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Critical Success Factors Required By Virtual Teams Members in Engineering Projects

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Abstract

Virtual teams have emerged as a result of development in communication technologies and the inevitability for companies to compete in the global market. Differentiating features between traditional and virtual teams are minimal face-to-face interaction and a predominant use of technology-enabled communication. The objectives of this research were to investigate critical factors that contribute towards virtual team success and to further assess the role played by trust, communication, conflict and knowledge.

Quantitative data collection methodology was employed for this research, using self-administered questionnaires. A total of 64 responses were received from a sample of 75. Most respondents were from South Africa (47%), while the remaining 53% were from India, United Kingdom and China. Four research questions were formulated based on gaps identified during the literature review.

Factor analysis was performed by adding the outcomes of each factor and ranking them in descending order to determine the factor that was highly ranked. Based on this analysis, the study concluded that feedback about how well each team member was doing should be viewed as how well the entire team is doing. Moreover, the ability of team members to make good decisions and establishment of interim deadlines linked with celebration of the milestones, were also ranked as critical factors towards virtual teams success.

Keywords: Virtual teams, Trust, Conflict, Communication Technology, Knowledge Transfer, Face-to-Face Interaction.

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Makwena Emmanuel Matlala

09 November 2011

Dedication

This research is dedicated to my late mother (Anna Mmahosea Matlala) and my late sister (Patricia Chuene Matlala), who both encouraged me during my early years to study hard and believing that anything is possible. I know both of them would have been proud of me for achieving my MBA.

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1.1 INTRODUCTION

Economic forces, competitive pressures and technological advances have created an environment within which companies have developed new ways of organising their workforce (Wang & Haggerty, 2009). In today's new technological era, the growing popularity of virtual teams in organisations, means that team members must respond to new, and different job demands as a result of more widely and internationally dispersed structures (Walvord, Redden, Elliot, & Coovert, 2008).

The key difference between traditional and virtual teams is that the latter make use of technology-supported communication substantially more than face-to-face communication (Curseu, Schalk, & Wessel, 2008). The use of virtual teams is a universal method of organising work in order to innovate, make decisions and solve complex problems and tasks (Curseu et al., 2008). According to Bergiel, Bergiel & Balsmeir (2008) until the creation and rapid development of the internet, virtual teams were neither a viable nor a cost effective option.

A study conducted in the USA during 2001 has found that 8.4 million employees were members of one or more virtual teams, while quarter of a billion were already working online at a global level (Bergiel et al., 2008).Virtual teams provide an organisation with the means to combine the various skills, talents and perspectives of a group of individuals (Webster & Wong, 2008).The concept of virtual teams evolved during the mid-1990s when companies began

organising projects over distance, with teams increasingly consisting of people coming from different cultural backgrounds and value systems, as well as speaking different languages (Bergiel et al., 2008).

The common assumptions regarding an institutionalised workplace no longer hold true, such as unknown foreign public holidays and cross-cultural misunderstandings (Morris, 2008). Cultural misunderstanding further make communication complex due to differences in language, verbal styles and non-verbal styles which influence team effectiveness (Shachaf, 2008).

1.2 PROBLEM IDENTIFICATION AND RESEARCH MOTIVATION

The purpose of this research is to investigate critical success factors that contribute towards effective performance of virtual teams in engineering projects. Businesses do not fully understand the human impact and implications of the virtual team environment, as they tend to treat virtual teams in the same way as traditional teams (Morris, 2008). Furthermore, the skills complexities and subtleties of dealing with different personalities make communication a more difficult prospect among virtual teams than in traditional teams (Horwitz, Bravington, & Silvis, 2006).

Virtual teams offer several significant benefits; however, they also create various challenges, particularly associated with communication and leadership (Kuruppuarachchi, 2009). Geographic dispersion decreases the number of face-to-face meetings and it is important to identify factors that contribute towards team success (Wakefield & Leidner, 2008).

In summary, the research problem identified is a need to identify key factors that contribute towards effective virtual teams, taking into account the peculiar challenges associated with minimal face-to-face interaction and extensive use of communication technology.

1.2.1 Virtual Teams Challenges

Ratcheva (2008) asserted that the matrix organisation that emerged a few decades ago, replacing the more traditional bureaucratic form of organisation, is being superseded by virtual teams. The concept of virtual teams originated within the context of project-based teams and this concept has been expanded to refer to different teams working permanently and reporting to managers located across the globe (Mogale & Sutherland, 2010). The growth of this practice has caused certain challenges to arise; exacerbated by tight schedules and the need to start quickly and perform instantly (Munkvold & Zigurs, 2007).

Some of the big challenges faced by virtual teams are competing demands for attention; ambiguity of remote communication; establishment of personal relationships and the need for accessible, stable and user-friendly technology (Nunamaker Jr, Reinig, & Briggs, 2009). Panteli & Tucker (2009) and Horwitz et al. (2006), further explained these challenges as the loss of many non-verbal cues; reduced mechanisms for informal conversation; reduced opportunities to build friendships; time zone differences; complicated and unreliable technology; building consensus at a distance; establishing shared meaning at a distance; different work processes; and lastly, different cultures.

These combined challenges have aggravated the following constraints: cultural, individual and personality differences; trust between team members may be

difficult to build because of the geographical dispersion and lack of physical interaction; and lastly, language barriers may be a major challenge and can have a negative impact on interpersonal relationships, trust and the overall work culture within the team (McLean, 2007).

Bergiel et al. (2008) asserted that in order to maximise productivity, it is important to be conversant with virtual teams. Morris (2008) stated that virtual teams have some subtle and key differences that need to be understood and properly managed. Furthermore, Siebdrat, Hoegi, & Ernst (2009), mentioned that very often dispersed teams fail to perform important processes effectively and are therefore unable to realise their potential. Given that virtual teams have become a reality, an in-depth understanding of virtual teams is of fundamental importance.

1.2.2 Research Problem Definition

In light of these challenges, this research seeks to investigate critical success factors important in ensuring virtual team effectiveness. Although there are some studies conducted on virtual teams, the specific factors required by virtual team members within the context of engineering projects are yet to be established.

Various studies, such as the research conducted by Bergiel et al. (2008), have focused on extending the knowledge about virtual teams and their advantages and disadvantages. Morris (2008) focused on discussing virtual teams, technology utilisation and how technology can be used to enhance human interaction.

The study by Malhotra, Majchrzak, & Rosen (2007), as by many other researchers, such as Mogale & Sutherland (2010), focused on leading virtual teams; with attention diverted towards the team leaders. The other researchers' focus were subject specific within virtual teams, such as the study by (Curseu et al., 2008), whose focus was on information processing in virtual teams.

All the above cases reinforce the need for the current study, as none of the previous studies focused on specific factors required by virtual team members, with specific devotion to the subordinates. Therefore, the purpose of the current research is to identify factors that are critical to the success of virtual teams. Based on this definition of the research problem, the objectives of this study are the following:

1.3 RESEARCH OBJECTIVES

- Investigate factors that contribute towards virtual team success.
- This study seeks to specifically assess the role played by factors such as trust, communication, conflict and knowledge in building effective virtual teams.

1.4 RESEARCH RELEVANCE IN SOUTH AFRICAN CONTEXT

In today's global economy, organisations with virtual teams of talented and skilled people can respond quickly to changing business environments (Bergiel et al., 2008). Capabilities of this type offer organisations a form of competitive advantage (Bergiel et al., 2008). This research is conducted within the engineering context, in one of South Africa's power utilities. South Africa has an emerging economy; consequently it faces some of the associated challenges, such as a scarcity of skilled workers and a lack of key manufactured products

(Mahajan, 2009). These problems have further affected the power utility, resulting in the need for importation of goods and services.

The engineering projects require physical customer presence during inspections and testing of various equipments, which has resulted in the formation of virtual teams located around the world. These teams are aimed at undertaking these activities in order to reduce travelling costs and improve turnaround times as a result of minimal long travelling. Significant expenses associated with accommodation, travel and various daily allowances may be reduced, or even eliminated, as virtual teams primarily communicate through technology, requiring no travel or associated expenses (Bergiel et al., 2008).

According to a study conducted by SACCI (2010), traffic congestion conservatively costs the South African business R15 million an hour, and these costs exclude fuel, vehicle maintenance, late freight deliveries, accidents and other business opportunity costs. Companies can benefit from this study by consideration of placing virtual teams in various locations and thereby minimising travelling costs and improving productivity.

South Africa has a substantial number of companies that trade in the rest of the world. Some of these companies, according to SouthAfrica.info (2011), include SAB Miller, MTN, Vodacom, Shoprite, Nu Metro, Massmart and Tourvest. It is important within the South African context to understand virtual teams and the significant factors required for their success. The outcome of this research is

highly beneficial to South African businesses and managers; allowing them to understand virtual teams' dynamics and the associated critical success factors.

1.5 SCOPE OF THE RESEARCH

The research was conducted in South African power utility, which is currently undergoing a multibillion rand capital expansion programme. The power utility has head office and various operations in South Africa, a satellite office in the United Kingdom and employees based in suppliers' premises in China, India and other countries. The research surveyed subordinates working in virtual teams in all the four countries.

The study sought to assess important success factors as assessed by subordinates (virtual team members), limited to virtual teams based in the United Kingdom (London), South Africa, India (Hyderabad) and China (Yi Xing City).

CHAPTER 2: LITERATURE REVIEW

The literature review critically evaluated the concepts that are investigated in this study, namely virtual teams, conflict, communication, trust and knowledge. These concepts are also consolidated and indicated how they are related to the research problem.

2.1 INTRODUCTION

The factors that are important for success in traditional teams, such as trust, are mirrored in virtual teams; however, the key difference in virtual teams is the mediation by technology, as geographic dispersion of team members requires the use of technology, such as email (Walvord et al., 2008). The growth of virtual teams can be credited as a response to the various challenges of the 21st century, such as rapid changes in business environment, globalisation of the market place and the growing popularity of inter-organisational alliances (Armstrong & Cole, Lipnack & Stamps, Townsend et al, cited in Curseu et al., 2008).

2.1.1 Definition of Virtual Teams

There are several definitions of virtual teams that exist. According to Malhotra et al. (2007), virtual teams are “teams whose members are geographically distributed, requiring them to work together through electronic means with minimal face-to-face interaction” (p.60). The key feature of this definition is minimal face-to-face interaction. Members of virtual teams may be sitting a few kilometres away from one another. Given today’s rapid use of technology, when those teams display minimal face-to-face interaction, they may be classified as virtual teams. This definition also helped to clarify an understanding that virtual

teams are not only about distance, rather, the focus is on minimal face-to-face interaction.

According to Townsend et al, quoted in Clark, Clark & Crossley (2010), virtual teams are "geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organisation task" (p. 178). The key feature of this definition is the use of communication technology, as this is a crucial tool in the process by making use of various technologies such as video conferencing, and email correspondence

Miles & Snow (1986), quoted in Horwitz, Bravington & Silvis (2006), defined virtual teams as: "an evolutionary form of a network organisation" (p. 473). The definition takes into account the dynamic nature of virtual teams. Because of ever changing nature, the implication is that the virtual teams should also change their medium of communication, which means that the virtual teams keep on changing and thereby supporting the evolutionary nature as mentioned in the definition.

According to Lipnack & Stamps, quoted in Maznevski & Chudoba (2000), virtual teams are "a group of people who interact through interdependent tasks guided by common purpose" (p. 473). The highlight of this definition is common purpose, which is important in order to achieve organisational goals.

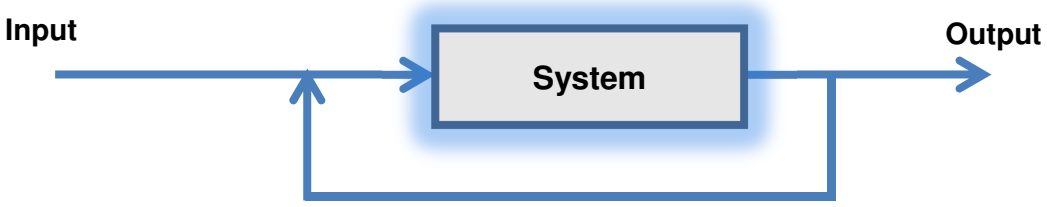
For the purpose of this study, the definition by Malhotra et al. (2007), which defined virtual teams as "teams whose members are geographically distributed, requiring them to work together through electronic means with minimal face-to-face interaction" (p.60), was used, taking into account the dynamic nature of the

organisation and the common purpose that the team should be guided through. Building on this definition, it was also important to understand the theories underpinning virtual teams.

2.1.2 Theories of Virtual Teams

Systems theory, as shown on Figure 1 was proposed in the 1940's by the biologist Ludwig von Bertalanffy in his studies on “Introduction to Cybertenics” (von Bertalanffy, 1972). Furthermore, von Bertalanffy emphasised that real systems are open to, and interact with, their environments, and that they can acquire qualitatively new properties through emergence, resulting in continual evolution.

Figure 1: Systems Theory



Source: von Bertalanffy (1972)

In their application of systems theory to virtual teams, Lipnack & Stamps (1997) stated that the principles of people, purpose and links form a simple systems model of inputs, processes and produced outputs, as indicated in Figure 2.

Three elements of virtual teams; namely cooperative goals, interdependent tasks and concrete results; allow virtual teams to achieve their purpose (Lipnack & Stamps, 1997). The links are what give virtual teams their distinction from traditional teams, as it is through interaction that people develop trusting relationships (Lipnack & Stamps, 1997). The channels by means of which

members make connections, allow communication and boundary crossing interaction that make virtual teams different (Lipnack & Stamps, 1997).

Figure 2: Virtual Team System of Principles

	Inputs	Processes	Produced outputs
People	Independent members	Shared leadership	Integrated levels
Purpose	Cooperative goals	Interdependent tasks	Concrete results
Links	Multiple media	Boundary-crossing interactions	Trusting relationship

Source: Lipnack & Stamps (1997)

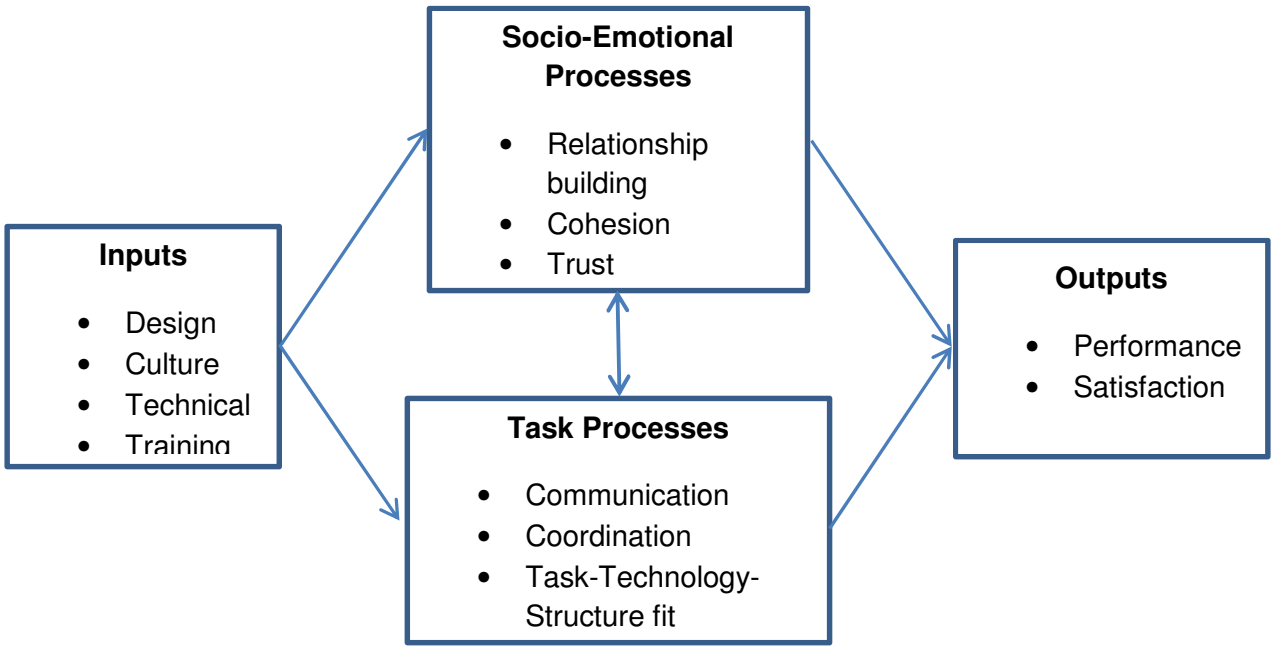
Through interactions, people develop trusting relationships, while it can be argued that trusting relationship are needed by all teams, they are more crucial in virtual teams because of lack of face-to-face communication (Lipnack & Stamps, 1997).

Three elements of virtual teams; namely cooperative goals, interdependent tasks and concrete results; allow them to achieve their purpose (Lipnack & Stamps, 1997). The links are what give virtual teams their distinction from traditional teams, as it is through interaction that people develop trusting relationships (Lipnack & Stamps, 1997). The theory indicates the key importance of people, purpose and links. Although the virtual team may comprise of highly competent people using compatible technology enabling

seamless communication, the lack of purpose may result in failure to achieve concrete results.

