they are better able to support the needs of personnel embedded in these teams through focussed training, access to specific tools to support communications, support for appropriate levels of travel and recognition that their required working hours may diverge from the norm for the location are needed.

#### **7.5.9.4. Develop a handbook for project virtual teams**

Not all project virtual teams will be able to access formal training. Therefore a handbook or recommended practice guideline should be developed that can be readily accessed. This handbook would include material such as; how to plan for a virtual team project, how to structure the lines of communication, how to ensure appropriate personnel are empowered to act autonomously when appropriate within the project structure, how to support the development of professionally based working relationships between team members, what to consider in the development of budgets and schedules so that the necessary activities that underpin an effective project virtual team are accounted for in the planning phase and, how to ensure the appropriate media are provided to enable the necessary communications.

## **7.6. Closing observations**

This research study was undertaken to improve understanding of interpersonal communications in project virtual teams, with a specific focus on the resources sector in Western Australia. To develop this understanding, the following research questions were established;

- What are the attributes of a successful communicator and coordinator in engineering projects where the virtual team approach is used?

The findings of this research identified a number of attributes that contribute to the communications success of a coordinator in these project types, namely; they need to be able to build relationships and establish both transactional and personal trust with their colleagues through delivering on their commitments and responding in a timely manner to questions; they need to have the appropriate level of technical competency to establish their credibility; they need to be conversant with the requisite communications media and understand how to select different media for different tasks, and; they need to be flexible and accessible to their colleagues, often undertaking communications outside of normal core hours.

- How do beliefs and expectations of a project's virtual team members vary at different levels and roles within the project and between the project's teams?

It was identified through the findings of this research that there are a number of different characteristics and expectations held by personnel in different roles and in different locations within these teams. Those located in the home (Perth) office were found to be less cognisant of cultural and temporal differences than their remote colleagues, occasionally failing to recognise and allow for the impact of these variables on personnel in their remote team offices. There were differences in the preferences of media between the senior, mid-level and junior personnel, with the senior personnel preferring to use rich media such as videoconference technology and face-to-face meetings, the mid-level personnel relied heavily on their use of telephone and email, while the junior personnel were often happy with telephone and desktop document sharing.

- In what ways do current theoretical perspectives adequately explain the relationships between interpersonal communication and the factors that make members of a distributed virtual team feel engaged and committed to the project?

Much of the current theoretical work has focussed on defining a virtual team and testing existing theory on virtual teams made up of university students assigned tasks to simulate their participation in such teams. There has been very little work examining real world teams in detail and an even smaller volume which has examined the resources sector. Equally, much of the existing research has failed to discriminate between large and small virtual teams and between ongoing virtual teams and those established to undertake a project, making it very difficult for later researchers to fully contextualise previous research. While the findings from the current research align well with a number of the existing theories, this study has also identified a number of areas for ongoing examination.

- How can interpersonal communication in engineering project teams be improved?

A number of areas for improvement were identified through the findings of this research, both for education and for practice. It is recommended that practitioners re-evaluate how they establish and run their project virtual teams and consider them as a new way of building the workforce needed when executing projects rather than continue with many of the existing practices. This would include actions such as changing from having a single overall project management team co-located in the head office controlling the entire project towards a model of devolved leadership where much of the decision making occurs in the various locations within the project where work is performed. Organisations should also review the roles and responsibilities associated with key coordination roles to ensure that personnel with the right attributes are assigned to these roles and given the appropriate authority and recognition to undertake their work. Education institutions must review how they train future leaders and team members, and recognise that virtual teams are now a permanent feature of the workplace. For this reason those being trained and educated need to be given the appropriate skills to work effectively in these teams. Both the changes in practice and education need to be underpinned by ongoing research by the academic community to ensure the emerging research reflects the new working environment as closely as possible and provides the insights needed to continue to build knowledge.

Each of the associated questions contributed to answering the overall question of;

- How do interpersonal communications between virtual teams affect the performance of team members in delivery of engineering projects into Western Australia's resources industry?

The findings of this research indicate that the performance of team members in project virtual teams is substantially influenced by the effectiveness of their interpersonal communications. The synthesised findings presented reflects the views of those working in these project virtual teams that, to deliver successful project outcomes, communications must be built on a foundation of effective interpersonal relationships and trust, along with a willingness to proactively engage with other members of the team regardless of separations of time zone, distance, culture or seniority. The project virtual team interpersonal communications environment model depicted in Figure 74 illustrates the complex interactions of factors that influence the ways in which members of these teams are able to communicate. These factors range from macro factors such as time zone differences through to personal, micro factors such as the individual's belief in and commitment to virtual teams as a way of working. All of these factors drive the overall effectiveness of the communications within these teams in both positive and negative ways. Each factor need to be accounted for in the way in which a team is structured and its personnel engaged and deployed. Only when these actions are incorporated in the running of these teams can fully effective communications be undertaken and the best outcomes achieved.

While much work remains before a full understanding of how and why personnel in project virtual teams communicate and interact, this work builds on existing research and opens pathways for future research to explore.

Project virtual teams are here to stay and are likely to be the chosen structure of many future resource engineering projects. As such, the way in which these teams function needs to be fully understood so that those using them can gain the advantages they offer and minimise many of the risks present in distributed teams. Without substantial focussed research into project virtual teams in practice, and ongoing sharing of findings in the form of publications, training, education and best practice guidelines, industry will continue to struggle to find the best way to deploy their personnel in distributed structures, wasting time, money, talent and opportunity.

It is incumbent on the academic and practice communities to work together to identify opportunities for future research collaboration. Industry must open its doors to allow ongoing academic scrutiny of their methods and approaches to deploying, leading and operating their project virtual teams, through all forms of investigation. Similarly, the academic community must move beyond trying to fit 21<sup>st</sup> century evolving business structures into 20<sup>th</sup> century business models and look to the future to find new models such as that set out herein that help define contemporary operations.

## 8. Appendices

## 8.1. Appendix A – Interview Instrument

### Interview Preamble

“Thank you so much for your time today. I am conducting research into the influences of interpersonal communications within internationally distributed virtual project teams engaged in delivering engineering projects into the Western Australian resources sector and I am trying to discover what people involved in these projects really think.

Would you be interested in a summary of my research once I have completed it?”

Yes / No

### **(Make a note if they are!)**

\* Explain Information Sheet

\* Provide Consent Form to read and both sign (store away safely)

“Thank you. Today’s interview is confidential as you know and you are aware that upon transcription of this interview your name, and any others that you mention will become numbers and codes. This is your time to consider and discuss what is important to you. My questions are merely prompts and of course, there are no right or wrong answers.

As I am recording this discussion, please let me know if you want to go off the record at any time and I will suspend the recording.

Let’s turn it on and begin!”

---

## Interview Questions

1. Can you give me a brief history of your career and how you came to be in your current position?
2. Could you outline your role in the project and specifically your level of involvement and interaction with the other offices that form part of the project?
3. Could you tell me which factors you believe most affect interpersonal Virtual Team communications in your project? – If you would like to just list the factors as they come to mind, then we can go back and review them in detail afterward.

Mark in the table below as the subject responds...

|  |                          |  |                 |
|--|--------------------------|--|-----------------|
|  | Time                     |  | Tenure          |
|  | Culture                  |  | Relationships   |
|  | Background               |  | IT problems     |
|  | Lack of Face-to-face     |  | Marginalisation |
|  | Organisational structure |  | Collectivism    |
|  | Empowerment              |  | Trust           |
|  |                          |  |                 |
|  |                          |  |                 |

4. Thinking about ... *[repeat the terms referenced by the subject in the order given, repeat this process until all of the subject's points have been covered...]*
  - a. Why do you believe this influences your virtual team communications?
  - b. How is this managed in your project?
  - c. Would you manage this differently if you had the opportunity?
  - d. Have you worked in other projects where this issue was managed differently?
    - i. How was it managed?
    - ii. How did that approach turn out?
5. Are there any other factors you had not previously mentioned you would like to add to the list? – [If yes, address them in the same way as above...]
6. What do you think makes for a good virtual team leader of member? Do you think there are differences between how a co-located team member works and a virtual one? Do you think they are different dependant on the “end” of the relationship they are working at? What makes a bad one...?
7. Is there anything you do at the start of a new piece of work to get a virtual team relationship working?
8. Approximately how much of your working time is spent in working with your virtual team colleagues as opposed to either working on your own or with your local colleagues?
9. Who sets the schedule for your virtual team discussions?
  - a. Are they; Fixed/regular, i.e. weekly at a certain time... Ad-hoc/as required or a combination of the above, i.e. a formal regular meeting then as required?
  - b. What technology do you use for your meetings? – *phone, v/c, IM etc.?*
10. Are your meetings scheduled to suit one party or another?

11. How do you manage disagreements and conflict between your local colleagues and your virtual teammates?
12. How do you recognise and reward excellence and achievement in your virtual teams?
  - a. Individually or collectively?
13. Can you outline how work is allocated in your virtual teams? I am trying to understand if your teams work as integrated units or as independent units?
  - a. Is work allocated with or without discussion?
  - b. How would you describe the complexity of the tasks you interact on with your virtual colleagues? Is it allocated by vertical package, horizontal package, skill set or a combination?
  - c. Do you work on discrete tasks or collaborate on common tasks; do you think this is the most effective way to operate?
  - d. How do you communicate coordination of work/tasks between your teams?
14. Does your project have a designated coordinator of Virtual Team communications or are multiple personnel responsible?
15. Have you had the opportunity to meet any of your virtual colleagues in person? Do you believe this has helped you to work together?
16. How important do you believe personal relationships are within your virtual teams?
  - a. How much time do you spend, if any, building and maintaining personal relationships with your virtual team colleagues?
  - b. What percentage of discussions is given over to relationship building versus technical matters?
  - c. If you have not spoken to your virtual team contacts in a few days do you make an effort to contact them or just contact them as required for work?
17. Did you receive any formal or informal training in working in virtual teams before you started this project?
  - a. If yes, please can you describe it;
    - Was it a one off; When was it conducted; How effective was it; Was it open to everyone or just certain team members; Was it tailored to your project or generic
  - b. If no, do you think you could have benefitted from any and if so, what kinds of training or support?
18. Within your project environment, do you have or do you use any specific software for your virtual teamwork?
  - a. If so, what do you use and how effective is it,
  - b. Is it available to everyone or just certain team members?
19. Based on your experiences in your virtual team in this project do you feel confident that this approach is effective and would you feel comfortable with it being used on future projects of this kind?
  - a. Can you describe why you feel like this?
20. What do you find most challenging about virtual teamwork?
21. What do you find most rewarding?
22. Before we close, is there anything else that has come to mind as you have spoken that has not been said, but which you feel is relevant?

## Conclusion

*“Thank you so much for your time today – I really appreciate it. I was wondering, should the need arise, would you be willing to have a brief follow up discussion during the time I am collecting my research data in order for me to clarify anything from today’s interview?”*

*Thank you again”.*





## 8.2. Appendix B - Information Sheet

### Research Aim

An investigation into the influences of interpersonal communications within internationally distributed virtual project teams engaged in delivering engineering projects into the Western Australian resources industry.

### Research Purpose

The purpose of this study is to develop an understanding of the cognitive and affective aspects of how project managers communicate with their globally distributed teams, what the members of these global teams expect from their managers, in terms of communication styles and information, and how this influences the performance of the teams within their projects.

### The Researchers

This research is being undertaken by Francis Norman. Francis is enrolled as a PhD student at Curtin University. Supervising this research is Associate Professor David Pick and Dr Carolyn Dickie, both of Curtin University.

### Ethical Issues

The research will be conducted in strict accordance with University protocols and ethics and with the Australian Code for the Responsible Conduct of Research. Obtaining quality data requires that the participants speak freely, comfortable that any sensitive information disclosed during interviews is confidential and non-traceable. Confidentiality of participant data is respected at all times. Each participant will be provided with a written guarantee of privacy and anonymity and will sign a consent form that outlines the nature of the project, and each party's role and responsibilities. Neither the participants nor the researchers will receive any reward or remuneration for participating in this study. Participants are free to withdraw from the study at any time without prejudice or negative consequence by contacting the researcher as detailed at the bottom of this letter.