Powell, Picolli & Ives (2004) built on this theory, and has developed it further by splitting the processes into socio-economic processes (relationship building, cohesion and trust) and task processes (communication, coordination and task-technology-structure fit), as shown on Figure 3 below:

Figure 3: Four Main Focus Areas of Virtual Teams



Source: Powell et al. (2004)

The theory by Powell et al. (2004), suggested that if job satisfaction and performance is poor, there is a need to look into the inputs, such as technical expertise. It may be possible that the technical expertise of the virtual team members is inadequate and thereby ultimately influencing the overall performance. Similarly, the issue may be with processes such as trust, which does not allow better processing of the inputs. As this theory emanates from the

system theory, the implication is that in order to be effective in achieving the outputs (satisfaction, performance), it is important that all inputs and processes should be compatible, effective and adequate.

Virtual teams and traditional teams are different forms of organisation, distinguished by the extensive use of communication technology and face-to-face communication. The theories above, explained the origin of virtual teams, together with their model. On this basis, it is important to understand the advantages and disadvantages that may be derived from this type of organisation.

2.1.3 Advantages and Disadvantages of Virtual Teams

The nature of virtual teams made it possible for employees to work and communicate in real-time around the globe (Bergiel et al., 2008). The human impact and implications of virtual teams are not fully understood (Morris, 2008) and businesses often establish operations and strategic alliances across the globe, making virtual teamwork critical to their success (Nunamaker Jr et al., 2009).

Virtual teams emerged as one of the most important management tools available for businesses to take advantage of; however, this tool also comes with its own obstacles (Greenberg, Greenberg, & Antonucci, 2007). With the appropriate processes in place, virtual teams can significantly outperform traditional teams (Greenberg et al., 2007). Some of the advantages and disadvantages of virtual teams are listed in Table 1.

Table 1: Advantages and Disadvantages of Virtual Teams

Advantages	Disadvantages
Reduces travel time and cost	Sometimes requires complex technological applications
Enables the recruitment of talented employees	Lack of knowledge among employees about virtual teams. Consequently, there is the need for HRD interventions
Promotes different areas	Lack of knowledge among some senior mature managers concerning advanced technological applications generally
Builds diverse teams	Not an option for every type of employee because of an employee's psychological make-up and other predispositions

Bergiel et al. (2008)

In traditional teams, familiarity with one another is developed both informally and through task-related activities (Bergiel et al., 2008). Team members are able to observe first-hand the time and effort expended by members, but when team members are dispersed, it is more difficult to build relationships (Greenberg et al., 2007). Dispersion as a result of virtual settings is sometimes seen as a liability rather than an opportunity, however, it is argued that dispersion can provide substantial benefits if companies can take advantage of the diversity and varied expertise (Siebdrat et al., 2009).

As shown in Figure 2, trust is a key variable in effective virtual teams. Furthermore, Figure 3 showed how trust is a variable within socio-emotional processes, which is important towards performance and satisfaction.

2.2 TRUST IN VIRTUAL TEAMS

Trust is defined as "the expectation that arises within a community of regular, honest, and cooperative behaviour, based on commonly shared norms, on the part of the members of that community" (p. 26). Trust becomes highly important in those virtual teams in which members communicate mainly through information and communication technologies (Robert Jr et al., 2009).

Trust is considered essential for effective team performance and is often believed to require face-to-face interaction (Clark et al., 2010). The definition of virtual teams pointed out the the key distinguishing feature which is lack of face-to-face interactions. Although virtual teams are popular and widely accepted, there is no substitute for face-to-face interaction (de Pillis & Furumo, 2007). The fundamental question is to understand what approach to be employed in the absence of face to face interactions. Although various technologies, such as video conferencing may be used, which allow the members to be able to physically see other, what lacks is the physical attachment.

There are factors that influence trust, which include the familiarity of the individuals in the relationship over a significant period of time, shared experiences and goals, reciprocal disclosure between individuals over time and demonstration of non-exploitation expressed over time (Dani, Burns, Backhouse, & Kochar, 2006 and Robert Jr, Dennis, & Hung, 2009). This theory

highlights the importance of time as the more the team are together, the more trust is developed. As stated by Munkvold & Zigurs (2007), the challenge is aggravated by tight schedules and the need to start quickly and perform instantly. This point was further augmented by Robert Jr et al (2009) who stated that trust is a time-consuming process involving sequential iterations of observable past behaviour, while on the other hand, trust can be imported among individuals with no prior history.

According to Curseu et al. (2008), the development of trust, cohesion and a strong team identity are one of the most difficult challenges facing virtual teams. Furthermore, Barczak et al. (2006), Brennan & Braswell (2005), Couzins & Beargie (2005), quoted in Bergiel et al. (2008), argued that trust, communication, leadership, goal setting and technology all emerge as factors vital to the formation of a successful virtual team.

Bergiel et al. (2008) asserted that trust is often the result of team members knowing that all people in a team can be counted on to complete their assigned tasks and it is an important factor that must exist in all successful personal and team relationships. Some of the solutions to trust-formulation problems are based on an understanding of how interpersonal trust in traditional teams differs in virtual teams (Rusman, van Bruggen, Sloep, & Koper, 2010).

Although it is acknowledged that trust is time-consuming process, the challenge is that some projects are of shorter duration, making quicker development of trust imperative. Similarly, projects of longer duration also require quicker

development of trust. There may be perceptions that the team has ample time to develop trust, by the time the trusting relationship is attained, this may come with other consequences, such as project delays because of lack of cohesion, which is critical towards performance, as depicted in Figure 3.

Figure 2 demonstrated how links are what give virtual teams their distinction from traditional teams. This aspect is crucial towards trusting relationship, making an understanding trust formation imperative.

2.2.1 Cognitive and Affective Trust

According to Greenberg et al. (2007), trust arises in two ways, these being cognitive and affective trust. Both forms of trust are referred to as interpersonal trust (Lewis and Wiegert, 1985, quoted in Webster & Wong, 2008). Cognitive trust is a function of the other person's integrity and ability, while affective trust is the result of the social bonds developed in a reciprocal relationship in which there is genuine care and concern for the welfare of the other person. The challenge is that as virtual teams are characterised by lack of face to face interaction, it may be difficult to develop affective trust.

As further explained by Webster & Wong (2008), cognition-based trust is grounded in reasoning about others' reliability and dependability. According to Robert Jr et al. (2009), once individuals gain some knowledge of team members' behaviours, they no longer rely on their own disposition to trust; instead they view each team member as an individual and use that individual's past behaviour to assess trust. Rusman et al. (2010) argued that although someone may feel affection for another person upon their first acquaintance,

this cannot yet be considered trust as this form of trust is fragile and dissipates easily.

Rusman et al. (2010) stated that in the absence of signs and signals, virtual teams fall back on inferred information and this may lead to erroneous and rather persistent judgements of trustworthiness and a more fragile form of interpersonal trust. Greenberg et al. (2007) argued that what constitutes an appropriate written response to replace body language may not be known to team members and may also be different from location to location. This argument brings forth the question about how the divergent responses may be interpreted by different team members. Furthermore, what happens as a result of incorrect interpretations could have significant impact towards trust due to wrong inferred information.

Greenberg et al. (2007) asserted that the social bonds necessary for trust can be created in virtual environments and it only takes longer than face-to-face. The challenge is that time may be a constraint in projects. Considering the time component, it is important to understand the stages that trust development goes through.

2.2.2 Sustaining Trust

It is imperative to sustain trust in virtual teams, due to two interrelated factors. These are diverse locations and technology-enabled communication (Greenberg at al., 2007). Both factors cause trust to be more difficult to develop and add a level of risk to team involvement (Greenberg et al., 2007). According

to Robert Jr et al. (2009), trust traditionally develops over time, while virtual teams have little prior history of working together.

Due to the dynamic nature of trust formation, Robert Jr et al. (2009) proposed that swift trust, which develops prior to interactions, and history-dependent knowledge-based trust, which develops through interactions, are two forms of trust manifested at different stages of a relationship. Greenberg et al. (2007) argued that establishing trust can be complicated as members may have no past on which to build, no future to reference and may never meet face to face; however, if swift trust does not develop, members will have to find ways of building trust in each other.

Similar levels of trust may be found in both traditional and virtual teams. The process of developing and sustaining trust is of crucial importance and external signals (reputation, roles, and rules) and intrinsic factors (predisposition to trust) determine initial swift trust (Greenberg et al., 2007), as shown in Figure 4.

2.2.3 Trust Development Stages

The studies conducted on traditional teams, Tuckman (1965) and Gersick (1988, 1989), cited in Greenberg et al. (2007), found that early in the development of a team, team members focus on organising activities such as getting to know each other. The research done on virtual teams has found five distinct stages (as shown in Figure 4), which revealed the importance of nurturing trust throughout the team's life (Greenberg et al., 2007).

According to Jarvenpaa and Leidner (1999) cited in Malhotra et al. (2007), trust in virtual teams is often based on actions rather than goodwill. Malhotra et al. (2007) stated that as goodwill is hard to observe virtually, expectations about actions and the actions themselves need to be made as explicit as possible; failure to do so will lead to each member communicating in his own way, resulting in a lack of cohesion and a difficulty in integrating the work of different team members. The argument pertains to how the team can make their respective actions considering the extensive use of communication technology.

Curseu et al. (2008) argued that one of the most important sources of trust, especially in the first stages of team formation, is the quality of interpersonal communication between the team members, as this may lead to the development of string interpersonal ties, which are essential for knowledge transfer and knowledge use within the team. Although interpersonal communication is central towards trust formation, the difficulty lies with minimal face-to-face communication, which may not be conducive towards building interpersonal ties.

Figure 4: Trust Development Stages

Greenberg et al. (2007)

According to Greenberg et al. (2007), dispositional trust refers to the tendency to be more trusting and this form of trust is required at the planning stage, while during the inception stage, swift trust is needed. Mayer et al. (1995), cited in Clark et al. (2010), defined ability as "that group of skills, competencies, and characteristics that enable a party to have influence within some specific domain" (p. 717), while integrity relates to a "set of principles that the trustor finds acceptable" (p. 719).

According to Greenberg et al. (2007), it is important to encourage appropriate behaviour and promote communication practices that enhance accurate perceptions. Benevolence is referred to as "the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit move" (Mayer et al., 1995, p. 718, quoted in Clark et al., 2010). During the transition stage, the team focus changes from organising activities to accomplishing the task (Greenberg et al., 2007). The challenge is to ensure that all forms of trust are sustained at all stages.

The virtual theory depicted in Figure 3 showed how trust (socio-emotional process) and communication (task process) are key processes needed to produce satisfactory performing virtual teams.

2.3 COMMUNICATION IN VIRTUAL TEAMS

In order to ensure that the virtual teams meet their objectives, daily communication between a team leader and individual team members is the glue that holds a virtual team together (Clark et al., 2010). Communication represents a big problem for virtual teams and the virtual character of the

communication processes has important implications for the dynamics of virtual teams (Curseu et al., 2008). According to Bergiel et al. (2008), virtual team members must learn to excel in active communication.

Although both virtual and traditional teams share the common characteristic of communication, the difference lies in the fact that asynchronous communication is required in virtual teams (Bergiel et al. 2008). Many of the best practices for traditional teams are similar to those of virtual teams (Bergiel et al. 2008), as both require a clear, well-founded and compelling purpose. However, whilst technology may not be the panacea thought by some, it is not the demon seen by others and with a very little carelessness, it can create a total disconnect (Morris, 2008).

According to Walvord et al. (2008), communication between virtual team members serves not only in the exchange of critical information among team members working in different places, but also in the building of interpersonal relationships. According to Bjorn & Ngwenyama (2008), virtual teams often bring together people from different cultures and languages across heterogeneous locations. The lack of homogeneity further exacerbates the communication challenge, which may result in communication breakdown. Moreover, it is important to understand the communication technology employed in the teams.

2.3.1 Communication Technology

According to Morris (2008), technology is a means to an end and not an end itself. It is there to enable and enhance interactions and not to replace them; it is

important to identify the opportunities that communication technology offers to the virtual team (Morris, 2008). The use of information and communication technology has altered the nature of multinational corporations (Shachaf, 2008). Computer-Mediated Communication (CMC), which is described as the type of communication through computer-mediated technologies, such as email, is more entrenched in the virtual environment because this is the only source available (Ehsan, Mirza, & Ahmad, 2008).

Dube & Robey (2008) asserted that communication technology affects information in virtual teams as there is a direct effect of communication technology on the knowledge pool and the use of knowledge in virtual teams. Bjorn & Ngwenyama (2008) argued that technology should also support the enrichment of mediated actions that facilitate visibility, awareness and accountability.

2.3.2 Communication Technology Challenges

In summarising the usage of technology, Morris (2008) stated that the challenge of using technology should not be underestimated as the pressures in using technology are mixed with assumed competence and its effects can be negative within the team. Furthermore, Munkvold & Zigurs (2007) asserted that virtual teams have to pay immediate attention to familiarising themselves with and integrating the available technology, while agreeing on preferred communication media and communication frequency. As technology evolves, the competence of virtual team members needs to be continually improved. Unlike traditional teams, it is imperative to ensure that all team members are kept abreast with all the technological developments, which change at a rapid rate.

According to Lin, Standing, & Liu (2008), efficiency in CMC is lower than face-to-face communication due to the lack of speech acknowledgements, as well as the fact that CMC consumes more time in explaining the conversation context. Some tasks, such as solving tasks, may not be suited to CMC as they require substantial interaction. CMC is believed to be a less effective source of communication compared to face-to-face. Ehsan et al. (2008) and Curseu et al. (2008) argued that anonymous groups using CMC need more time to come to a decision than anonymous group using face-to-face.

Most of the virtual teams are making use of CMC. In light of this theory, the inefficiency in CMC may impact on communication breakdown. On this basis, it is important to understand communication breakdown and its associated consequences, such as conflict.

2.3.3 Communication Breakdown and Conflicts

Technology-Mediated Communication is a defining characteristic of virtual teams, and distinguishing teams by the extent of use of this type of communication, partially explain the type and degree of conflict experienced (Wakefield & Leidner, 2008). Furthermore, Wakefield & Leidner stated that communication technologies are effective in reducing task conflict, with process conflict more readily abated in the virtual team, as the leader performs coordinator activities. Kankanhalli, Tan & Wei (2007) suggested that the causes of task conflict in virtual teams can be made known to the team through training, and managers should be aware of potential conflicts that results from team diversity and the performance effects of conflict. This theory is in line with the model by Powell et al (2004), which identified training as one of the key inputs in the process.

Kankanhalli et al. (2007) asserted that managers need to be aware of communication technology and should also be cognisant of the relationship between conflict attribution and conflict resolution approaches, as well as the effectiveness of various conflict resolution approaches. Lin et al. (2008) argued that it is critical that managers build relationships and social cohesion in the initial stage of the virtual project, as they have significant impact on the performance and satisfaction of virtual teams.

The reliance on technology-mediated communication may partially explain the type and degree of conflict experienced; with the result that virtual teams that make greater use of Technology-Mediated Communication are more likely than those with lesser use to engage in more task, relational, and process knowledge exchanges (Wakefield & Leidner, 2008). It is important to ensure efficient technology facilitation and virtual team leaders must learn to recognise the triggers, shift their focus to improving team interaction, and effectively take action, so that team productivity can be taken (Thomas, Bostrom, & Gouge, 2007), as virtual teams could not exist in their current state without the advanced technological tools available today (Bergiel et al., 2008).

Munkvold & Zigurs (2007) argued that it is crucial for virtual teams to structure their interaction from the onset, including introducing team members' background and competence, discussing project goals and deliverables, defining roles and responsibilities, and setting milestones. In order to ensure sustained success, virtual teams must continue to expand their means of

electronic collaboration as the rapid development of all communications technologies will be a characteristic of the typical virtual team (Bergiel et al., 2008). Furthermore, Walvord et al. (2008) argued that a superior way to provide rich information to virtual team members is to avoid communicating the contextual information that is irrelevant. Instead the members should use multiple modalities to communicate the target information more fully (Walvord et al., 2008).

As mentioned earlier, reliance on excessive technology-mediated communication can generate conflicts and on this basis, it is important to understand the underlying factors important in conflict as both conflict and communication are interrelated.

2.4 CONFLICT IN VIRTUAL TEAMS

Conflict in teams is defined as "the disagreement among team members that results from incompatible goals and interests" (Jehn, 1995, quoted in Furumo, 2009, p.68). As opposed to traditional teams, conflicts in virtual teams remain unidentified and unaddressed longer (Armstrong & Cole, 2002, quoted in Bosch-Sijtsema, 2007). The fundamental point is to understand the impact that how prolonged conflict may have on the virtual teams performance.

Virtual teams have to work with single business policies and corporate cultures across collaborating organisations, geography, and cultures and this can lead to potential clashes of business and national cultures (Horwitz et al., 2006). According to Kankanhalli et al. (2007), task characteristics in relation to conflict and its outcomes in relation to virtual team performance have not yet been explored in research, although there is evidence with regard to its effect on

traditional teams. As shown in Figure 3, task processes result in performance and satisfaction and thereby reinforcing the need to understand the task related factors imperative for virtual team performance. .

Virtual teams' model on Figure 3 showed that, task and relational processes are two different processes that lead to concrete results. Conflict that may surface in teams emanate from any of these two processes, which may be task or relational related.

2.4.1 Task Conflict

Task conflict manifests itself when task knowledge is not fully understood or shared by team members and this may result in disagreements among members about work content, appropriate tasks, or the assignment of team activities (Wakefield & Leidner, 2008). According to Hong & Vai (2008), shared understanding and learning climate are thought to be able to solve the challenge related to the unwillingness among the virtual team members to participate in the knowledge sharing process.

Kankanhalli et al. (2007) argued that task complexity is not likely to affect team performance directly, however, when task complexity is moderate or high, debate among the members about the task can help bring out better solutions, and when task complexity is low, the solution is well understood and debate about the task may not be beneficial. Lira, Ripolli, Peiro & Orengo (2008) asserted that task conflict increases divergent opinions, interpretations, viewpoints, critical evaluations, assessments of alternatives, shared information, problem identification and problem solving.

2.4.2 Relationship Conflict

Relationship conflict arises when relational knowledge, which refers to personal understanding of team members including individual cultures and norms, is insufficient and this may evoke negative emotions and interpersonal disagreements between members not directly related to the task (Wakefield & Leidner, 2008). The detection and management of conflict occurs more readily in virtual teams with effective leaders than in those with less effective leaders (Wakefield & Leidner, 2008). Although there is a need to have effective leaders, the minimal face-to-face interaction does not help in terms of relational conflict.

Relationship conflict has affective components such as tension and friction involve personal issues such as mutual dislike, personality clashes, and annoyance among team members (Kankanhalli et al., 2007). Individuals who understand and like each other may still disagree over tasks goals; moreover, the fact that individuals successfully relate to one another does not guarantee they will de facto agree on work processes (Wakefield & Leidner, 2008). According to Kankanhalli et al. *(*2007), relationship conflict is not likely to lead to beneficial task outcomes; while on the other hand, relationship conflict should be resolved through collaboration to avoid harmful effects on performance.

One of the inputs to the virtual team's model by Powell et al. (2004) is culture. Furthermore, Powell et al. (2004) stated that cultural differences may result in conflict and thereby leading to ineffective performance. On this basis, it is important to understand the link between conflict and culture.

2.4.3 Cultural Diversity and Conflict

Virtual teams represent rich diversity of stakeholders, experiences, functions, and the team's ability to successfully innovate depends on how diversity is understood, appreciated and leveraged (Malhotra et al., 2007). According to Shachaf (2008), cultural diversity has both positive and negative effects on virtual teams; negative effects are associated with intercultural communication, while positive effects are associated with the potential for better decision-making. What is significant is to transform all the negative cultural differences into positive effects considering that an individual's cultural background cannot be changed.

Cultural diversity within virtual teams is likely to contribute to both task and relationship conflict, while functional diversity may result in task conflict. Moreover, the relationship between task conflict and team performance is likely to be contingent upon task complexity and conflict resolution approach (Kankanhalli et al., 2007). As culture is a key input in the virtual teams, it is principal to come up with conflict resolutions mechanisms as failure to do so, may impact on the virtual team effectiveness.

2.4.4 Conflict Resolutions

Virtual teams are faced with conflict resolution issues as teams are made up of diverse individuals in dynamic settings and the management of conflict plays a key role, as it is difficult to manage conflict in virtual teams compared to face-to-face teams (Bergiel et al., 2008). Conflict resolution may help virtual team members to resolve problems related to the task, interpersonal issues and contributions to the team (Munkvold & Zigurs, 2007).

According to Kankanhalli et al. (2007), attribution theory explains how teams resolve misunderstandings and conflict, so that when conflict arises, team members try to assess the cause of the problem, and such attribution may be personal or situational in nature, and may be constructive or non-constructive, for continued communication. Kankanhalli et al. (2007) argued that attribution can pave the way for conflict resolution, using the following three approaches: integrative (solving the problem through collaboration), distributive (solving the problem through assertion) and avoidance (ignoring the problem). The key differentiator with the conflict resolution in virtual teams should be how to understand the contextual actions in the absence of face-to-face interaction in view of ensuring the effectiveness of the process.

As shown in Figure 3, knowledge and technical expertise are inputs for the virtual team performance. According to Powell et al., (2004) some empirically found challenges in successful communication are failure to communicate due to wrong or lacking contextual information, and this problem can be overcome through training that will consequently lead to improved knowledge. Although training may help in terms of explicit information, the difficulty centres on implicit information.

Some of the inputs of the virtual teams' model, as depicted in Figure 3, are training and technical, which both encompass the knowledge capacity of virtual team members.

2.5 KNOWLEDGE IN VIRTUAL TEAMS

Staples & Webster (2008) identified knowledge as "a critical asset for organisations in today's economy" (p. 618). The emergence of new

organisational forms, increased virtualisation of working arrangements and a shift away from time and space, has inevitably transformed our understandings about the nature of knowledge and how it is created (Ratcheva, 2008).

Moreover, knowledge is emerging as highly complex and dynamic, and a holistic understanding of knowledge creation processes requires an integrated viewpoint of collective knowledge in the context of the unique nature of social interaction processes (Ratcheva, 2008). According to Paul (2006), virtual teams can significantly expand the knowledge resources available, yet they also create additional challenges to the already difficult activities.

The roles of virtual teams in organisations become increasingly important which makes it crucial to identify and influence team members' knowledge (Kanawattanachai & Yoo, 2007). According to Wang & Haggerty (2009), knowledge is a source of competitive advantage and the capabilities to support it are critical in virtual settings. Ratcheva (2008) argued that new knowledge creation processes in virtual partnerships reside in the connections of experts, and the working rules established amongst team members determine how knowledge is accumulated.

Explicit and tacit knowledge are important in that explicit knowledge enables generalisation and the application of knowledge across different contexts, while tacit knowledge is less likely to be useful for a particular situation (Paul, 2006). Collaborative activities enable the application of knowledge because they can be an efficient and effective means by which knowledge can be made more

readily available in an understandable form (Paul, 2006). Furthermore, Wang & Haggerty (2009) argued that tacit knowledge is difficult to transfer because people are not able to communicate their thoughts effectively in a mediated setting, which implies both a technology-based problem (which is the typical attribution made about tacit knowledge transfer problems) and communication skill problem.

According to Bergiel et al. (2008), a general lack of knowledge among employees about the higher level technological applications related to virtual teams is one of its main downsides. Hong & Vai (2008) argued that good management of a cross functional virtual team needs more than just capital investment in information technology and recommended that the team should develop the intention and the capacity of members to share knowledge. The team may have latest compatible technologies making communication easier, however failure to acknowledge and embrace knowledge transfer would make all the efforts go to waste.

It is also important to recognise that individual competence, rather than technological or social factors, are crucial to effective knowledge transfer (Wang & Haggerty, 2009). What this mean is that every team member must possess the right skills and make use of communication technology to enable knowledge transfer. Following on this, the question is to understand effective knowledge transfer crucial in virtual teams.

2.5.1 Knowledge Transfer

Virtual teams must develop mechanisms for sharing knowledge, experiences, and insights critical for accomplishing their missions (Rosen, Furst, & Blackburn, 2007). Moreover, virtual team members need to develop a shared understanding of what they are trying to achieve, how they might achieve it, what they need to do and what each member brings to the team task (Hong & Vai, 2008). Sharing a common goal is found to be important at the initial stage when embarking on knowledge-sharing activities, but to sustain interest and effort, the climate needs to be conducive to learning (Hong & Vai, 2008).

Hong & Vai (2008) indicated the four knowledge-sharing mechanisms that include shared understanding, learning climate, job rotation and coaching. Effective teams rely on knowledge sharing and group cohesiveness to achieve better performance and when team members respectfully coordinate their actions, they can improve the collective mind so that the team can bond toward a better understanding of the tasks

Huang (2009) argued that in addition to knowledge sharing, group cohesiveness, which is a dynamic process reflected in the tendency of a group to stick together, is important to understand the performance of groups. Staples & Webster (2008) asserted that task interdependence affects the relation between trust and knowledge sharing, while both team structure and balance also affect the relation between knowledge sharing and performance

One way to better leverage a virtual team's collective expertise is through a trans-active memory system (TMS), which represents the potentially valuable collective team knowledge that individual team members have developed or acquired, encoded, stored and can retrieve (Rosen et al., 2007). Furthermore, Kanawattanachai & Yoo (2007) stated that TMS can be developed by virtual teams without having face-to-face meetings. Huang (2009) argued that effective sharing and use of knowledge depends on the team's ability to create and manage its TMS. In light of this theory, the central question that has not been covered is to understand the specific skills needed to ensure that the abilities needed for TMS are effective.

2.6 SUMMARY AND CONCLUSION

The literature emphasised how trust is different in traditional teams in comparison to virtual teams and explained the practices for effective virtual team members. Why sustaining trust is difficult in virtual teams has been evaluated. Additionally, it has been noted that no literature made mention of specific factors required by virtual team members to be successful during all team development stages. The literature focused on factors pertaining to virtual team leaders, while very little information is given regarding the specific factors that subordinates should possess.

Two types of conflicts (task and relationship) inherent in virtual teams, together with conflict resolution mechanisms were mentioned. Cultural diversity and its impact on conflict were also asserted, including various causes and components. Although it is mentioned that the inefficiency in CMC, cultural differences and communication breakdown are some of the aspects that result

in conflict, there is insufficient articulation of the specific factors required in virtual teams. Furthermore, it is important to understand the nature of tasks (task related factors) that assist in reducing conflict.

The literature stated that knowledge is the competitive edge, and examined the importance of individual competence, factors that are crucial for the effectiveness of the team, communication breakdowns and knowledge sharing mechanisms. Further assertion is made regarding effective sharing and use of knowledge dependence on the team's ability to create and manage its TMS. However, there is lack of assertion on the type of skills that are important for the team members.

CHAPTER 3: RESEARCH QUESTIONS

The fundamental research problem that this study seeks to investigate, centres around the critical success factors important for the effective functioning of virtual teams. The questions emanate from the literature review conducted in Chapter 2 and align with the research problem highlighted in Chapter 1. The following questions were identified as being relevant to the research problem:

RESEARCH QUESTION 1

What critical factors are important to sustain trust within virtual teams?

The literature reviewed outlined the different virtual team development stages and the importance of ensuring that trust is nurtured throughout all development stages. The outcome of this question will assist in understanding whether there are any differences regarding the ranking of important factors amongst virtual team subordinates.

RESEARCH QUESTION 2

What factors contribute towards conflict in virtual teams?

The literature reviewed revealed that communication technology contributes substantially towards conflict within virtual teams, due to minimal face to face interaction. This question sought to understand the underlying issues necessary for effective management of virtual teams. The outcome of the investigation will assist virtual teams and managers in ensuring that some of these issues are

taken into cognisance during all virtual team stages. Furthermore, the outcome will also assist to highlight highly ranked issues as ranked by subordinates.

RESEARCH QUESTION 3

What specific task-related factors are considered important in ensuring effective virtual teams?

This question sought to understand the important task-related factors that impact on conflict and thereby lead to improved virtual team performance. Although these factors may have been established in relation to traditional teams, no research has yet investigated the actual factors pertaining to virtual teams.

RESEARCH QUESTION 4

What are specific skills required by virtual teams to achieve optimal knowledge transfer?

The literature revealed that optimal knowledge is highly dependent upon a team's ability. Bearing that in mind, it is important to understand the specific skills required in ensuring virtual team effectiveness. The outcome of this study will assist to highlight the relative importance of these skills as assessed by subordinates.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION

The purpose of this study was to investigate the critical success factors required in virtual teams. The study further assessed the role played by factors such as trust, communication, conflict and knowledge in building effective virtual teams.

4.2 RESEARCH DESIGN

Research design is defined as: "the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure" (Kothari, 1990, p. 39). In line with the purpose of this research, the following factors, as outlined by Kothari (1990), were taken into consideration and formed the basis of some of the decisions taken in this research: the means of obtaining the information, the availability and skills of the researcher, the objective of the problem to be studied and the availability of time and money for the research work.

The research design undertaken in this study was quantitative. According to Welman, Kruger, & Mitchell (2005), the purpose of quantitative research is "to evaluate objective data consisting of numbers while qualitative research deals with subjective data that are produced by the minds of respondents" (p. 8). Furthermore, the research problem is best addressed by understanding what factors influence an outcome (Creswell, 2003). In the context of this study, the outcome is effective virtual teams, while the critical success factors were revealed by answering research questions posed in Chapter Three.

Descriptive research methods were used which according to Kothari (1990), are concerned with describing the characteristics of a particular individual or group. The research questions sought to obtain a description of factors pertaining to virtual teams. According to Blumberg, Cooper, & Schindler (2005), if the research is concerned with finding out who, what, where, when or how, then the type of study to be undertaken is descriptive, as opposed to a causal study that is concerned with learning why certain factors result in certain outcomes.

4.3 POPULATION

The population of this study consisted of virtual team members involved in any engineering work around the world on behalf of a South African power utility company. This includes work undertaken by individuals working for non-South African companies, South African companies and those undertaken by internal power utility company employees. According to Welman et al. (2005) population is “the full set of cases from which sample is taken” (p. 53). The size of the population is uncertain, but is deemed to be significantly low.

4.4 SAMPLING

Sampling methods can be divided into two major categories, namely probability (also known as random sampling) and non-probability sampling. In keeping with the quantitative design chosen for this study, the purposive sample was used as the probability that any element will be included in a sample could not be specified (Welman et al., 2005). Furthermore, this sampling was chosen to ensure that the various subgroups, which are subordinates located in various countries, are represented in the sample.

The sampling design that was used formed the basis of some of the decisions made in this research. This was in accord with characteristics of a good sampling design, which were listed by Kothari (1990), as follows: sample design should result in a truly representative sample, have a small sampling error, be viable in the context of funds available, and lastly, be such that systematic bias can be controlled in a better way.

Although it may be argued that in this type of sampling, sampling error cannot be estimated and the element of bias is always there, this type of sampling was chosen on the basis of relative time and money inherent in this method (Kothari, 1990). The relative time refers to the time available to complete this research, which is restrained, while the money refers to all the funds needed, such as money to conduct surveys, which is also limited. As confirmed by Welman et al. (2005), non-probability samples are less complicated and more economical. The focus of the researcher was in line with the characteristics of a good research design, which have been previously stated in the research design.

It may be argued that as items for the sample are deliberately selected by the researcher, this may present a danger in bias. The solution to counteract this problem was to ensure impartiality, work without bias and have the necessary experience to ensure sound judgement (Kothari, 1990). As this research is on a small scale, Kothari (1990) suggested that purposive sampling may be adopted. The sample size was 75

4.5 UNIT OF ANALYSIS AND SAMPLING FRAME

The unit of analysis is defined as "the members of the elements of the population" (Welman et al., 2005, p. 53). The unit of analysis in this research was virtual team members (individuals). The unit of analysis "happens almost automatically at the problem identification stage" (Vos, 2004, p. 107). This is in line with the problem statement that related to virtual team members. According to Vos (2004), it is consequently important to realise that unit of analysis is inevitable and should be consciously built into the process of formal problem formulation. As stated in the research problem, the purpose of the current research is to identify factors that are critical to the effectiveness of virtual teams; therefore in formulating this problem, virtual team members was the unit of analysis.

According to Welman et al. (2005), sampling frame "is a complete list in which each unit of analysis is mentioned only once" (p. 120). The virtual team list was compiled by the researcher and, as confirmed by Kothari (1990), if a sampling frame is not available, the researcher has to prepare it. The list should be correct, reliable and appropriate as it is extremely important for the source list to be as representative of the population as possible.

4.6 DATA COLLECTION METHODS

The data was collected by making use of self-administered questionnaires, which are defined as "an instrument used to collect information from people who complete the instrument themselves" (Bourque & Fielder, 1995, p. 2). The main reasons why this approach was taken was a consequence of the costs of the research and the reachability of respondents. Some of the virtual team

members are based all over the world and therefore communicating with them by means of questionnaires was deemed easiest. The identities of the respondents were not disclosed to allow confidentiality.

The questionnaires were sent using email. In order to improve response rate, telephonic calls and follow-up emails were carried out. Most of the respondents were fairly educated; thereby minimising the need for physical explanation and clarification. Some of the merits of self-administered questionnaires, as stated by (Kothari, 1990), are: low cost even when the universe is large; free from the bias of the interviewer; respondents have adequate time to give well-thought answers; and respondents who are not easily approachable may be reached conveniently.

The demerits of the self-administered questionnaires are: low rate of return of the duly-filled questionnaires; bias due to non-response is often indeterminate; and in-built flexibility because of the difficulty of amending the approach (Kothari, 1990). In order to counteract these demerits, this research conducted pilot studies in order to detect possible flaws such as inadequate time. The pilot studies conducted were sent through both email and hand-outs. The hand-outs helped to provide an opportunity to notice non-verbal behaviours.

The pilot studies are imperative as “it is virtually mandatory to test the survey questionnaire on a small group of individuals who are representative of the population for which they are intended” (Welman et al., 2005, 148). The questionnaire was given to five people during a pilot stage so as to maximise

the reliability and validity. The feedback received from the initial questionnaire were improved and resent to ensure clarity. According to Oppenheim (1992), if the pilot work suggests improved wordings, the improved version needs to be piloted too.

A four point Likert scale, with one (1), indicating not at all important and four (4), indicating critically important, was used. The Likert scale is described as a measure of attitudes designed to allow respondents to indicate how strongly they agree or disagree with carefully constructed statements that range from very positive to very negative towards an attitudinal object (Zikmund, 2003). Full questionnaire is shown in Appendix 1.

The reasons why the Likert scale measurement was used, as opposed to other types of measurements is that the reliability of the Likert scale tends to be good (Oppenheim, 1992). Furthermore, Oppenheim stated that is it is also less laborious than other means of measurement. The four point scale was used in line with the existing measurement, developed by Bolman & Deal and customised by Beaty (2005), quoted in Mogale & Sutherland (2010).

4.7 DATA ANALYSIS

According to Zikmund (2003), data analysis is “the application of reasoning to understand and interpret the data that has been collected” (P. 66). After data collection, a template for data entry was designed in Microsoft Excel 2010, into which the data was entered. Once the raw data was received from the respondents, it was reviewed in ensuring that it was free from errors. This

practice, according to (Kothari, 1990), is aimed at detecting any errors and omissions and further correct errors wherever possible.