### Benefits

By participating in this research you will be contributing to research that has the potential to improving the ways in which internationally distributed virtual project teams engaged in delivering engineering projects work.

### Confidentiality

Any information obtained in connection with this study will remain confidential. The results of this study and any written reports will not identify either you or your organisation. All audio files and transcripts will be managed in accordance with Curtin University's research ethics requirements.

### Requirements of Participants and Time Duration

Participants are invited to participate in a one-on-one, face-to-face, video or telephone interview lasting approximately 90 minutes. The interview will be recorded for data analysis and research development.

### Contact Details

For further inquiries about the study or any matter in relation to this research, please contact:

|  |  |  |
|--|--|--|
| Associate Professor David Pick   | Dr Carolyn Dickie  | Francis Norman   |
| Curtin Business School   | Curtin Business School   | Curtin Business School   |
| Curtin University  | Curtin University  | Curtin University  |
| GPO Box U1987  | GPO Box U1978  | Tel: +61 411 264 466   |
| Perth, Western Australia 6845  | Perth, Western Australia 6845  | <a href="mailto:francis.norman@postgrad.curtin.edu.au">francis.norman@postgrad.curtin.edu.au</a> |
| Tel: +61 8 9266 2705   | Tel: +61 8 9266 1367   |  |
| <a href="mailto:david.pick@cbs.curtin.edu.au">david.pick@cbs.curtin.edu.au</a> | <a href="mailto:carolyn.dickie@cbs.curtin.edu.au">carolyn.dickie@cbs.curtin.edu.au</a> |  |

**This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number SOM-29-11). If needed, verification of approval can be obtained by either writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, PERTH WA 6845, or telephone +61 8 9266 2784.**

### 8.3. Appendix C - Informed Consent Form

**Project:** An investigation into the influences of interpersonal communications within internationally distributed virtual project teams engaged in delivering engineering projects into Western Australia

Interviews for the above research project will be conducted either face-to-face or via telephone or video connection, one-on-one and digitally audio recorded and scheduled to suit participants. It is anticipated that each interview will take approximately 90 minutes or less. Confidentiality is paramount. Following completion of the transcription of the interviews all identities shall be converted to code numbers. Some interview extracts will be used in papers and the study's final thesis; but no information in the papers, thesis or any subsequent publication will be able to be traced to an individual. All audio files and transcripts will be managed in accordance with Curtin University's ethical research requirements. Participation is voluntary and you are free to withdraw at any time.

If you have further questions, please contact Associate Professor David Pick: Tel +61 8 9266 2705

Thank you for your co-operation.

*I \_\_\_\_\_ (participant's name) have been informed of, read and understand the purposes of this study and have been given opportunity to ask questions. I agree to my interview being audio recorded and understand that all content remains confidential - that my name will not be associated with any report, subsequent publication or presentation arising from this interview. I know where to direct my queries and have a copy of the consent form. I understand I can withdraw at any time.*

| Participant |       | Researcher |       |
|-------------|-------|------------|-------|
| Signature:  | _____ | Signature: | _____ |
| Name:       | _____ | Name:      | _____ |
| Date:       | _____ | Date:      | _____ |

## 8.4. Appendix D – Cognitive maps

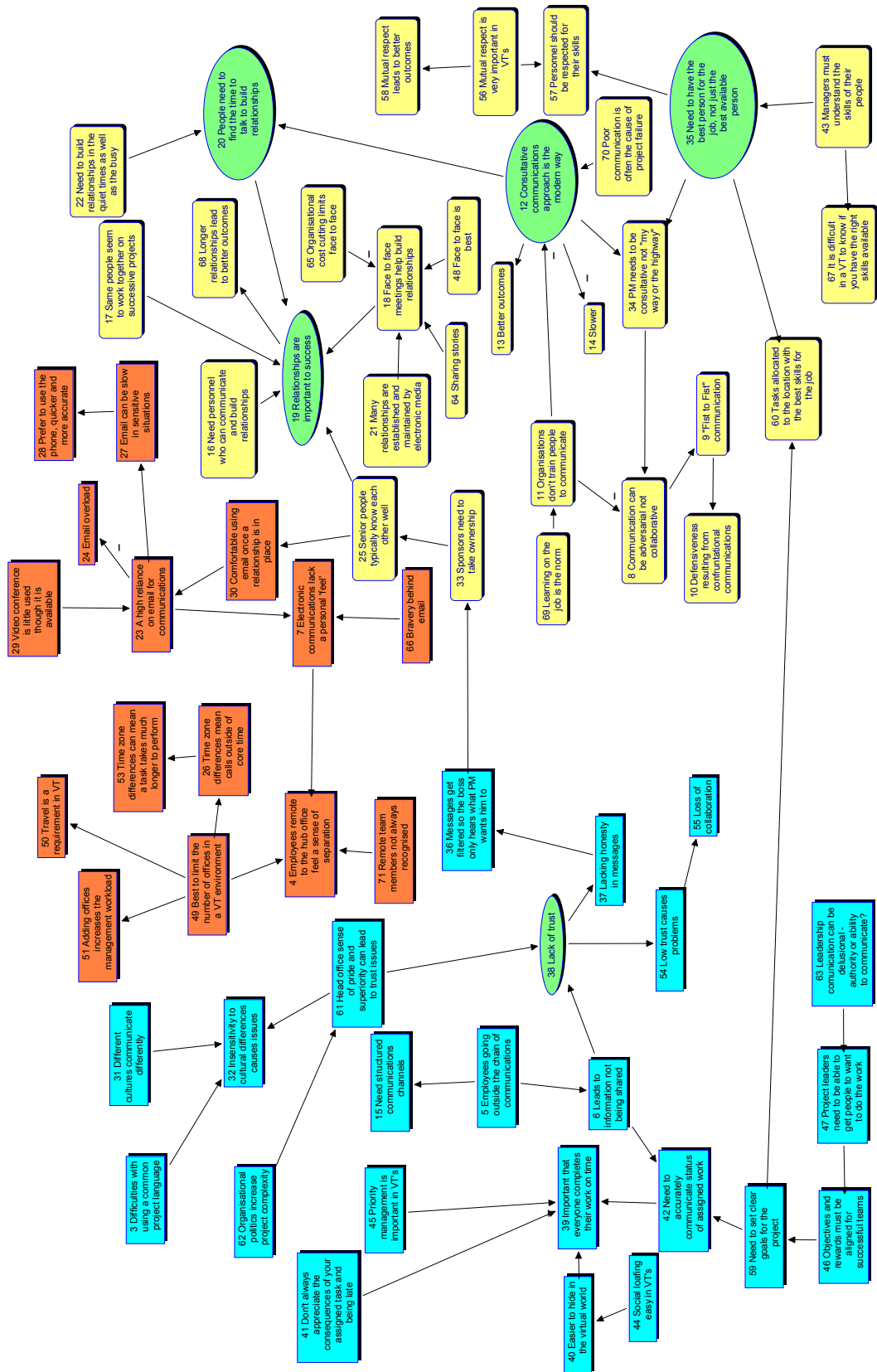


Figure 76: Senior home cognitive map

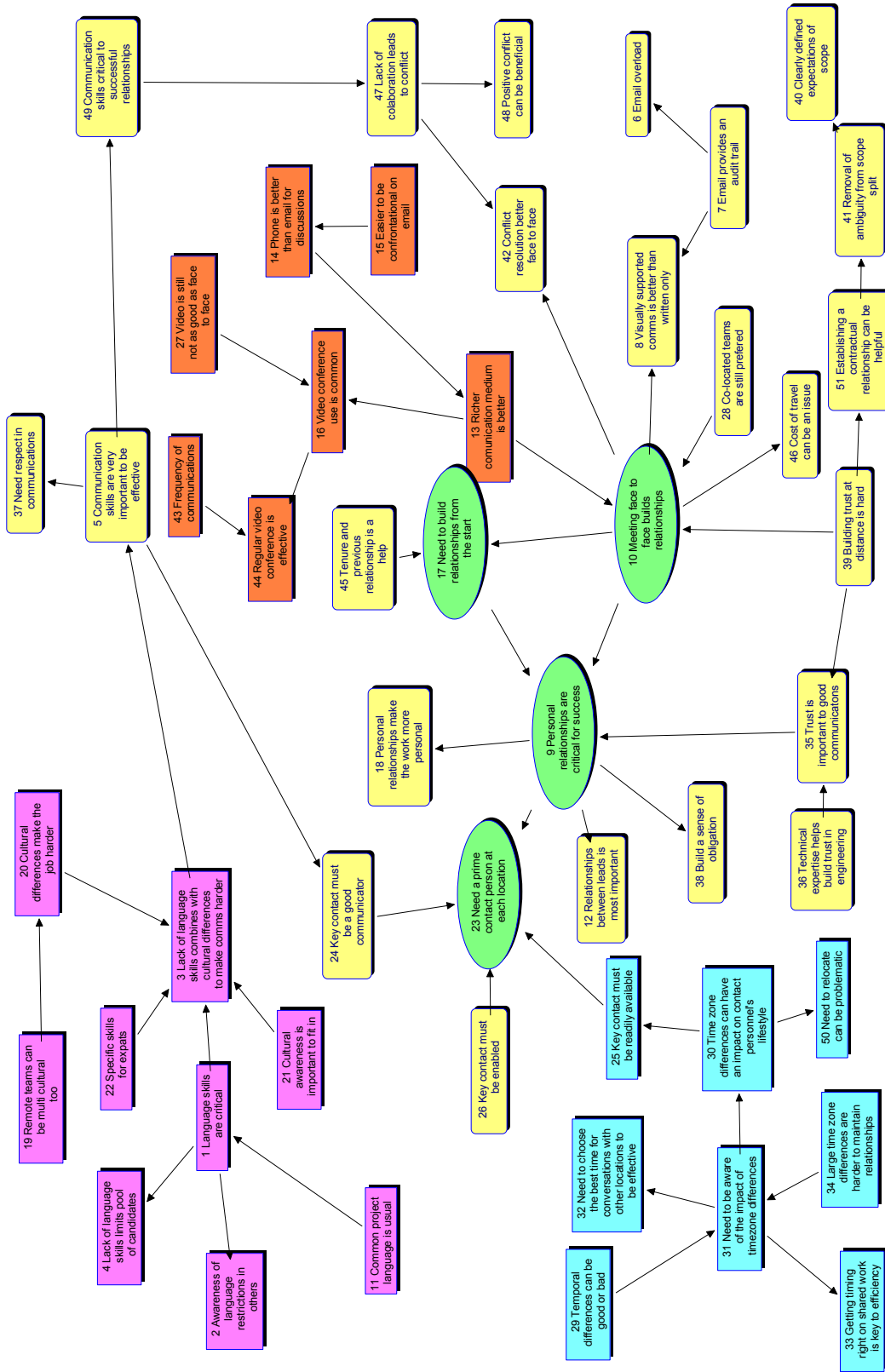


Figure 77: Senior away cognitive map

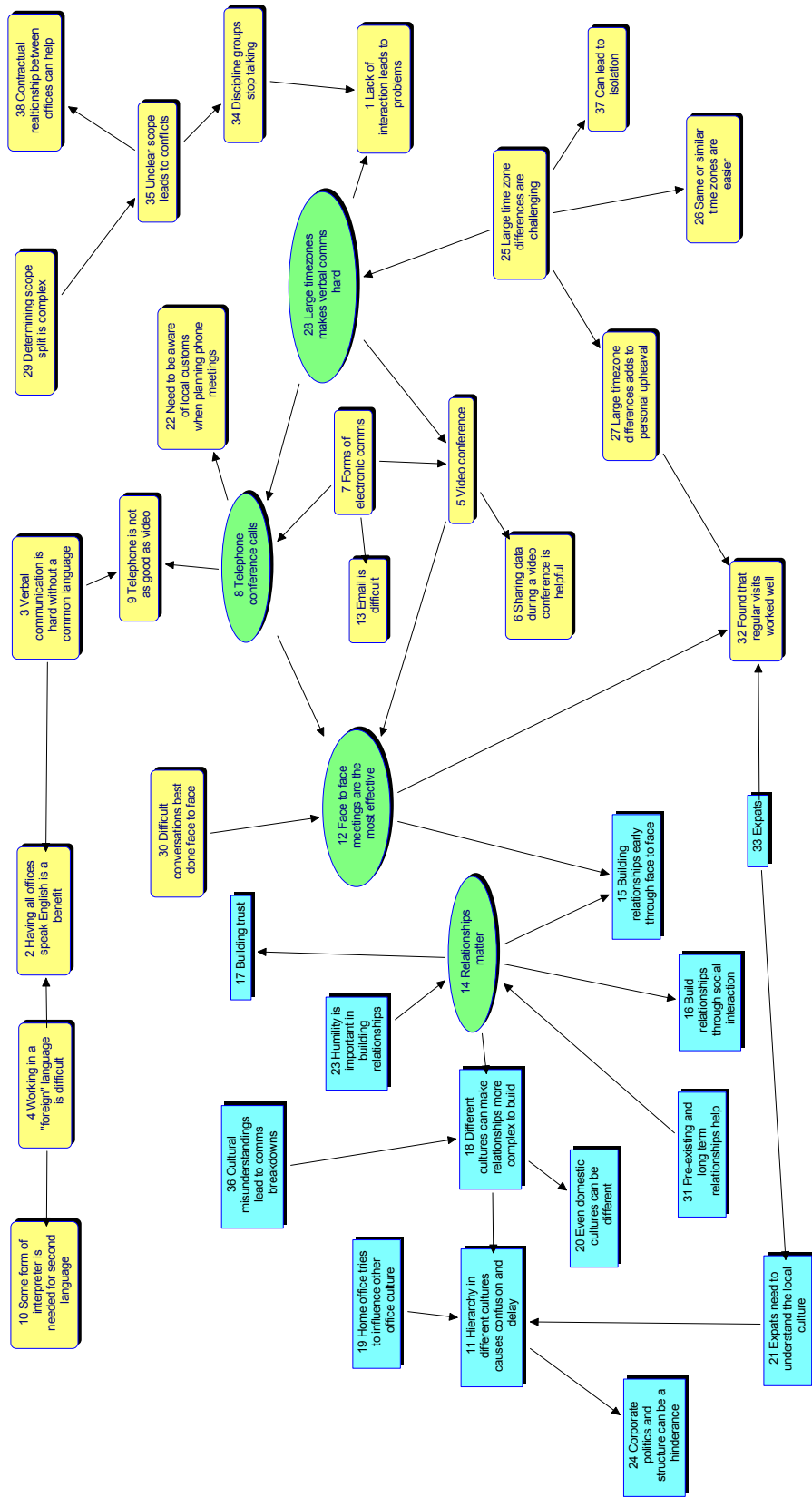


Figure 78: Mid home cognitive map

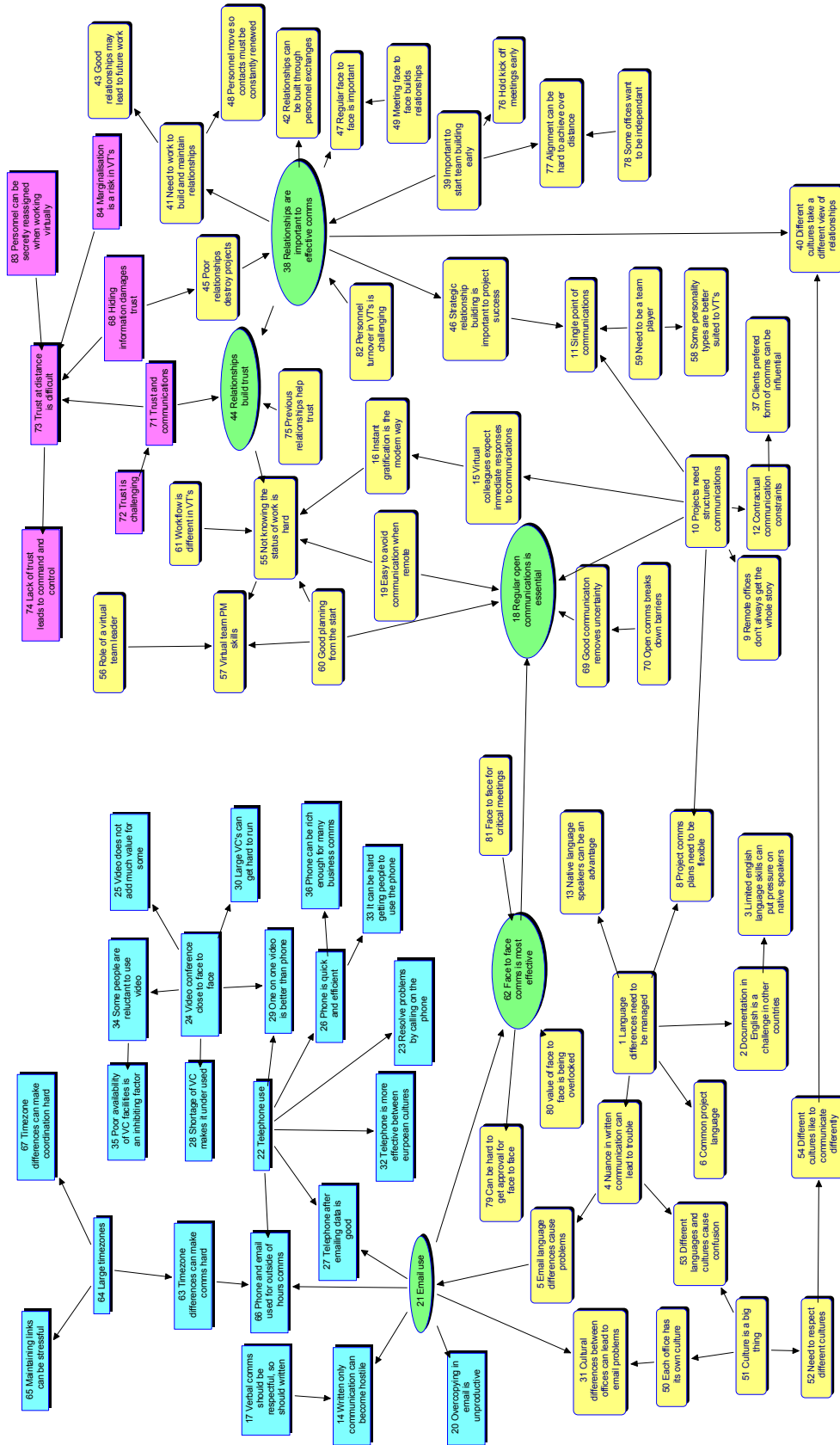


Figure 79: Mid away cognitive map



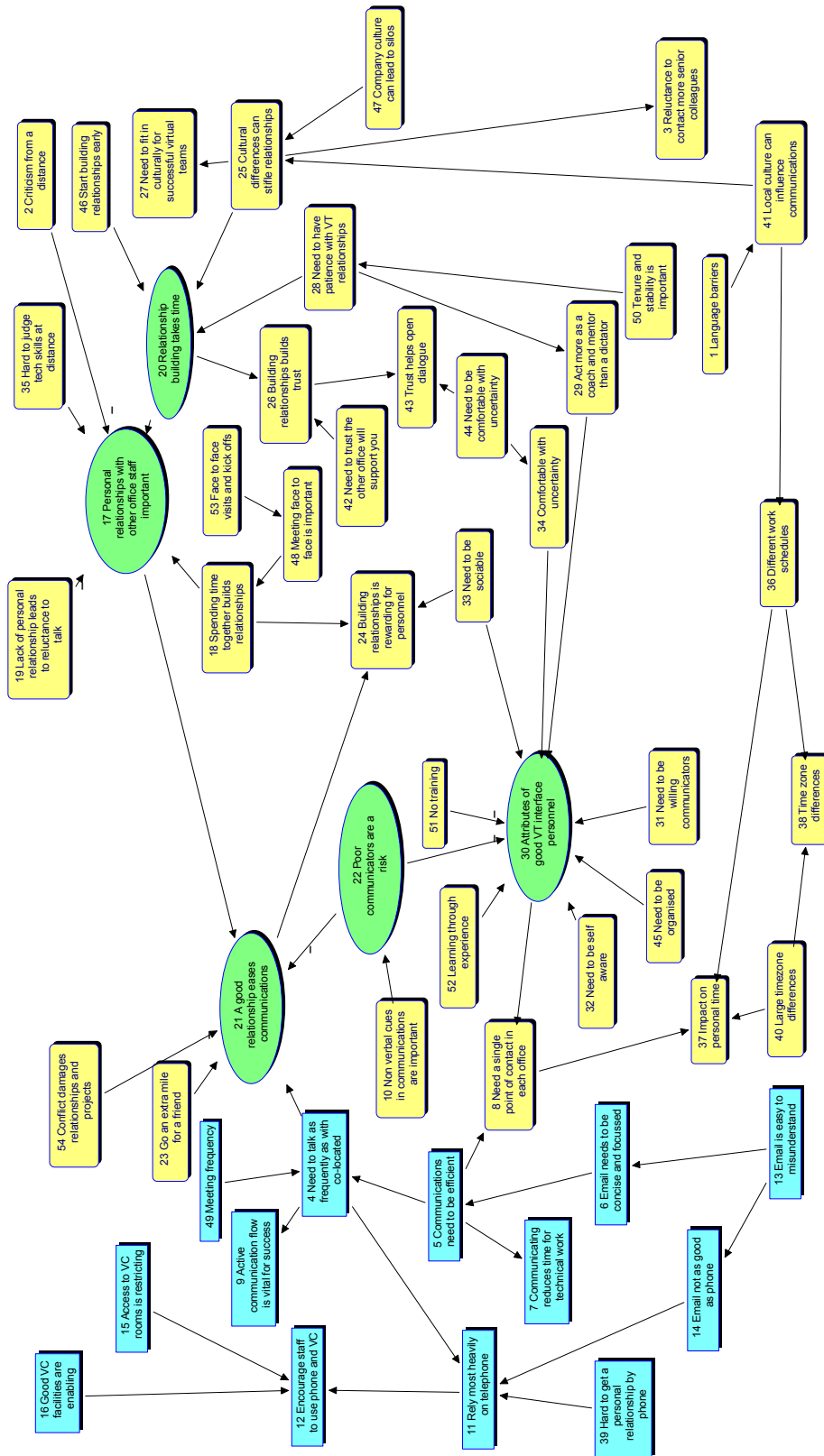


Figure 80: Junior home cognitive map

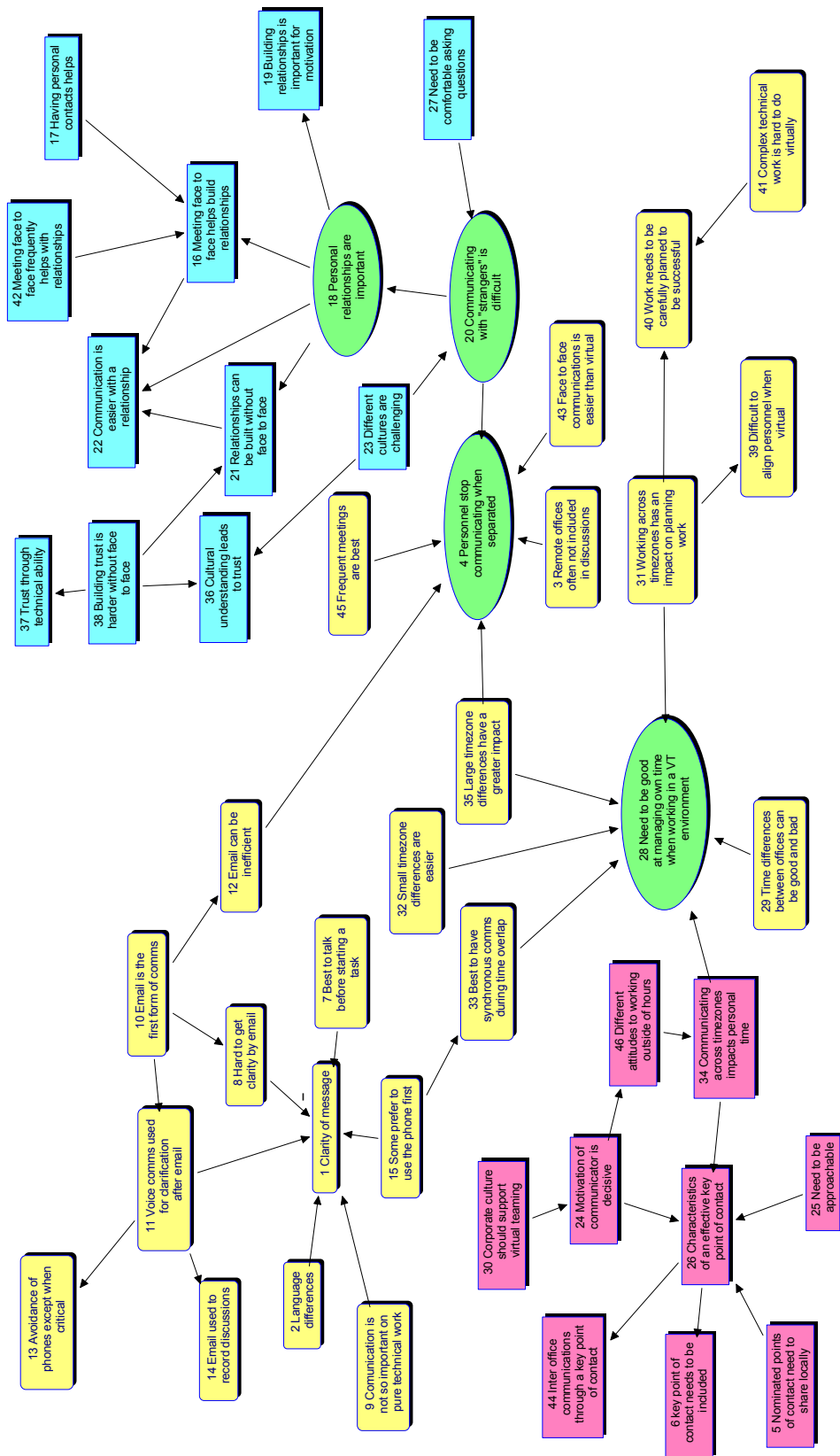


Figure 81: Junior away cognitive map

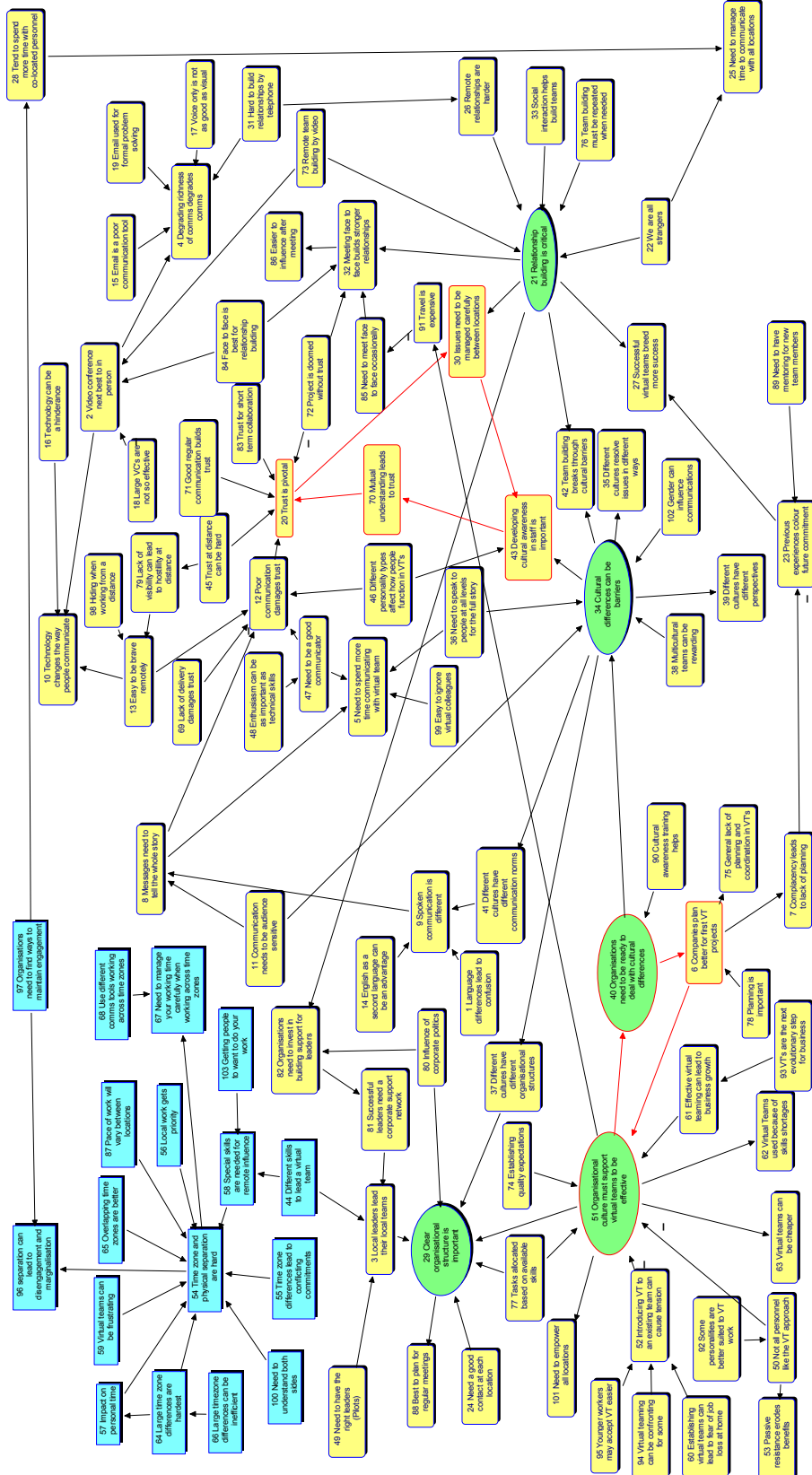


Figure 82: Independents cognitive map

## 8.5. Appendix E – Checklist Exemplar

| Category                                    | Action  | Outcome or Mitigation   |
|---|---|---|
| Readiness for project virtual team          | <p>Why are we adopting Virtual Teams approach for this project?</p> <ul style="list-style-type: none"> <li>• Cost</li> <li>• Capacity</li> <li>• Capability</li> </ul>  | <i>Organisation to clearly describe their motivation for adopting virtual teams as part of their strategy so that future decisions can be contextualised</i>        |
|   | <p>Is virtual teaming part of our company core business</p>   | <i>Organisation to understand that virtual teams project execution requires different processes to traditional delivery approaches</i>                              |
|   | <p>How will the overall project be managed?</p> <ul style="list-style-type: none"> <li>• Centrally</li> <li>• Devolved</li> </ul>   | <i>Determining the management approach will facilitate the allocation of appropriate personnel and support</i>  |