The demographic information was collected as follows:

- Country of location for the subordinate
- Country of location for the subordinate's manager and
- Duration of the subordinate within virtual team environment

Factor analysis was performed by adding the outcomes of each attribute and ranking them in descending order to determine the factor that was highly ranked. In order to measure the internal consistency of the reliability of a questionnaire, a Cronbach's alpha test was performed.

The normality test (Kolmogorov Smirnov), was conducted to decide whether parametric (ANOVA) or nonparametric (Kruskal Wallis) tests were appropriate. Since the sample size was larger than 50 (n = 64), the Kolmogorov-Smirnov test was used. If the sample size were 50 or less, Shapiro-Wilk statistic would have been used. The probability associated with the test of normality was < 0.05 leading to a conclusion that the data was not normal.

The Kruskal-Wallis test was conducted to compare the differences in the responses. The subgroups were classified according to location of the subordinates and their managers and also duration of subordinates in the virtual team environment. In areas where the differences were found, a box plot was conducted to determine outliers and extreme values. According to Zikmund

(2003), a box plot provides a pictorial representation of the distribution of the data for a variable.

4.8 RESEARCH LIMITATIONS

- Questionnaires offer little opportunity for the researcher to check the truthfulness of the answers given by the respondents.
- Pre-coded questions can be restricting and frustrating for respondents and thus deter them from answering.
- Inability to confidently generalise the outcome of the study to other organisations as the study was conducted within one organisation only.
- Virtual team members doing non-engineering projects related work were also excluded.

CHAPTER 5: PRESENTATION OF THE RESULTS

5.1 INTRODUCTION

The purpose of this chapter is to present the results emerging from the data analysis. The results are organised according to the four research questions following an overarching section on demographics. As previously mentioned in Chapter 1, the objectives of this research was to investigate critical factors that contribute towards virtual team success and further assess the role played by factors such as trust, communication, conflict and knowledge in building effective virtual teams.

In order to answer the research questions, a questionnaire consisting of five sections (Appendix 1) was designed based on the gaps identified in the literature review. Section A collected data on base locations of both employees and managers and the duration of employees within the virtual team environment. Sections B to E were content-based and closed-ended questions, allowing the respondents to rank the importance of factors on a four point Likert scale ranging from “not important” to “critically important”.

A questionnaire was sent to 75 respondents in four countries, of which 64 responded, yielding an 85% response rate. The results were analysed using Statistical Packages for Social Sciences (SPSS). The identities of the respondents were not disclosed, which is in line with the research methodology outlined in Chapter 4.

5.2. DEMOGRAPHICS

This section gives a breakdown of the demographic profiles of the 64 respondents. The respondents were asked three questions to enable proper categorisation based on their duration within virtual teams and location of both virtual team members and their respective managers. Figure 5 below shows a split of respondents. Most respondents were from South Africa (47%), while the remaining split was as follows: India (23%), China (17%) and United Kingdom (13%).

Figure 5: Frequency Response of the Subordinates Based On Location

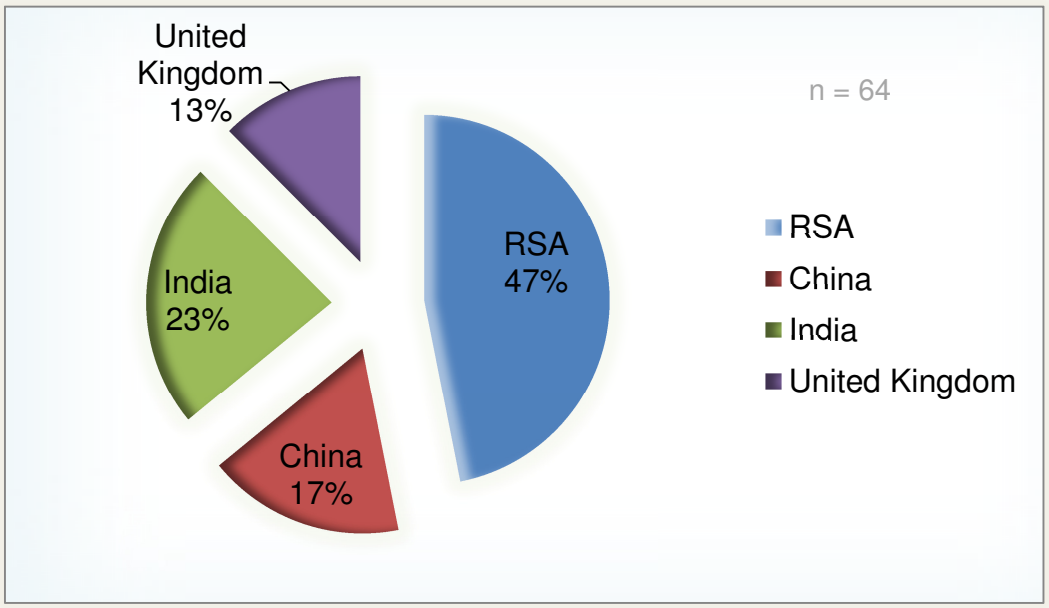
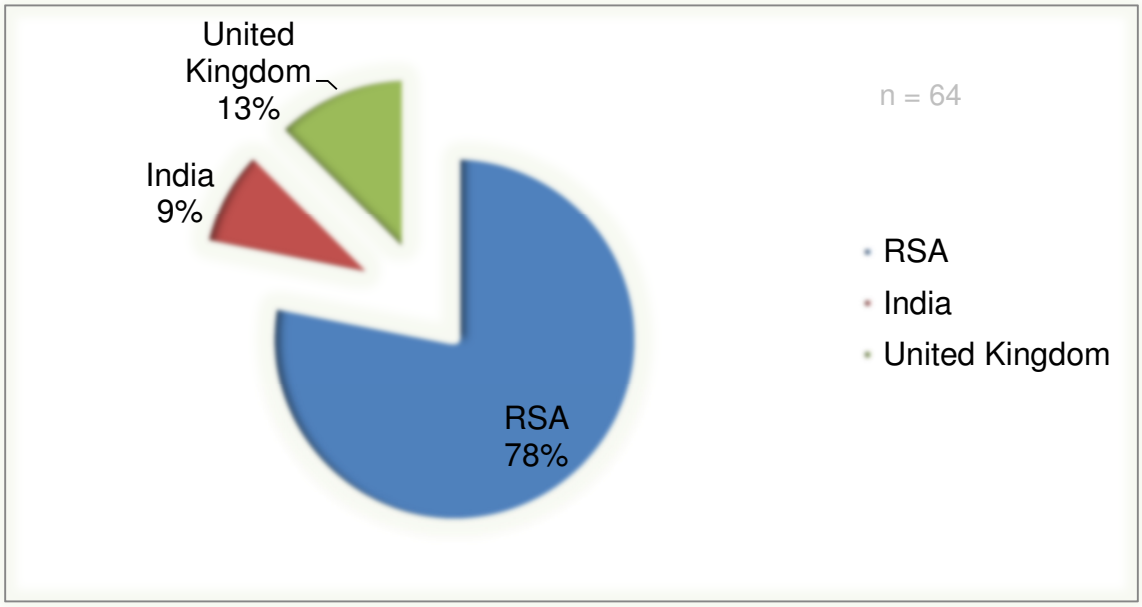


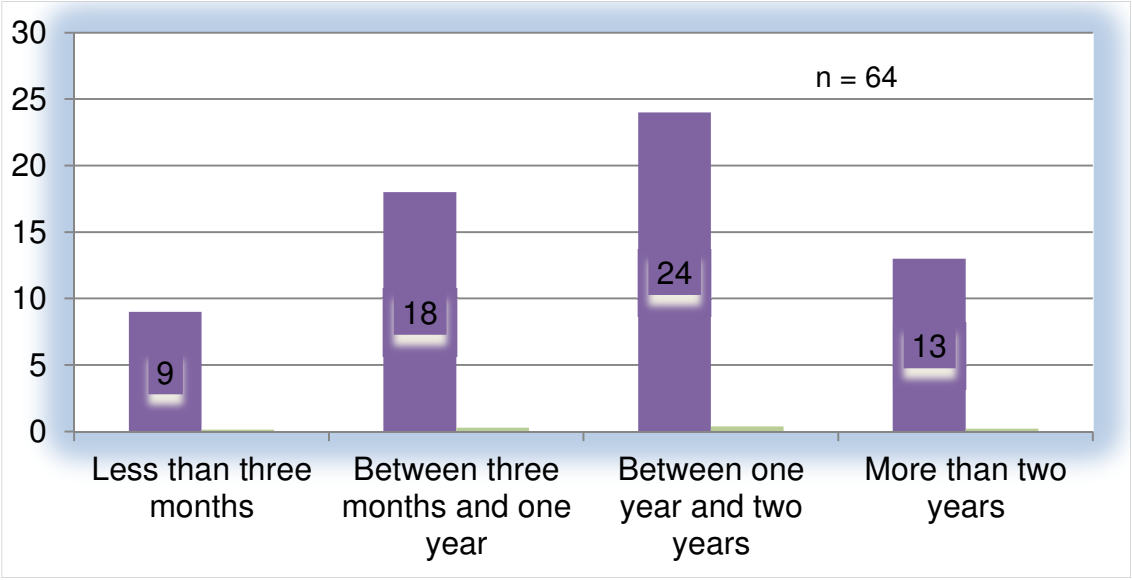
Figure 6 below shows that 78% of the respondents' managers were based in South Africa, while there were no managers based in China. The remaining 22% was split between the United Kingdom (13%) and India (9%).

Figure 6: Frequency Response of the Country managers Are Based In



An analysis of the respondents' length in virtual teams is shown in Figure 7. Most of the respondents had been participating in virtual teams between one year and two years (38%), while the remaining split was as follows: between three months and one year (28%), more than two years (20%) and less than three months (14%).

Figure 7: Length in Virtual Teams



5.3 RELIABILITY ANALYSIS

In order to measure the reliability of the questionnaire, a Cronbach's alpha test was performed. The range of the Cronbach's alpha is from 0 to 1. This test was conducted to verify whether questions in each of the sections mentioned assessed the factors correctly. The reliability analysis results are shown in Table 2 depicted below:

Table 2: Reliability Analysis Of Questions In Parts: B To E

Section of the questionnaire	Number of items	Cronbach'sAlpha coefficient
B - Sustainability of trust in virtual team	10	0.725
C - Factors that contribute towards conflict in virtual teams	10	0.731
D – Task-Related factors important in ensuring effective virtual teams	12	0.661
E - Personal capabilities and skills considered important by virtual team	12	0.671

A full reliability analysis is shown in Appendix 2. When question 4 in section B (Change focus from individual to group) was removed, the reliability improved to 0.725. The other items were also deleted, improving the reliability as follows:

Section C: When question 2 (The frequency at which people in the team disagree about opinions regarding work to be done) was removed, the reliability improved to 0.731.

Section D: When question 9 (The members of my team have a variety of different backgrounds and experiences) was removed, the reliability improved to 0.661.

Section E: When question 13 (The ability to visualise, articulate and solve complex problems and concepts, and make decisions that make sense) was removed, the reliability improved to 0.688.

5.4 RESULTS OF THE RESEARCH QUESTIONS

In all the content-based sections, frequency distributions are provided to identify the highly ranked factors. A questionnaire was used and respondents were asked to rank the extent to which the listed factors are important, using a four point Likert scale, as follows:

1 – Not all important

2 – Somewhat important

3 – Very important

4 – Critically important

The inferential statistics were conducted in order to test whether the assessment of virtual work depends on the country base of the respondents or the country base of where the managers and duration in virtual teams. Prior to conducting the inferential statistics, the normality test (Kolmogorov Smirnov)

was conducted to decide whether parametric (ANOVA) or nonparametric (Kruskal Wallis) tests were appropriate. The full results of all sections of the normality tests are presented in Appendix 2. Since the p-values were less than 0.05, the null hypothesis was rejected, which led to a conclusion that the data was not normal. On this basis, the non-parametric tests were conducted by performing Kruskal Wallis.

5.4.1 Results of Research Question 1

5.4.1.1 Frequency Analysis

A frequency analysis of the ranked factors is shown in Table 3 below, ranked in descending order by the factor considered critically important within engineering projects. In terms of the weighted rankings, if every respondent had scored a four (4) on each factor, the highest possible score would have been 256. The highest ranked factor (232) is not far off the highest possible score (256) and thereby strongly underlining the critical importance of this factor.

Table 3: Ranked Factors Considered Important For Research Question 1

Ranking	Questions	Weighted ranking
1	Establish interim deadlines and celebrate when met	232
2	Selecting a team leader	220
3	Honesty in describing members' experience and abilities	216
4	Team building exercise	212
5	Being counted on to do what the team members say they will do	208

Ranking	Questions	Weighted ranking
6	Encourage participation of organising activities	208
7	Telling the truth about the limits of the members' knowledge	176
8	Encourage appreciation of each member's contribution	169
9	Acknowledge and commend suggestions of individual members to the team	147
10	Encourage social aspects of communication	145

As the questionnaire was administered in four countries, the responses were also analysed individually to establish if there is harmony amongst all the countries regarding factors considered critically important. As shown in Table 4, the results are aligned with the overall outcome, with the exception of the United Kingdom that rated "honesty in describing members' experience and abilities" as the most critically important.

Table 4: Top Ranked Factor per Country - Research Question 1

Country	RSA	India	China	United Kingdom
Only employees based in	Establish interim deadlines and celebrate when met	Establish interim deadlines and celebrate when met	Establish interim deadlines and celebrate when met	Honesty in describing members' experience and abilities

5.4.1.2 Statistical Test – Where Subordinates Are Based

The Kruskal-Wallis test was performed to compare the subgroups to see if there are differences in the responses. The result of the statistical test is shown in Table 6 (only those where the p-value was less than 0.05), below: The p-values of three questions were less than 0.05 leading to a conclusion that there is statistical evidence that the variables are different across the countries.

Table 5: Statistical Test: Research Question 1 - Based On Where Subordinates Are Located

Question Number	Questions	Median				P-value
		South Africa	China	India	United Kingdom	
3	Encourage social aspects of communication	2	1	3	3	0.002
6	Encourage appreciation of each member's contribution	2	3	3	3	0.017
9	Telling the truth about the limits of the members' knowledge	2	3	3	4	0.001

5.4.1.2.1 Box Plots – Research Question 1

In cases where the differences were found, the box plot analysis was conducted in order to establish areas that were significantly different from each other. The

box plots for questions significantly different are shown in Figures 8, 9 and 10 below.

These box plots provide a visual comparison of the medians between the subgroups and illustrate the difference between medians in the different groups. Values indicated with rounds and stars are extreme values and outliers respectively. The median is shown by the black line inside the box.

As shown in Figure 8, there was an outlier emanating from United Kingdom's response. Extreme values were also observed from China. In all the eleven (11) responses from China, all have rated between one (1) and two (2) and no ratings above two (2) were observed.