| Home office capability                      | <p>How capable is the host office?</p> <ul style="list-style-type: none"> <li>• What can it deliver?</li> <li>• How experienced are its personnel at virtual teaming</li> </ul>   | <i>The home or host office must understand what its core skills and role is in the project such that it can make informed decisions on the distribution of work</i> |
|   | <p>What work cannot be done at the host office and why?</p> <ul style="list-style-type: none"> <li>• Cost</li> <li>• Capacity</li> <li>• Capability</li> </ul>  | <i>As above, the host office must know what it can and cannot deliver so that an informed decision can be made on the selection of partner offices</i>              |
| Selection and appointment of remote offices | <p>Where can the project secure the balance of needed personnel?</p> <ul style="list-style-type: none"> <li>• How few locations can they be spread across?</li> <li>• How much experience exists in the identified</li> </ul> | <i>Addressing these questions in the light of those addressed above will allow the project leadership to develop an optimised virtual team structure</i>            |

| Category | Action   | Outcome or Mitigation   |
|----------|--|---|
|          | <p>offices in virtual teaming?</p> <ul style="list-style-type: none"> <li>• How successful was their virtual team experience?</li> </ul>   |   |
|          | <p>Are appropriate KPI's in place to ensure all offices are rewarded for their participation in the virtual team project</p>   | <p><i>Ensuring appropriate Key Performance Indicators (KPI's) for each part of the virtual team will help to ensure the project encounters as few disputes as possible</i></p>  |
|          | <p>How will the offices contract with the project?</p> <ul style="list-style-type: none"> <li>• Formal agreement?</li> <li>• Informal (assumed) agreement?</li> </ul>  | <p><i>It is recommended that each location has a formal contractual agreement in place, even where the offices are within the same overall organisation.</i></p>  |
|          | <p>What are the geographic, temporal, cultural and language separations that will occur with the proposed choices of locations?</p> <ul style="list-style-type: none"> <li>• How will they be managed</li> <li>• How will personnel be trained</li> </ul>  | <p><i>The project management need to consider the barriers to effective collaboration between their team locations and personnel and put in place appropriate processes to address them</i></p>   |
|          | <p>What happens if a portion of the project is placed on hold?</p> <ul style="list-style-type: none"> <li>• Does the office executing the held scope carry the risk or the overall project?</li> <li>• How long until personnel are redeployed?</li> </ul> | <p><i>These questions need to be addressed as part of both the KPI's and the agreement between offices. Redeployment of personnel from with a project can lead to substantial ongoing issues in its execution and need to be carefully considered before occurring.</i></p> |
|          | <p>How will inter office disputes be resolved?</p>   | <p><i>Identifying a process to address interoffice disputes that is impartial should be part of the planning for a project virtual team</i></p>   |

| Category                             | Action  | Outcome or Mitigation   |
|--------------------------------------|---|---|