Figure 8: Box Plot For "Encourage Social Aspects of Communication"

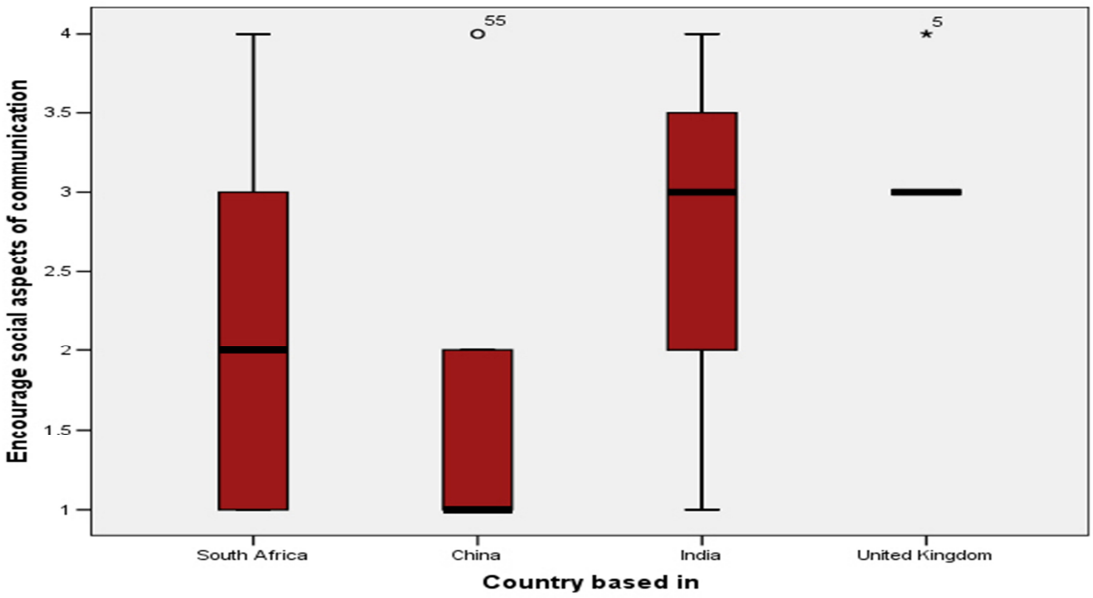
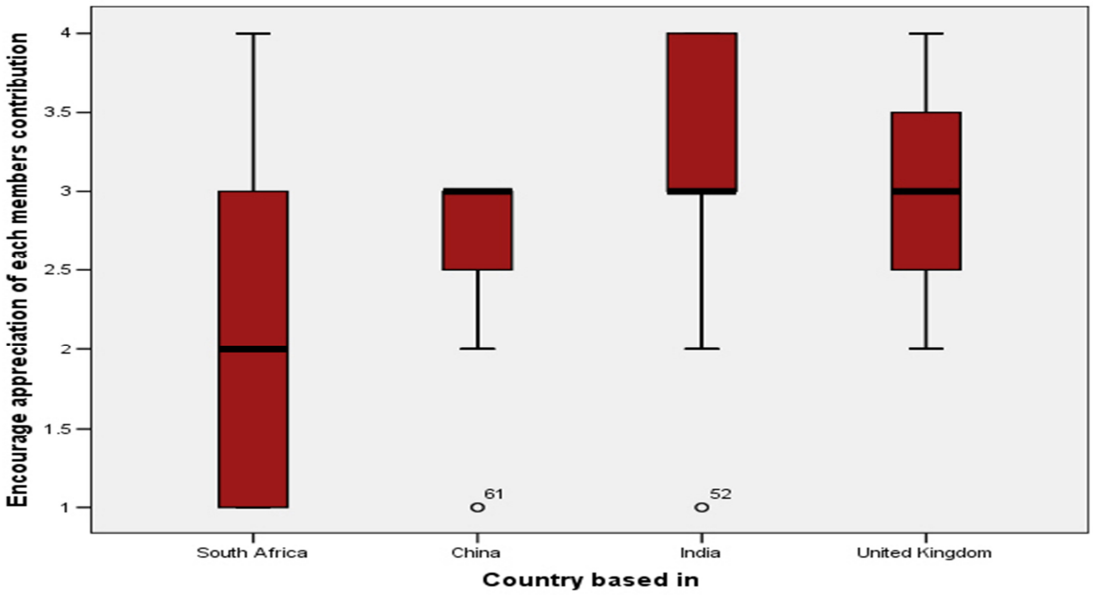


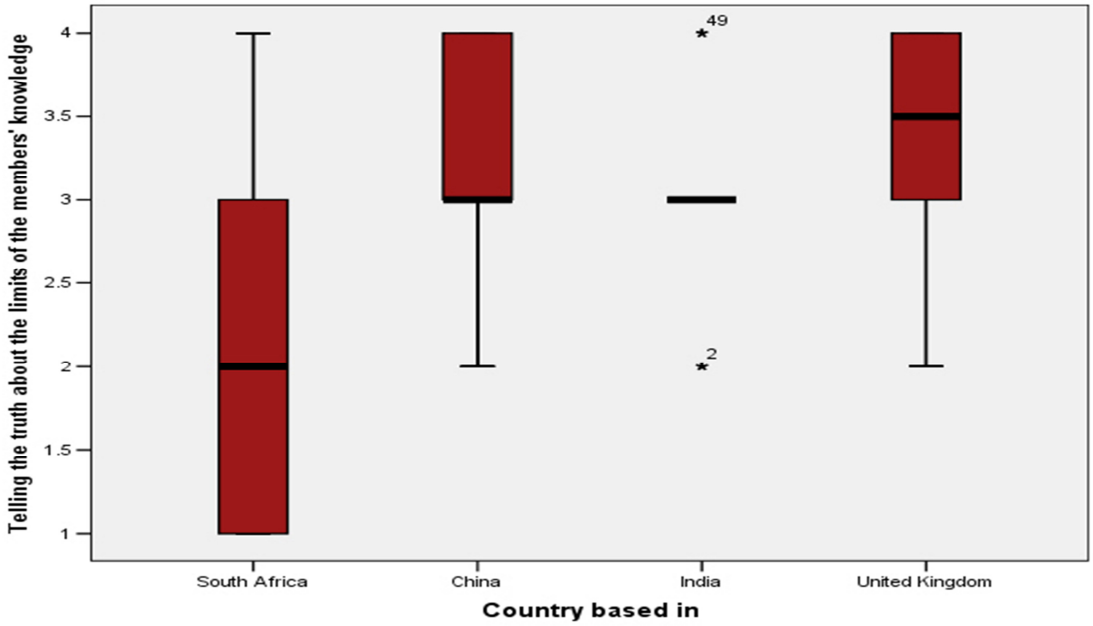
Figure 9 below shows extreme values from China and India with regard to the factor pertaining "encourage appreciation of each member's contribution".

Figure 9: Box Plot For "Encourage Appreciation of Each Member's Contribution"



The significant difference relating to “telling the truth about the limits of the members' knowledge” is shown in Figure 10 below: Moreover, there was also lack of symmetry on the responses from the rest of the countries.

Figure 10: Box Plot for "Telling the Truth about the Limits of the Members' Knowledge"



5.4.1.3 Statistical Test – Where Subordinates' Managers Are Based

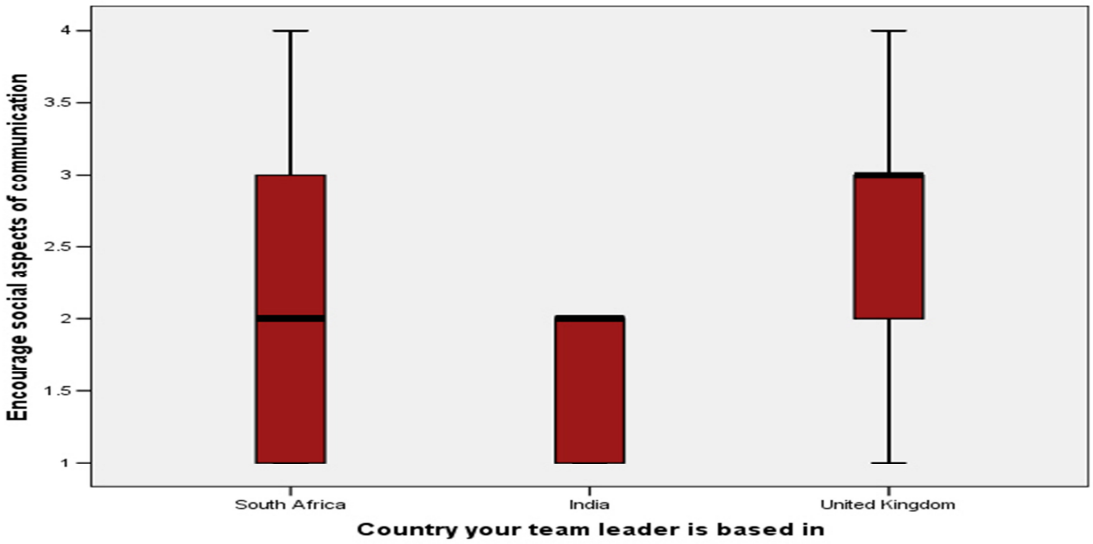
The results of the statistical test, based on where managers are located, are shown in Table 6. The p-value for the two of the questions was less than 0.05. On this basis, a conclusion was made that there is statistical evidence that the variables are different across the countries.

Table 6: Statistical Test: Research Question 1 - Based On Where Managers Are Located

Question Number	Questions	Median			P-value
		South Africa	India	United Kingdom	
3	Encourage social aspects of communication	2	2	3	0.019
7	Team building exercise	4	3	3	0.027

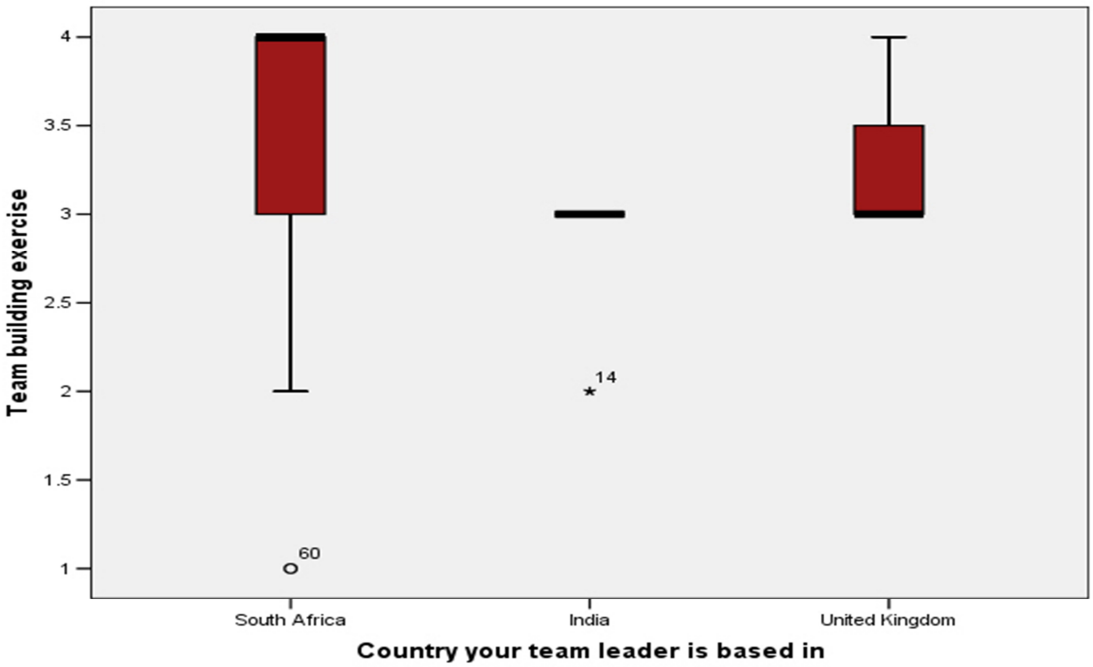
In order to further explore the areas contributing to differences of the variables and where the managers are based, a box plot analysis was conducted. Results are shown in Figures 11 and 12 below.

Figure 11: Box Plot For "Encourage Social Aspects of Communication"



Outliers and extreme values were observed from India and South Africa respectively, relating to "team building exercise" (as shown in Figure 12). Furthermore, there was strong indication of this factor emanating from the respondents whose managers are based in the United Kingdom.

Figure 12: Box Plot for "Team Building Exercise"



5.4.2 Results of Research Question 2

5.4.2.1 Frequency Analysis

The respondents were asked to rank issues considered important in contributing towards conflict in virtual teams. The highest score obtained was 211, in comparison to a possible high score of 256. The lowest weighted ranking was 156, which was "The extent at which there are differences of opinions regarding tasks". Results are shown in Table 7 below:

Table 7: Ranked Factors Considered Important For Research Question 2

Ranking	Questions	Weighted ranking
1	Conflict about delegation of tasks in the team	211
2	The frequency at which there is conflict about ideas in the team	186
3	Personality conflicts evident in the team	185
4	Emotional conflict among members of the team	183
5	The frequency at which there is friction among the team members	179
6	Tensions among members of the team	170
7	The frequency at which members of the team disagree about who should do what	166
8	The extent at which there are differences of opinions regarding tasks	164
9	The frequency at which members disagree about the way to complete a team task	160
10	The extent of conflict about the work you do	157

Table 8 shows the top ranked factor per country. The only difference is with India-based employees, who rated differently compared to the other countries.

Table 8: Top Ranked Factor per Country - Research Question 2

Country	RSA	India	China	United Kingdom
Top ranked issue	Conflict about delegation of tasks in the team	The frequency at which members disagree about the way to complete a team task	Conflict about delegation of tasks in the team	Conflict about delegation of tasks in the team

5.4.2.2 Inferential Statistics – Research Question 2

The Kruskal-Wallis test was performed (results shown in Table 9). The p-value of only one question was less than 0.05 leading to a conclusion that there was statistical evidence that the factors are brought about by the different length of time in virtual teams.

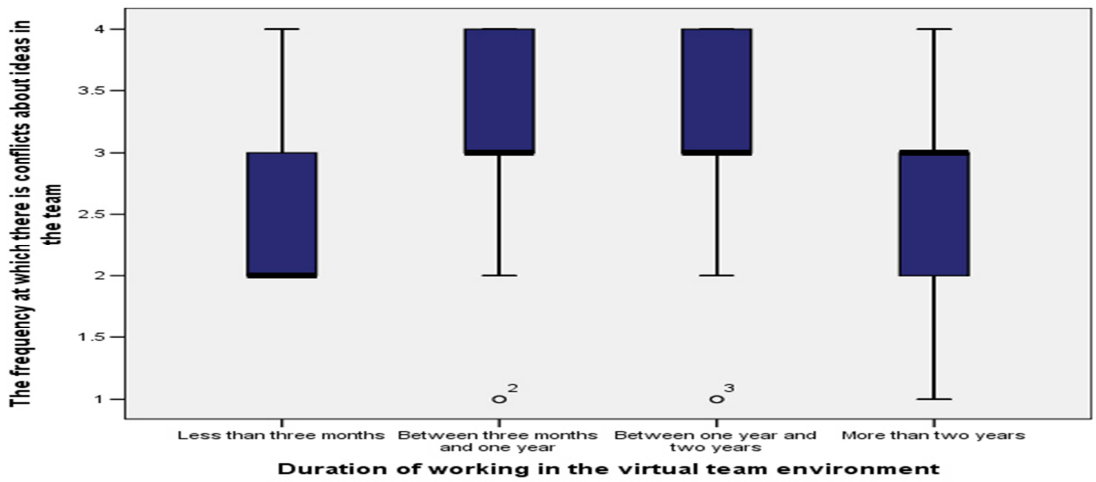
Table 9: Statistical Test – Research Question 2 – Based On Length in Virtual Teams Based On Length in Virtual Teams

Question Number	Questions	Median				P-value
		< 3 months	Between 3 months and 1 year	Between 1 year and 2 years	More than 2 years	
1	The frequency at which there are conflicts about ideas in the team	2	3	3	3	0.018

In order to establish differences amongst length of time in virtual teams, box plot evaluations were conducted. Results are shown in Figure 13 below: There were extreme values observed emanating from the respondents whose duration in virtual teams was between three months and two years.

5.4.2.2.1 Box Plots – Research Question 2

Figure 13: Box Plot for "The Frequency at Which There Are Conflicts about Ideas In The Team"



5.4.3 Results of Research Question 3

5.4.3.1 Frequency Analysis

In terms of the weighted rankings, if every respondent had scored a four (4) on each factor, the highest possible score would have been 256. The highest ranked factor (235), is not far off the highest possible score (256), and thereby showing a strong indication attached to this factor. The lowest scored factor is 175, which was "Other members of my team depend on me for information needed to perform their tasks". The results of the ranked factors are shown in Table 10 below:

Table 10: Ranked Factors Considered Important For Research Question 3

Ranking	Questions	Weighted ranking
1	Feedback about how well I am doing my job primarily comes from information about how well the entire team is doing	235
2	The team rather than the manager decides who does what tasks within the team	213
3	The work performed by the team is important to the customers in my area	211
4	Members of the team have great confidence that the team can perform effectively	211
5	Members of my team are very willing to share information with other team members about work	209
6	As a member of the team, I have a real say in how the team carries out its work	200

Ranking	Questions	Weighted ranking
7	The team concept allows all the work on a given product to be completed by the same set of people	200
8	My work goals come directly from the goals of my team	199
9	The company provides adequate team skills training for my team (e.g. communication, organisation, interpersonal, etc)	188
10	Most team members get a chance to learn the different tasks that the team performs	187
11	Everyone on my team do their fair share of their work	185
12	Other members of my team depend on me for information needed to perform their tasks	175

As the questionnaire was administered in four countries, the responses were also analysed individually to establish differences amongst all the countries regarding factors considered critically important. As shown in Table 11, the results are aligned with the overall outcome, with the exception of the United Kingdom which rated differently.

Table 11: Top Ranked Factor per Country - Research Question 3

Country	RSA	India	China	United Kingdom
Top ranked factor	Feedback about how well I am doing my job primarily comes from information about how well the entire team is doing			Members of my team are very willing to share information with other team members about work

5.4.3.2 Statistical Tests – Research Question 3

As stated earlier, only results where the p-value was less than 0.05 is presented. The results (as shown in Table 12) show that one factor which is,"members of the team have great confidence that the team can perform effectively", has got a p-value that was less than 0.05. A conclusion was reached that there was statistical evidence that the factors are different in terms of the location in which managers are based.

Table 12: Statistical Test: Research Question 3 – Based On Where Managers Are Located

Question Number	Questions	Median			P-value
		South Africa	India	United Kingdom	
10	Members of the team have great confidence that the team can perform effectively	3	4	4	.004

Furthermore, Kruskal-Wallis revealed significant differences based on duration in virtual teams. The results are shown in Table 13 below indicating that two factors were different.

Table 13: Statistical Test: Research Question 3 - Based On Length In Virtual Teams

Question Number	Questions	Median				P-value
		< 3 months	Between 3 months and 1 year	Between 1 year and 2 years	More than 2 years	
10	Members of the team have great confidence that the team can perform effectively	3	3	4	3	.002
12	Members of my team are very willing to share information with others	3	3	4	4	.004

In order to establish differences amongst managers' location and length of time in virtual teams, box plot evaluations were conducted and the results are shown in Appendix 4.

5.4.4 Results of Research Question 4

5.4.4.1 Frequency Analysis

Table 14 below shows the extent to which the following listed skills are considered important by virtual team members. The highest ranked factor (223) is the "ability to make good decisions".

Table 14: Ranked Factors Considered Important For Research Question 4

Ranking	Questions	Weighted ranking
1	Ability to make good decisions	223
3	Technical expert - Accomplishment of complex tasks of a technical nature	199
4	Attention to detail when performing tasks	191
5	Ability to succeed in the face of conflict and opposition	186
6	Ability to build strong alliances	185
7	The extent of easiness in interacting with other people or team members	175
8	Being a humanist - Having a strong interest or concern for other team members welfare, values and dignity	174
9	Ability to build strong alliances	171
10	Concern for people	171
11	Interpersonal skills - Developing and maintaining positive relationships with others	171
12	Good listener	168

Table 15 below shows agreement amongst all the countries with regard to the highest rated factor, which is the “ability to make good decisions”.

Table 15: Top Ranked Factor per Country - Research Question 4

Country	RSA	India	China	United Kingdom
Top ranked issue	Ability to make good decisions	Ability to make good decisions	Ability to make good decisions	Ability to make good decisions

5.4.4.2 Statistical Tests – Research Question 4

As stated earlier, only results where the p-value was less than 0.05 is presented. The p-values of three of the questions were less than 0.05 and thereby leading to a conclusion that the factors were different between the four sub-groups (as in Table 16). Box plot analyses are shown in Appendix 3.

Table 16: Statistical Test: Research Question 4 – Based On Duration In Virtual Teams

Question number	Questions	Median				P-value
		< 3 months	Between 3 months and 1 year	Between 1 year and 2 years	More than 2 years	
2	Concern for people	2	3	3	3	0.010
3	Being a humanist - Having a strong interest or concern for other team members welfare, values and dignity	3	2	3	2	0.001
6	The extent of easiness in interacting with other people or team members	2	3	3	3	0.015

5.5 CONSOLIDATED TOP RANKED FACTORS COMPARED TO LENGTH IN TEAMS

The consolidated results of all research questions (Section B to E), compared to duration in virtual teams are shown in Table 17 below. There is consensus

among members in section E (What are the right skills required by virtual team members to achieve optimal knowledge transfer?) and all members rated the "ability to make good decisions" as the most critical skill.

Table 17: Top Ranked Factor In Comparison To Length in Virtual Teams

	< 3 months	Between 3 months and 1 year	Between 1 year and 2 years	More than 2 years
B	Establish interim deadlines and celebrate when met		Encourage participation of organising activities	Honesty in describing members' experience and abilities
C	Conflict about delegation of tasks in the team		The frequency at which there is friction among the team members	Conflict about delegation of tasks in the team
D	Feedback about how well I am doing my job primarily comes from information about how well the entire team is doing			Members of my team are very willing to share information with other team members about work
E	Ability to make good decisions			

CHAPTER 6: DISCUSSION OF THE RESULTS

6.1 INTRODUCTION

The overriding aim of this study is to understand the critical success factors important for virtual teams. This chapter discusses and interprets the research results in the context of the research questions that were posed. The analysis is aligned with the research problem, literature review and the research questions. Furthermore, the results are discussed in an effort to confirm and substantiate whether the research questions have been answered.

6.2 DISCUSSION OF DEMOGRAPHICS

As stated in Chapter 4, the population for this research was comprised of virtual team members, who are involved in any engineering projects work around the world, on behalf of a power utility company. Figure 5 in Chapter 5 showed a high representation by South African-based employees and, as most of the work undertaken by the power utility is currently in South Africa, the 47% representation of South African-based employees is a true reflection.

Figure 6 showed that 78% of virtual team managers are based in South Africa. In Chapter 4 it was mentioned that some of the members of the population are individuals working for non-South African companies and South African companies, who are normally contracted and report to the power utility management and therefore, the 78% representation is a true reflection as the contracting managers are based in South Africa. The reason why there was no manager based in China is because none of the non-South African-based companies are based in China.

6.3 DISCUSSION OF THE RESULTS FOR RESEARCH QUESTION 1

What critical factors are important to sustain trust within virtual teams?

6.3.1 Top Four Ranked Factors – Research Question 1

6.3.1.1 Establish Interim Deadlines and Celebrate Milestones When Met

According to Table 3 in Chapter 5, the highest ranked factor considered important in order to sustain trust in virtual teams was "establishing interim deadlines and celebrate milestones when met".

As stated previously, the research problem identified is the need to identify key success factors that contribute towards effective virtual teams, taking into account the peculiar challenges associated with minimal face-to-face interaction and extensive use of communication technology. Munkvold & Zigurs (2007) stated that despite challenges such as tight schedules and a need to start quickly and perform instantly, it is also important to ensure that trust is sustained at all stages. In light of the tight schedules, it is imperative that the overall project goals are broken down into interim deadlines and the teams should celebrate milestones whenever achieved.

The results also augment the virtual teams theory by Lipnack and Stamps (1997), which stated that concrete results (as shown in Figure 2), are the output of the purpose, while interdependent tasks are the processes that need to be undertaken. The interdependency of tasks means that in order to achieve the objectives, all members must deliver. Failure to do so may result in stagnant development of trust amongst each other. Trust is an essential element as it

affects performance; even more so when tasks are interdependent (Robert Jr et al., 2009).

This study was conducted in engineering projects context, which has high interdependency of tasks. Various stakeholders, such as Design, Safety, Procurement, Quality, Environmental and others act as gate keepers within the projects and failure of one discipline to deliver has significant impact on the project. Moreover the difference with engineering projects is large special processes which are complex and involve specialisation and thereby exacerbate interdependency**.** Most of these activities that virtual teams perform are in the critical chain and thereby emphasising the interdependency. The milestones can only be achieved through multidisciplinary teamwork

The results answer one of the critical success factor imperative for sustaining trust, given the minimal face to face interaction and extensive use of communication technology. Celebrating the milestones also helps in building the social bonds needed for the positive assessments of benevolence (Greenberg, et al., 2007). Furthermore, the results of this study relate with the theory base.

In summary, the research results have answered the research question, which aimed to reveal critical factors important to sustain trust within virtual teams. The next level of understanding is to understand the extent to which interim deadlines should be celebrated, considering that projects' duration and complexity. This study was not able to achieve the required depth of understanding to answer this question sufficiently.

6.3.1.2 Selecting a Team Leader

The second highest ranked factor was "selecting a team leader". One of the common dysfunctions associated with the teams is lack of trust (Banutu-Gomez & Rohre, 2011) and an ineffective team leader can contribute towards low trust in the team (Clark et al., 2010). The result relates to the literature, as the selection of a team leader was found to be critically important.

The key in developing virtual teams is geography, national culture, language and time (Bergiel et al., 2008). One might imagine how ineffective it would be to have a team leader whose culture and language is different to the team as this would adversely affect trust development. This study was conducted in four countries which involve India, China United Kingdom and South Africa. China is one of the countries where most people do not speak English and having a leader who can only speak English would exacerbate communication breakdown.

Similarly, a leader who is based in one of the countries where there are significant time zone differences may also have substantial communication problems which would impact on the project. As stated earlier, engineering projects are characterised by high interdependency and challenges such as a need for immediate design approval are exacerbated due to time zone differences.

The research finding support these challenges and further mean that effective team leader selection process would help in alleviating the inherent challenges, such as individual employee's psychological make-up and other predispositions (Bergiel et al., 2008), may be overcome.

In summary, the research finding that has revealed "selecting a team leader", as one of the critical success factor relate with the literature that has outlined challenges such as geography, national culture and time-zone difference. The research objectives have been met and results are aligned with the theory base.

6.3.1.3 Honesty in Describing Members' Experience and Abilities

"Honesty in describing members' experience and abilities" was rated as the third critical factor. The highest ranked factor (establishing interim deadlines and celebrating when met), is achieved through teamwork. Banutu-Gomez et al. (2011) stated that teamwork means together each team member should aim to achieve more. The key word that stands out is "together". On this basis, the findings of the first and third factors are complementary.

Trust is often the result of members knowing that all virtual team members can be counted on to complete their assigned tasks (Bergiel et al., 2008). Furthermore, trust is defined as "the expectation that arises within a community of regular, honest, and cooperative behaviour, based on commonly shared norms, on the part of the members of that community (Fukuyama, 1993, quoted in Clark et al., 2010, p. 26). The key word from the definition is "honesty", which means that virtual teams must be honest with each other. Honesty is further reinforced by high interdependency.

What this result means is that to be honest will enable all members to know each other's strengths and weaknesses and work towards the common purpose, which will lead to concrete results (Lipnack and Stamps, 1997), rather than counting on a member to complete the task and failing due to his lack of ability or experience. In an engineering projects' context, a quality inspector

should be able to state his weaknesses such as lack of experience in certain technologies and the team leader may assign a chief inspector to help and thereby not compromising on the quality of the equipment and the project schedule.

Although it is acknowledged that ability, as stated by (Greenberg et al., 2007), is one of the two components that members assess during the early development stage and that the more proficient team members are, the more likely that trust will develop, it is similarly important for the members to be honest regarding their abilities.

In summary the objectives of this study was to reveal the critical success factors and "honesty in describing members' experience and abilities", was found to be one of the factors important required in virtual teams. The next stage would be to distinguish between recruitment of the members, which should involve acquiring individuals of high ability and experience, together with honesty in abilities and experience once the members have been recruited.

6.3.1.4 Team Building Exercises

According to Robert Jr et al. (2009) swift trust, which develops prior to interactions, and history-dependent knowledge-based trust, which develops through interactions, are two forms of trust manifested at different stages of a relationship. Team building exercises are designed to enhance swift trust and set the stage for increasing cognitive and affective trust (Greenberg et al., 2007). The research results are aligned with this literature.

Although there may be arguments with regard to how the team building exercises is achieved (considering the nature of virtual teams), team building exercises do not necessarily mean getting the team together into one location, as conventionally known in traditional teams. Technology may be used to facilitate this exercise. One of the ways it can be used is to make use of a chat or discussion board, as stated by Clarke et al., (2010). The research objectives have been met as team building exercises was found to be one of the critical success factors towards effective virtual teams. The next level of understanding would be to measure success factors as a result of team building exercises.

6.3.2 Least Ranked Factors – Research Question 1

The four lowest ranked factors shown in Table 3 are:

- Encourage social aspects of communication
- Acknowledge and commend suggestions of individuals' members to the team
- Encourage appreciation of each member's contribution
- Telling the truth about the limits of the members' knowledge

The first and third least ranked factors have softer skills aspects. As virtual teams may at times not physically know each other, this could explain why this aspect was rated the lowest. The fourth lowest ranked factor is different to the top ranked factor, which was "honesty in describing members' experience and abilities", as the differentiating factors are knowledge and experience.

6.4 DISCUSSION OF RESULTS FOR RESEARCH QUESTION 2

What Are Factors Contributing Towards Conflict In Virtual Teams?

6.4.1 Top Four Ranked Factors – Research Question 2

6.4.1.1 Conflict about Delegation of Tasks in the Team

The results have revealed that "conflict about delegation of tasks in the team", was the most critical factor that contributes towards conflict. Three types of conflict were identified by Wakefield et al., (2008), namely: task, relational and process. "Conflict about the delegation of tasks in the team" is classified under process conflict category. One of the key distinguishing characteristics of virtual teams is minimal face-to-face communication (Malhotra et al., 2007). This is in accord with the research results as the process conflict surfaces when members disagree regarding the methods and processes required to complete the tasks (Wakefield et al., 2008). Conflict is also exacerbated by communication delays, time-zone differences and lack of contact due to space-time dispersion (Kankanhalli et al., 2007).

Although process conflict surfaces in traditional teams as well, the advantage is that members are able to meet face-to-face and iron out the differences, while virtual teams do not enjoy this advantage. This study involves virtual team members who are knowledge workers and thereby characterised by their ability and a need for non-routine tasks. This poses another problem, where some members may have problems relating to tasks allocation, due to difference need of task complexity and importance. This supports the research findings as members would experience conflict fuelled by a need for challenging tasks.

Although every project is different as compared to operational processes, there are some activities that are routine, which are documented as standard designs. The research objectives have been met as the most critical factors were identified. In this case, the factor identified needs to be taken into consideration as it may contribute towards conflict, which is exacerbated by ineffective ways of conflict resolutions emanating from minimal face-to-face interaction.

6.4.1.2 The Frequency at Which There Is Conflict about Ideas in the Team

In traditional teams, dress codes, shared language, shared organisational routines, and organisational identifiers such as organisational charts and office buildings, help in bringing team members together (Bosch-Sijtsema, 2007).Virtual teams do not enjoy this advantage. Most of the traditional conflict resolution styles involve face-to-face interactions in order to be effective. In traditional teams, members engage in debates and deliberations on divergent ideas until a conclusion is reached and thereby minimising conflicts.

The three conflict resolution approaches identified in the literature review were integrative (solving the problem through collaboration), distributive (solving the problem through assertion) and avoidance (ignoring the problem). Although any of these approaches may be adopted, the challenge is minimal face-to-face interactions.

The research findings support the assessment of the literature review which implies that the more conflict surfaces regarding ideas in the team; the more

prevalent it will be in the team. The research objectives have been met as this factor has been identified as critical within virtual teams.

6.4.1.3 Personality Conflicts Evident In the Team

Personality conflict falls within relational conflict, which arises when personal understanding of teams, including individual cultures and norms, is insufficient (Wakefield et al., 2011). Cultures and norms play a crucial role and the setup within most of the virtual teams involves members from different cultural backgrounds. Associated conflicts are exacerbated by minimal face-to-face interaction. The literature review suggested that virtual team training, which includes aspects of culture, is important and provides a framework that can be used to educate employees to adapt behaviour in consideration of culture (Anawati & Craig, 2006).

It may be a norm for a Chinese to communicate message into the public domain, while an English person may view the message in a bad light, resulting in conflicts. Similarly, a Saudi Arabian woman, working with a German man, may have a cultural clash with the German man, as women in Saudi Arabia may be culturally prevented from taking part in male-dominated activities.

In summary, the research results are aligned with the literature reviewed and the research objectives have been met. The next stage of understanding is to develop specific personality profile needed in light of these inherent challenges, which this study has not managed to delve into.

6.4.1.4 Emotional Conflict among Members of the Team

Emotional conflict is linked with personality conflict, as both are categorised under relational conflict. The lack of face-to-face interaction fuels the conflict.

One could imagine a situation where a virtual team member communicates through email and the receiving member gets offended by the content of the email, responding back in an emotional manner, and thereby leading to conflict perpetuation.

The emotional conflict emanates from socio-emotional process (trust, relationship building and trust), which are important towards virtual team performance (Powell et al., 2004). It is important that virtual team members should clearly understand each other's diverse backgrounds, which will inform how decisions will be made. Furthermore, as seen in Figure 3, training has been identified as an input in the theory of virtual teams (Powell et al., 2004), which could mean that aspects such as emotional intelligence may have to be built in into the training in ensuring that members know how to better handle their emotions.

In summary, the research objectives have been met as emotional conflict was identified as one of the critical factors important towards success. Similar to the personality conflict, the next stage of understanding will be to establish the personality profile important in line with emotions and this will help in ensuring that well-matched individuals are recruited.

6.4.2 Least Ranked Factors – Research Question 2

The least ranked factors of research question 2 are shown in Table 7, summarised as follows:

- The extent of conflict about the work you do
- The frequency at which members disagree about the way to complete a team task

- The extent at which there is differences of opinions regarding tasks
- The frequency at which members of the team disagree about who should do what

The highly ranked factor "Conflict about delegation of tasks in the team" had to do with delegation of tasks, while this factor has to do with the conflict of the work virtual team members do. What this means is that once the work has been properly allocated (delegation), the extent of conflict within each team member's conflict is low.

6.5 DISCUSSION OF THE RESULTS FOR RESEARCH QUESTION 3

What Specific Task-Related Factors Are Considered Important In Ensuring Effective Virtual Teams?

6.5.1 Top Four Ranked Factors – Research Question 3

6.5.1.1 Feedback about how well I am doing my job primarily comes from information about how well the entire team is doing

As stated previously, "together" is a key word that comes out of the definition of teamwork (Banutu-Gomez et al., 2011). In order to achieve the overall objectives of the team, performance should not be based on any individual member's contribution. Some of the drawbacks of virtual teams identified in the literature are a need to develop the skills of individual members to work in virtual teams; too many members are possible in a team; and monitoring and performance management difficulty (Kuruppuarachchi, 2009). This literature supports the research findings that has identified that feedback about how one virtual team member is doing should hail from how well the entire team is doing.

Furthermore, Hackman and Powell (2004), quoted in Kuruppuarachchi (2009), stated that one of the key dimensions which are important in a team is a need for the reward systems of the organisation to be recognised as collective performance of the team. This is in accord with the research findings, which focus on collective performance rather than individual performance. In any organisation, especially project environment, individual performance may be meaningless, as one member that falls behind in his performance may adversely affect the broader project's objectives.

This research finding is consistent with that of traditional teams, where the focus is on the team rather than the individual team member. What this means is that although there are some key differences between the two setups, some of the things that are found in traditional teams still exist within virtual teams.

In the context of this study, the various disciplines involved in the project may at times consist of 20 divergent stakeholders. Failure of one discipline to perform, such as Commissioning Department, has significant impact on the overall project performance. Although other disciplines, such as Procurement may have managed to place order in time followed by on-time deliveries, delays in final testing of equipment by the Commissioning Department would result in the project coming to a standstill. It is imperative to develop performance scorecard that is not discipline focused; instead the focus should be on multi-disciplinary performance.

In summary, the research objective which aimed to identify the critical success factors required within virtual teams has been met. The challenge is to ensure

that measures are in place to deal with disciplines and individual members fixated to individual performance rather than collective performance.

6.5.1.2 The Team Rather Than the Manager Decides Who Does What Tasks within the Team

As previously stated, the core of developing virtual teams is geography, national culture, language and time (Bergiel et al., 2008) and managers at times are not well-versed in these dynamics within the teams. This result is aligned with the earlier findings regarding factors contributing towards conflict in virtual teams, which ranked “selecting a team leader” the highest.