|                                      | How will travel be managed and enabled?   | <i>Ownership of travel budgets and the ability to undertake travel needs to be identified from the start and travel recognised as a critical contributor to inter-personnel trust</i>   |
| Task allocation and control          | How will the project work be broken up for virtual teaming? <ul style="list-style-type: none"> <li>• Horizontal packages?</li> <li>• Vertical packages?</li> </ul>  | <i>Understanding how and why work will be shared between offices from the initial planning will assist in the appropriate selection of personnel and the establishment of quality control and communications channels</i>   |
|                                      | Is there an alignment program for kick-off and at key milestones <ul style="list-style-type: none"> <li>• Facilitators</li> <li>• Attendee program</li> <li>• On boarding of new personnel</li> </ul>   | <i>Establishing an alignment process and a frequency of running such a process will help to apply structure across the project and ensure personnel are fully aware of the development of the project</i>   |
|                                      | How will tasks be allocated and by who, work checked and approved to minimise project delays and micromanagement while building trust?  | <i>Once a project structure is in place and skill sets identified, determining how and by who work is allocated and controlled will assist in the building of trust and relationships between team members.</i>   |
| Communications and personnel support | How will the communication interfaces be managed? <ul style="list-style-type: none"> <li>• By who <ul style="list-style-type: none"> <li>○ Seniority</li> <li>○ Authority</li> </ul> </li> <li>• How will they be selected</li> <li>• How will they be trained</li> </ul> | <i>Developing a communications matrix that recognises that communication at all levels is critical to the success of the project will assist in ensuring the appropriate personnel are allocated to these tasks and that they are recognised for their contribution</i> |

| Category | Action  | Outcome or Mitigation   |
|----------|---|---|
|          | <p>What communications media will be made available to personnel?</p> <ul style="list-style-type: none"> <li>• What will be company provided</li> <li>• Will personnel be empowered to use their own choices</li> </ul> | <p><i>Setting out a communications media plan that is flexible and allows personnel to leverage media of their own choice should assist in maintaining agile communications within the team and successful project outcomes</i></p> |
|          | <p>How will personnel be supported if they work out of hours to undertake interface activities?</p>   | <p><i>The project management personnel must recognise that many personnel will be required to maintain communications outside of core hours and put in place plans for fatigue and wellbeing management</i></p>                     |
|          | <p>Is the project planning to provide access to internal or external virtual teaming coaches and mentors for existing and new team members?</p>   | <p><i>The project must recognise that many personnel may be new to the demands of their roles and may need coaches, mentors and/or training to be as effective as possible. This should be included in the project plans.</i></p>   |

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