The research question in this section sought to identify the task-related factors considered important in order to ensure better virtual team performance. The two research results are complementary. What this result mean is that the importance of selecting a team leader (previous findings), further permeate to the decision for task allocation, which indicate that the team leader chosen should be able to enable the team to decide on who does what tasks in the team.

Furthermore, the other previous finding relating to critical factors contributing towards conflict was the delegation of tasks (ranked first). What this means is that the delegation process should be influenced by the team, rather than an autocratic decision by the manager. While it is important to identify the factors that contribute to conflict in virtual teams, it is similarly important to take note of the task-related factors to be demonstrated by team members. This result imply that in order to minimise the challenges to do with culture, personality conflict,

language, time and emotional conflict, the team should decide who does what tasks within the team.

The research objectives have been met as the identification of the critical success factor has been achieved. This study has not delved into specific approach needed to be followed in ensuring better and efficient coordination of the task allocation. The manager can still play the overarching role and make use of certain processes guided by task-technology-structure fit as depicted in Figure 4.

6.5.1.3 The Work Performed By the Team Is Important To the Customers in My Area

As team members, it is important to undertake tasks that are important to the organisation and to the customers. The research findings can be linked to the earlier findings, which have identified "Conflict about delegation of tasks in the team" (ranked first) as a critical factor contributing towards conflict in virtual teams. The conflict in the delegation of tasks may mean that virtual team members fight over tasks that are important to customers within their respective areas.

The context of this study involves divergent engineering projects. There are perceptions that some projects are more important than the others, due to their perceived contribution in the business. The research findings complements the previous findings, such as conflict about delegation of tasks, as each member may be inclined to perform only those tasks that are viewed as critically important. The research objectives have been met as critical success factors

have been identified. The challenge is to strike a balance between all tasks that need to be performed and their relative perceived importance in achieving broader organisational goals.

6.5.1.4 Members of the Team Have Great Confidence That the Team Can Perform Effectively

Virtual teams comprise of knowledge workers. There may be perceptions that as virtual teams comprises of knowledge workers, the implication is that their performance is effective. Consequently, team members may have confidence in each other's performance. This finding supports the literature which stated one of virtual teams' advantages as enabling the recruitment of talented employees (Bergiel et al., 2008).

6.5.2 Least Ranked Factors – Research Question 3

The four least ranked factors are shown in Table 21 below and summarised as follows:

- Other members of my team depend on me for information needed to perform their tasks
- Most team members get a chance to learn the different tasks that the team performs
- Everyone on my team do their fair share of their work
- My work goals come directly from the goals of my team

This study was conducted in a project environment context, whereby responsibilities matrices are drawn up, stipulating each team member's explicit involvement. As team members are clear of their responsibilities within the

project, the lowest ranked factor ("Other members of my team depend on me for information needed to perform their tasks") is seen as least important with regard to virtual team performance.

6.6 DISCUSSION OF THE RESULTS FOR RESEARCH QUESTION 4

What Are The Skills Required By Virtual Team Members To Achieve Optimal Knowledge Transfer?

6.6.1 Top Four Ranked Factors – Research Question 4

6.6.1.1 Ability to Make Good Decisions

The ability to make good decisions is classified within the structural category, which relates to explicit goals, well-developed control systems, and clear job descriptions (Bolman & Deal, 1992). The research question investigates the extent to which skills are considered important by virtual team members.

In traditional teams, the decision-making process may, at times, involve quick consultation with some of the team members in ensuring that a good decision is taken. Virtual teams do not enjoy this advantage because of minimal face-to-face interactions. The decisions should be made in line with the goals that the team seek to achieve.

According to Bergiel et al (2008), while goals are important for all teams, they are critically important for team members who do not meet or see each other. This category of skills was rated above the HR (Human Resources) and networker categories, unsurprisingly so, as minimal face-to-face interactions reduce the need for networking and interpersonal skills due to communication through electronic means.

The research objectives have been met as an "ability to make good decisions" is one of the critical success factors that were found to be important in ensuring effective virtual teams by enabling optimal knowledge transfer.

6.6.1.2 Technical Expert - Accomplishment of Complex Tasks of a Technical Nature

The research objective is to investigate factors required by virtual teams' members in engineering projects. The nature of virtual environment is characterised by teams that are scattered globally, which may at times be highly complex and unique (Kuruppuarachchi, 2009). A project, as compared to normal operations, is unpredictable and requires members to be able to resolve issues as and when an opportunity arises.

Advantages associated with virtual teams, as stated in the literature, are the recruitment of the most talented employees within a specific field and the engendering of creativity among team members (Bergiel et al., 2008). The research findings support the literature. The dispersion of virtual teams can provide substantial benefits if companies can take advantage of the diversity and varied expertise of team members at different locations (Siebdrat et al 2009). Furthermore, technical expert skills are typically the types of skills required by virtual team members.

6.6.1.3 Attention to Detail When Performing Tasks

The skill "attention to detail when performing tasks", together with the first (ability to make good decision) and second (technical expert) ranked skills, falls within the structural category. The structural category is highly emphasised by

these findings, indicating how crucial they are within the virtual working environment. The difference between the significance of this skill in virtual teams in comparison to traditional teams is that, although they are both critically important, the minimal face-to-face interaction means that virtual teams have a higher probability for making mistakes, while in traditional teams there is an opportunity for other team members to help in minimising errors.

According to Banutu-Gomez & Rohre (2011), once a team is created it becomes a family in a more structured way because everyone has a responsibility as a member to finish a common objective. It is difficult to form the family within a virtual team environment due to minimal face-to-face interactions. The research results mean that each member should be prepared to perform tasks to the highest diligence and accuracy as an opportunity for corrections is low.

6.6.1.4 Ability to Succeed In The Face Of Conflict and Opposition

What this research finding means is that although it is acknowledged that conflict is a special challenge within virtual teams, it is important that virtual team members should have the ability to succeed in the face of conflict and opposition. Most of the tasks within the engineering project environment are interdependent and each member should be able to overcome opposition and conflict as and when it occurs.

6.6.2 Least Ranked Factors – Research Question 4

Four of the five least ranked factors (see Table 14), fall within the human resources category and this is associated with softer types of skills. The four lowest skills are summarised as follows:

- Caring and support for others
- Good listener
- Interpersonal skills - Developing and maintaining positive relationships with others
- Concern for people

As virtual teams are characterised by minimal face-to-face interaction (Malhotra et al., 2007), these research findings align with the literature. In traditional teams, familiarity with one another is developed both informally and through task-related activities. Consequently, team members are able to observe first-hand the time and effort expended by members, but when team members are dispersed, it is more difficult to build relationships (Greenberg et al., 2007).

CHAPTER 7: RECOMMENDATION AND CONCLUSION

The purpose of this chapter is to consolidate the outcomes of the study in line with the objectives defined in Chapter 1. Additionally, it serves as an opportunity to provide recommendations for implementation and to suggest ideas for future research.

7.1 BACKGROUND OF RESEARCH

This study investigates the factors required by virtual teams within engineering projects. As far as it could be ascertained, this is the only study in South Africa that specifically focuses on these factors from the employees' point of view. Some of the previous studies focus was on leading virtual teams, with attention diverted towards team leaders. Other researchers' focus was subject-specific within virtual teams, such as trust and communication.

The literature reviewed provided the definition of virtual teams, its theory, the needs for virtual teams, as well as its associated advantages and disadvantages. Virtual teams are brought together by means of technology with minimal face-to-face interaction (Malhotra et al., 2007). This necessitates the shift in factors needed in teams; which are not necessarily the same as those in traditional teams.

The current literature stated that trust is considered essential for effective team performance and is often believed to require face-to-face interaction (Clark et al., 2010). Furthermore, Greenberg et al. (2007) asserted the importance of sustaining trust, because of two interrelated factors: diverse locations and technology-enabled communication. Location and communication make trust very difficult to develop and sustain it. It is important for the virtual teams to take

note of specific factors that are required in order to ensure that trust is permeated through all team development stages.

The other important point highlighted was the necessity of managing conflict within the teams. This problem is exacerbated by locations and technology-enabled communication. Task characteristics in relation to conflict and its outcomes towards virtual team performance have not yet been explored in research, although there is evidence regarding its effect on traditional teams (Kankanhalli et al., 2007).

The literature acknowledged that ensuring optimal knowledge depends entirely on the team's ability and, therefore, it is important to understand skills needed by team members in ensuring optimal knowledge transfer (Huang, 2009).

The quantitative study was conducted in order to objectively evaluate the data. The sample used was 75, with 64 of the respondents replying to the electronically sent questionnaires. The data was analysed using descriptive statistics and Kruskal-Wallis tests, with the latter aimed at assessing whether virtual work depends on the country base of the respondents, the country base of their team leaders and the time spent in the virtual team environment. The descriptive statistics provided weighted ranking of the factors of all the four research questions, together with demographics. These included the split of the different countries of the respondents and time within the virtual team environment. The reliability that was achieved was between 0.661 and 0.731 for the four research questions.

7.2 RESEARCH FINDINGS

The research findings have highlighted some key findings in relation to factors required by virtual teams within engineering projects. Brief overview of the findings is as follows:

7.2.1 Trust in Virtual Teams

This study has concluded that establishing interim deadlines and celebrating achievements is the most important factor required in order to to sustain trust within all virtual team development stages. The literature found that dispositional trust, which refers to the tendency to be more trusting, is the form of trust required at the planning stage. It is crucial to ensure that trust is entrenched within teams, particularly at the initial stages. Research findings have found that in order to ensure that trust is sustained, it is important to break down milestones and celebrate achievements, which help in ensuring seamless trust development.

As some projects may take up to five (5) and ten (10) years to come to conclusion, celebrations are only held once this period has elapsed. The findings indicate that rather than waiting for so long and, bearing in mind the minimal face-to-face interaction, breaking the project into milestones helps to expedite trust development. Some people develop trust when they see the results of others, and waiting for too long may result in stagnant trust development.

7.2.2 Conflict in Virtual Teams

As stated in the literature, virtual teams are characterised by minimal face-to-face interactions (Malhotra et al., 2007) and the research findings reveal that conflict about delegation of tasks is the most important factor contributing towards conflict in virtual teams.

Most of the virtual team members in line with the population for this study are knowledge workers who normally require challenging tasks. Whenever there is a clash in duties, which is normally unresolved, conflict perpetuates. It is normal for conflict to occur in any team, particularly due to potential clashes of business and national cultures (Kankanhalli et al., 2007), but what is of critical importance is the implementation of conflict resolution processes. These are difficult to attain during virtual settings. The perpetuation of conflict, together with the inherent characteristics of knowledge workers, means that the delegation of tasks should always aim to address the intellectual needs of all team members. This is a difficult balance to achieve.

7.2.3 Task-Related Factors in Virtual Teams

Table 10 has presented the ranked factors which showed that the most important task-related factor is feedback of how well each member is doing, which should emanate from how well the entire team is doing. Minimal face-to-face communication emphasises the importance of each member's output within the projects. As stated in Chapter Three, the research question was to

establish task-related factors considered important in order to ensure better virtual team performance.

In order to ensure better conflict management, when team members view team performance as collective, rather than related to individual superiority, the negative impact of conflict is subsided, this in turn helps to improve the performance of the virtual team. The research findings have answered the gap in literature, which revealed that task characteristics in relation to conflict and its outcomes towards virtual team performance have not yet been explored in research (Kankanhalli et al., 2007).

7.2.4 Specific Skills within Virtual Teams

The research question sought to reveal the right skills required by virtual team members in order to achieve optimal knowledge transfer. The inherent nature of virtual teams makes optimal knowledge transfer difficult to attain. The research findings were aligned with the theory that virtual teams must develop mechanisms for sharing knowledge, experiences, and insights critical for accomplishing their missions (Rosen et al., 2007).

As indicated on Table 14, the ability to make good decisions was the highest ranked factor. This is very important in the unfavourable circumstance characterised by minimal face-to-face contact, and the findings are in accord with the previous research questions. In order to minimise conflict, it is important to ensure that better decisions are made.

7.3 RECOMMENDATIONS TO MANAGERS OF VIRTUAL TEAMS

The success of every manager is highly dependent on the team, and failure of any team by implication means that the managers have failed in accomplishing their duties. Every organisation faces its own peculiar challenges and it is of critical importance to identify factors important for success in any setup.

Each working environment and team member should be clearly understood by all concerned, particularly on aspects such as culture, which may have significant impact on performance. If there is a lack of understanding then managers should take the lead in in narrowing this gap. A paradigm change is also needed as practices within traditional teams may not be necessary in virtual teams. Similarly, it is also important to leverage traditional team practices, which may still be applicable in virtual settings.

Managers should take into consideration both internal and external factors when managing virtual teams. In terms of the research findings, managers should keep in mind the most and least ranked factors in order to be able to prioritise objectively. Continuous review of management approach and styles is very important and needs to be aligned with all the trends, which may also change as other factors, such as technology change. Similarly, it is also important for each team member to clearly understand the critical success factors as this will also help to ensure a cohesive approach in attaining the project goals.

7.4 FURTHER RESEARCH

This study has focused on factors required by virtual teams in engineering projects. To further understand other important aspects for virtual team performance, further research should be conducted, encompassing the following:

- What are specific personality profiles needed by virtual teams members in order to function optimally?
- What is the relationship between a specific personality profile and aspects such as trust, communication and conflict?
- Are there different factors needed by virtual team members within trust development stages?
- Develop a model for conflict resolution within virtual team development stages.
- The relationship between employee and manager's personality profile within virtual settings.
- Additional research should be conducted to understand the paradigm shift model needed by managers in order to adjust within the virtual settings.
- Further research should be conducted to understand the HR recruitment practices needed in recruiting virtual teams.
- Further research should be conducted to establish the extent to which interim deadlines should be celebrated within the project environment in ensuring that trust is sustained at all team development stages.

- Further research should be conducted to understand causal effects of celebrating interim milestones within all team developments stages.
- What are the underlying factors contributing towards different views from virtual team members of different origins with regard to critical success factors required by virtual teams?

7.5 RECOMMENDATIONS AND CONCLUSION

In order to compete, companies need to acknowledge globalisation and the emergence of technology, which has led to the establishment of virtual teams. Some previous research has focused on virtual leaders, while the research presented in the current study concentrated specifically on virtual team members. The current study is able to add to the body of knowledge regarding factors needed within the engineering projects environment. Some of these factors have been previously acknowledged; however, their relative importance has not been established.

This study concludes that in order to ensure better virtual team performance it is important for team members' success to be determined in relation to how well the entire team is doing. The other critical success factors were the ability of team members to make good decisions and establishment of interim deadlines linked with celebration of the milestones when achieved. Furthermore, this study concluded that conflict about delegation of tasks in the team has significant negative impact towards effective virtual teams.

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9. APPENDICES

APPENDIX 1: QUESTIONAIRE

Thank you for agreeing to take part in this research. Your participation is voluntary and you may withdraw from the survey at any time without any penalties. Please note that I will not using your name or the name of the company in the research report, so your input will remain highly confidential.

I am a student at University of Pretoria (Gordon Institute of Business Science), studying Master in Business Administration and currently conducting research titled “factors required by virtual team members in engineering projects”.

For the purpose of this study, virtual teams are defined as: “teams whose members are geographically distributed, requiring them to work together through electronic means with minimal face-to-face interaction” (Malhotra et al., 2007, p.60).

You are kindly requested to take your valued time in completing the attached questionnaires, which consists of five sections (A-E). Part A relates to general questions, while parts B to E consist of specific questions related to the research question

There are no right or wrong answers. Please answer freely and share your real feelings. Your individual responses will not be shared with your supervisor or manager and are not for business use.

Thank you

Emmanuel Matlala - MBA 2010/2011 Student/Researcher

PART A

1.In which country are you based?

☐ South Africa

☐ China

☐ India

☐ United Kingdom

2. In which country is your team leader based

State the name of the country ----------

3.How long have you worked in virtual team environment?

☐ Less than three months

☐ Between three months and one year

☐ Between one year and two years

☐ More than two years

PART B

Please rank your responses on the scale as depicted on the table below in terms of level of importance:

1 Indicates – Not all important

5 Indicates – Somewhat important

6 Indicates – Very important

7 Indicates – Critically important

No	To what extent are the following issues important in order to sustain trust in virtual teams?	1	2	3	4
1	Encourage participation of organising activities				
2	Acknowledge and commend suggestions of individuals members to the entire team				
3	Encourage social aspects of communication				
4	Selecting a team leader				
5	Change focus from individual to group				
6	Establish interim deadlines and celebrate when met				
7	Encourage appreciation of each members contribution				
8	Team building exercises				
9	Honesty in describing members' experience and abilites				
10	Telling the truth about the limits of the members' knowledge				
11	Being counted on to do what the team members say they will do				

PART C

Please rank your responses on the scale as depicted on the table below in terms of level of importance:

1 Indicates – Not all important

2 Indicates – Somewhat important

3 Indicates – Very important

4 Indicates – Critically important

Category	No	To what extent do the following factors contribute towards conflict in virtual teams	1	2	3	4
Task Conflict	1	The frequency at which there is conflicts about ideas in the team				
	2	The frequency at which people in the team disagree about opinions regarding work to be done				
	3	The extent of conflict about the work you do				
	4	The extent at which which there is differences of opininions regarding tasks				
Relational Conflict	5	The frequency at which there is friction among the team members				
	6	Personality conflicts evident in the team				
	7	Tensions among members of the team				
	8	Emotional conflict among members of the team				
Process Conflict	9	The frequency at which members of the team disagree about who should do what				
	10	The frequency at which members disagree about the way to complete a team task				
	11	Conflict about delegation of tasks in the team				

PART D

Please rank your responses on the scale as depicted on the table below in terms of level of importance:

1 Indicates – Not all important

2 Indicates – Somewhat important

3 Indicates – Very important

4 Indicates – Critically important

No	To what extent do the following task characteristics help to reduce conflict and improve virtual team performance?	1	2	3	4
1	The team rather than the manager decides who does what tasks within the team				
2	As a member of the team, I have a a real say in how the team carries out its work				
3	Most team members get a chance to learn the different tasks that the team performs				
4	The work performed by the team is important to the customers in my area				
5	The team concept allows all the work on a given product to be completed by the same set of people				
6	Other members of my team depend on me for information needed to perform their tasks				
7	My work goals come directly from the goals of my team				
8	Feedback about how well I am doing my job comes primarily from information about how well the entire team is doing				
9	The members of my team have a variety of different backgrounds and experiences				
10	The company provides adequate team skills tarining for my team (e.g., communication, organisation, interpersonal, etc)				
11	Members of the team have great confidence that the team can perform effectively				
12	Everyone on my team do their fair share of their work				
13	Members of my team are very willing to share information with other team members about work				

PART E

Please rank your responses on the scale as depicted on the table below in terms of level of importance:

1 Indicates – Not all important

2 Indicates – Somewhat important

3 Indicates – Very important

Category	No	To what extent do the following personal capabilities and skills considered important by virtual team members?	1	2	3	4
HR	1	Interpersonal skills - Developing and maintaining positive relationships with others				
	2	Good listener				
	3	Concern for people				
	4	Being a humanist - Having a strong interest or concern for other team members welfare, values and dignity				
	5	Caring and support for others				
	6	Ability to build strong alliances				
Networker	7	The extent of easiness in interacting with other people or team members				
	8	Ability to succeed in the face of conflict and opposition				
	9	Ability to build strong alliances				
Structural	10	Ability to make good decisions				
	11	Technical expert - Accomplishment of complex tasks of a technical nature				
	12	Attention to detail when performing tasks				
	13	the ability to visualize, articulate, and solve complex problems and concepts, and make decisions that make sense				

APPENDIX 2: KOLMOGOROV-SMIRNOV TEST

One-Sample Kolmogorov-Smirnov Test – Research Question 1

	N	Normal Parameters (a, b)		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
Encourage participation of organising activities	64	3.25	.667	.271	.271	-.245	2.169	.000
Acknowledge and commend suggestions of individuals members to the team	64	2.30	1.079	.227	.213	-.227	1.816	.003
Encourage social aspects of communication	64	2.27	1.073	.193	.193	-.175	1.548	.017
Selecting a team leader	64	3.44	.588	.315	.287	-.315	2.521	.000
Change focus from individual to group	64	3.31	2.648	.382	.382	-.279	3.056	.000
Establish interim deadlines and celebrate when met	64	3.63	.655	.404	.283	-.404	3.233	.000
Encourage appreciation of each members contribution	64	2.64	.998	.250	.156	-.250	2.000	.001
Team building exercise	64	3.31	.710	.271	.233	-.271	2.169	.000
Honesty in describing members' experience and abilities	64	3.38	.917	.346	.248	-.346	2.768	.000
Telling the truth about the limits of the members' knowledge	64	2.75	.959	.275	.178	-.275	2.197	.000
Being counted on to do what the team mebers say they will do	64	3.25	.959	.298	.217	-.298	2.387	.000

a Test distribution is Normal.

b Calculated from data.

One-Sample Kolmogorov-Smirnov Test - Research Question 2

	N	Normal Parameters (a, b)		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
The frequency at which there is conflicts about ideas in the team	64	2.91	.811	.296	.235	-.296	2.368	.000
The frequency at which people in the team disagree about opinions regarding work to be done	64	2.73	.913	.224	.180	-.224	1.791	.003
The extent of conflict about the work you do	64	2.45	.665	.279	.268	-.279	2.232	.000
The extent at which there is differences of opinions regarding tasks	63	2.59	.710	.370	.249	-.370	2.938	.000
The frequency at which there is friction among the team members	64	2.80	1.129	.228	.147	-.228	1.821	.003
Personality conflicts evident in the team	64	2.89	.911	.211	.211	-.201	1.688	.007
Tensions among members of the team	64	2.66	.996	.291	.177	-.291	2.331	.000
Emotional conflict among members of the team	64	2.86	.906	.234	.173	-.234	1.868	.002
The frequency at which members of the team disagree about who should do what	64	2.59	.921	.280	.189	-.280	2.238	.000
The frequency at which members disagree about the way to complete a team task	64	2.50	1.084	.225	.167	-.225	1.797	.003
Conflict about delegation of tasks in the team	64	3.30	.790	.266	.193	-.266	2.130	.000

a Test distribution is Normal.

b Calculated from data.

One-Sample Kolmogorov-Smirnov Test - Research Question 3

	N	Normal Parameters (a,b)		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
The team rather than the manager decides who does what tasks within the team	64	3.33	.856	.284	.216	-.284	2.271	.000
As a member of the team, I have a real say in how the team carries out its work	64	3.13	.678	.318	.307	-.318	2.540	.000
Most team members get a chance to learn the different tasks that the team performs	64	2.89	.715	.311	.267	-.311	2.486	.000
The work performed by the team is important to the customers in my area	64	3.30	.810	.292	.193	-.292	2.333	.000
The team concept allows all the work on a given product to be completed by the same set of people	64	3.11	.594	.339	.339	-.302	2.709	.000
Other members of my team depend on me for information needed to perform their tasks	64	2.73	.782	.289	.226	-.289	2.314	.000
My work goals come directly from the goals of my team	64	2.94	.814	.296	.235	-.296	2.370	.000
Feedback about how well I am doingmy job primarily comes from information about how well the entire team is doing	64	3.67	.506	.429	.258	-.429	3.434	.000
The members of my team have a variety of different backgrounds and experiences	64	3.20	.647	.295	.295	-.252	2.361	.000
The company provides adequate team skills training for my team (e.g. communication, organisation, interpersonal, etc)	64	3.13	.630	.344	.344	-.343	2.754	.000
Members of the team have great confidence that the team can perform effectively	64	3.30	.706	.262	.241	-.262	2.099	.000

One-Sample Kolmogorov-Smirnov Test - Research Question 3

	N	Normal Parameters (a,b)		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
Everyone on my team do their fair share of their work	64	2.92	.674	.343	.298	-.343	2.744	.000
Members of my team are very willing to share information with other team members about work	64	3.27	.782	.258	.211	-.258	2.061	.000

a Test distribution is Normal.

b Calculated from data.

One-Sample Kolmogorov-Smirnov Test - Research Question 4

	N	Normal Parameters (a,b)		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
Interpersonal skills - Developing and maintaining positive relationships with others	64	2.67	.892	.284	.200	-.284	2.273	.000
Good listener	64	2.63	.951	.231	.166	-.231	1.851	.002
Concern for people	64	2.67	.668	.280	.280	-.251	2.242	.000
Being a humanist - Having a strong interest or concern for other team members welfare, values and dignity	64	2.72	.766	.331	.247	-.331	2.646	.000
Caring and support for others	64	2.58	.887	.214	.211	-.214	1.712	.006
Ability to build strong alliances	64	2.89	.857	.210	.210	-.191	1.681	.007
The extent of easiness in interacting with other people or team members	64	2.73	.840	.327	.235	-.327	2.617	.000
Ability to succeed in the face of conflict and opposition	64	2.91	.771	.236	.217	-.236	1.887	.002
Ability to build strong alliances	64	2.67	.778	.273	.212	-.273	2.183	.000
Ability to make good decisions	64	3.48	.713	.343	.235	-.343	2.748	.000
Technical expert - Accomplishment of complex tasks of a technical nature	64	3.11	.620	.320	.320	-.289	2.560	.000
Attention to detail when performing tasks	64	2.98	.968	.225	.147	-.225	1.802	.003
The ability to visualise, articulate and solve complex problems and concepts, and make decisions that make sense	64	3.30	.683	.262	.262	-.255	2.095	.000

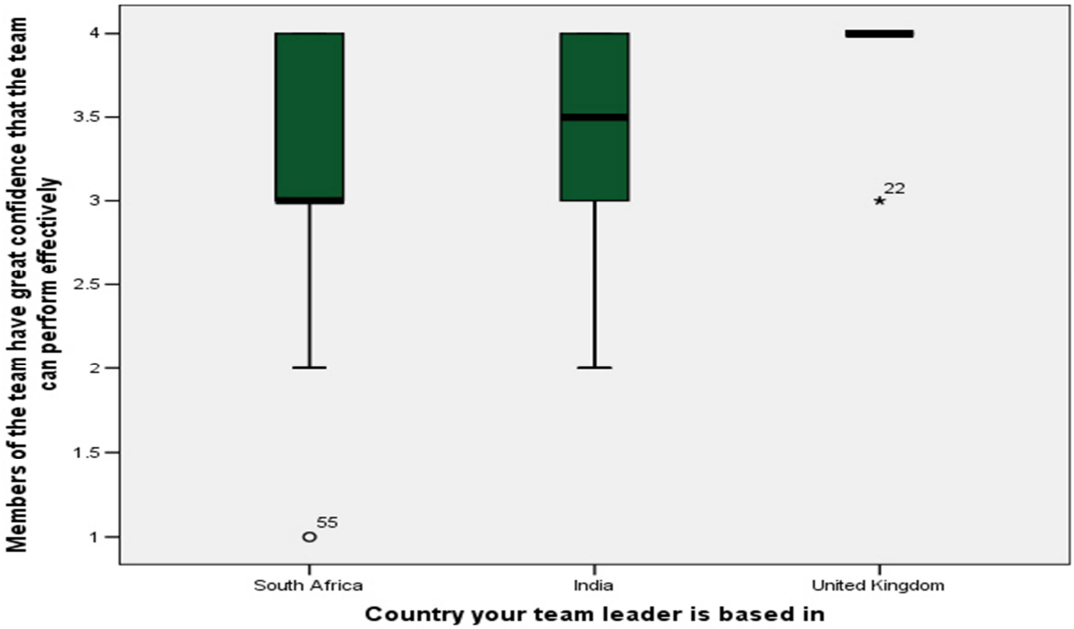
a Test distribution is Normal.

b Calculated from data.

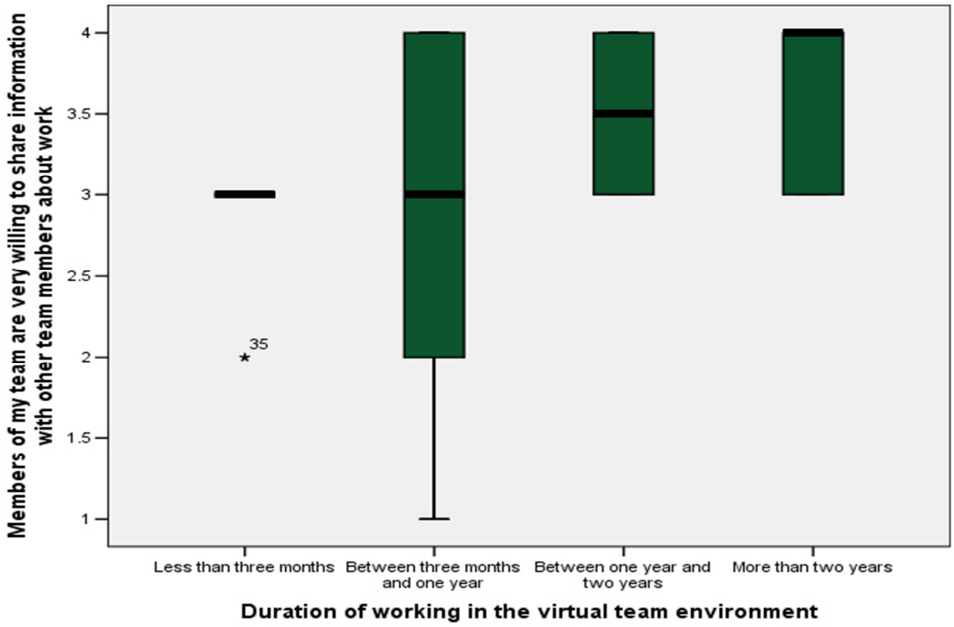
APPENDIX 3: BOX PLOTS

Figure 14: Additional Box Plots

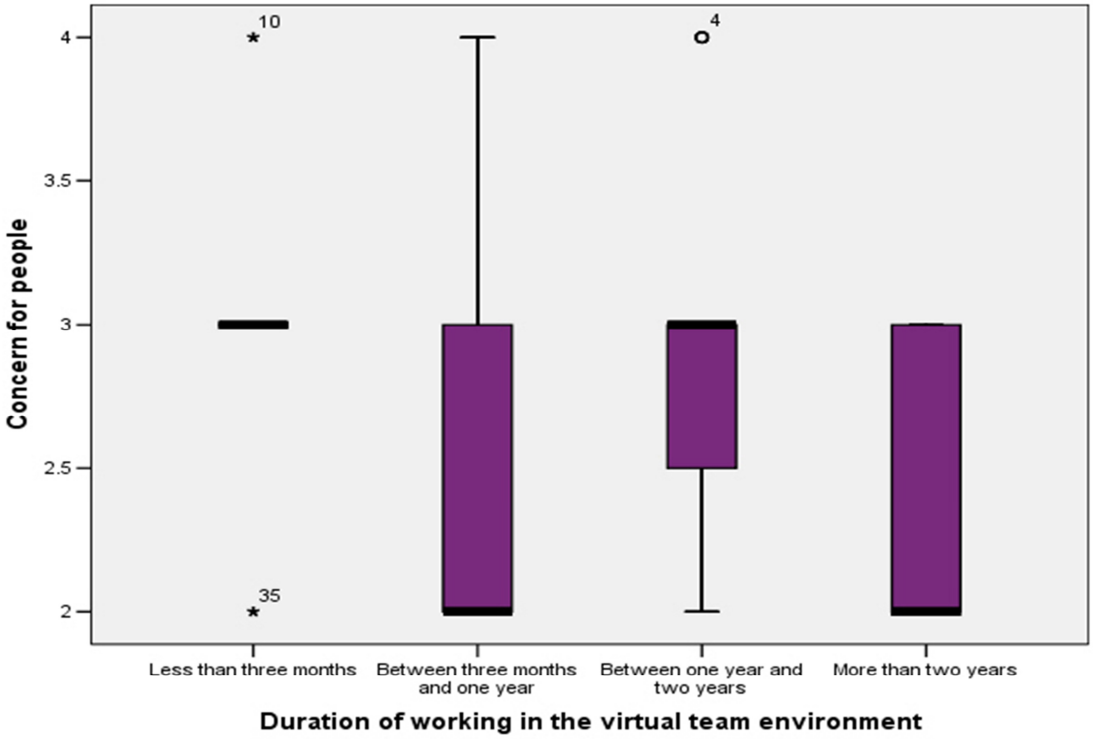
Box plot for "Members of the team have great confidence that the team can perform effectively"



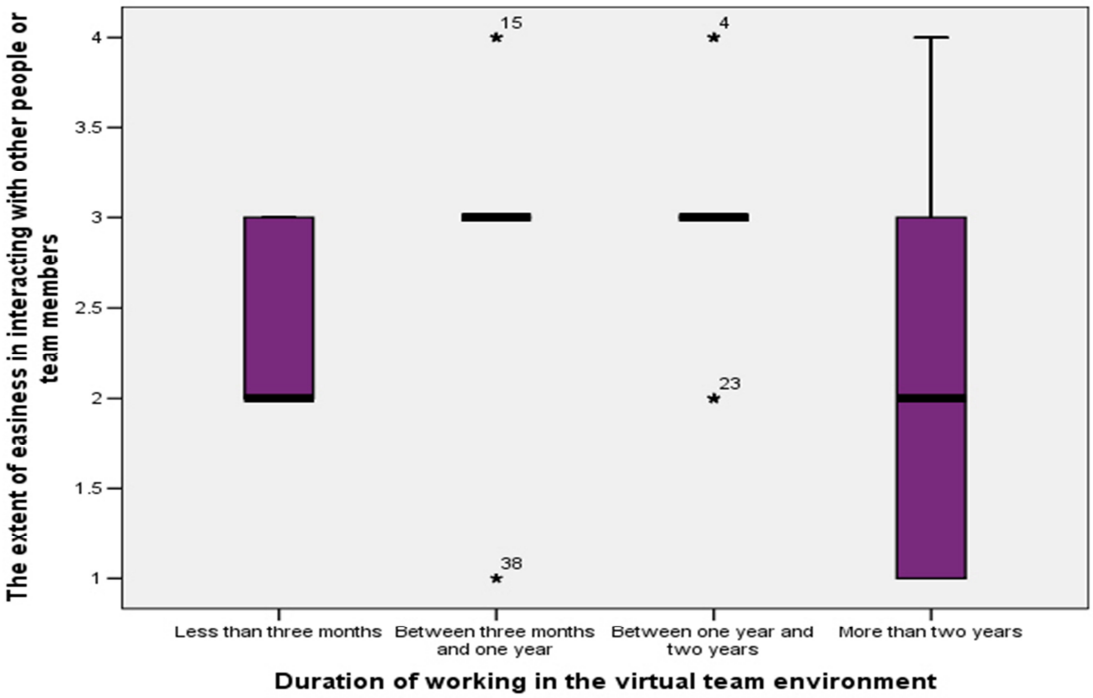
Box plot for "Members of my team are very willing to share information with other team members about work"



Box plot for **"Concern for people"**



Box plot for **"The extent of easiness in interacting with other people or team members"**



Box plot for "Being a humanist - Having a strong interest or concern for other team members welfare, values and dignity"