DEPARTMENT OF INFORMATION SYSTEMS

Full Thesis

For the Degree of Master of Science

The determination of whether a Unified Communication System can be effective in supporting informal communication and collaboration in virtual teams.

Submitted by – Kyle Hill 607H4347

Date of Submission – 05 October 2019

Supervisor – Chris Upfold

Abstract

The overall objective of the research is to determine whether a Unified Communication System intervention can be effective in supporting informal communication and collaboration in virtual teams. In so doing, this research is aimed at developing a current framework of critical success factors for facilitating informal collaboration and communication. As teams have evolved to the point where there is no longer a need for team members to be co-located, with a greater importance now being placed on how they collaborate, this framework will also highlight how it can support virtual teams due to the huge potential advantage they can provide to the organisation. A virtual communication and collaboration system will be selected based on the outputs of the current framework and interactions which occur through the system will be observed to provide quantitative and qualitative results. In conclusion, the research will suggest recommendations for the successful implementation of informal communication and collaboration technologies within the organisation. The research will also indicate to a limited degree, the impact of the implementation of these technologies, and the outcome for the organisation, whether positive or negative.

Whilst conducting the research, it became apparent that while the UCS was capable of performing the processes and functions required, the individuals and teams engaging with the technology did not always make use of the full scope of the technology provided. Regardless, a UCS was observed to provide direct benefits to an organisation in increasing communication and collaboration in the organisation. These increases can be observed in both the physical and virtual sense. However, the converse is true for generating social capital which lead to the observation that there are a smaller number of interactions happening in the smaller teams, but these are of higher value when compared to the larger teams of this study. It is also clear that the larger a team becomes, the more the trend is to focus on adopting new technologies to make their roles more efficient. This adoption is not however translated into outputs such as social capital but is translated into stronger networks and the formation of new networks. It is also clear that most negative factors around the UCS are related to the respondent's hardware rather than the solution itself. Cost reductions because of virtuality will also be observed and using the Developed Framework as a blue print, an organisation should be able to observe direct benefits for an organisation by being able to confirm the thesis of this research in that having a UCS intervention is effective in supporting informal communication and collaboration in virtual teams.

Acknowledgements

This research has been a massive undertaking and several people deserve thanks for their support and encouragement during the process.

A huge thanks to my supervisor, Chris Upfold, who has been a continual source of encouragement, new ideas, support and reviews. Without your guidance, I have no doubt that this task would have been beyond me.

To my family, many thanks must be made for the numerous hours spent brainstorming, problem solving and providing feedback, without which I would have lost motivation a long time ago. Dad, your in-depth analysis and comment on my work is always appreciated, as too is your late-night proof reading of my works.

To the members of the Rhodes University IS department, many thanks must be made for the opportunities and support I have received throughout, and your assistance and understanding in various matters will never go unappreciated or forgotten.

To the respondents of the surveys. Your time and honest insight have proved invaluable during this research.

Finally, to Lisa who has been the hidden support structure thought this whole process. There is no way to put into words what your support, encouragement and help has meant to me and this thesis is what it is today because of you.

Table of Contents

List of Figures

Figure 2.1: Model of Communication

Figure 6.2: Capital Distribution in the Organisation

Figure 6.3: Continuum of Norms

Figure 7.4: IDEF0 Basic Model

Figure 7.5: IDEF0 Applied Model

Figure 8.6: Skype for Business Contacts Screen

Figure 8.7: Instant Messaging Screen with File Transfer

Figure 8.8: Instant Messaging Screen with Integrated Video

Figure 8.9: Skype for Business Whiteboard Screen

Figure 8.10: Skype for Business Poll Option

Figure 8.11: Skype for Business Poll Results

Figure 8.12: Skype for Business Desktop Sharing Screen

Figure 8.13: File Transfer and Collaboration from within Microsoft Word

Figure 13.14: Part 1 Summary

List of Tables

Chapter 1 – Introduction

This chapter introduces the research problem and its associated sub-problems, defines the scope and general area of the research, and provides an overview of the structure of this research paper.

1.1 Introduction

Teams in the modern sense of the word have evolved way beyond the traditional bounds of make-up and location. No longer do team members sit co-located in an office working individually on separate ideas; they now collectively collaborate on vast projects even though they may be located at opposite ends of the globe (Pridmore and Phillips-Wren, 2011: 284-285; Bonvillian, 2019: 77).

Virtual collaboration is defined by Bjorn and Ngwenyama (2009: 228–230) and Rodriguez *et al.* (2018:409) where "teams or groups of geographically and/or organisationally distributed participants collaborate towards a shared goal". Teams use a combination of formal and information communication together with communication technologies to accomplish specific tasks (Rodriguez *et al.*, 2018). Virtual collaboration is key to the organisation's success in an ever increasingly competitive marketplace, and in promoting a firm's competitive advantage (Kraut, Fussell, Brennan, and Siegel, 1990: 83; Rapp, Ahearne, Mathieu and Rapp, 2010: 215).

Essential to this collaboration is the concept of informal communication (Mathieu and Rapp, 2010: 21). Many studies have observed how informal communication differs from formal communication, due to its lack of structure amongst other aspects (Isaacs, Whittaker, Frohlich and O'Conaill, 1997; Mcloughlin *et al.*, 2018). Authors such as Patel, Pettitt, and Wilson (2012) also note that informal communication may take up to, as much as, thirty percent of an individual's workday. From this, it would seem apparent that, informal communication and collaboration play a major role in the successful functioning of a team.

Informal communication and collaboration have been suggested as majors form of competitive advantage for an organisation (Carr and Zube, 2014: 33-34). However, in order to determine the real value of informal collaboration, some or other measure should be determined.

Consequently, this thesis will aim to design and test a framework describing the key success factors for successfully implementing an informal collaboration environment for virtual teams by means of a technology intervention. The focus of this research is on defining what

constitutes informal collaboration, identifying the attributes of informal communication, determining the value of informal collaboration and finally exploring how technology may be used to support informal collaboration in virtual teams.

1.2 General Area of Research

As suggested by Kraut *et al.* (1990: 5) and Dennis, Fuller and Valacich (2008: 580-582), "informal communication is defined as a spontaneous communicative event between random, out-of-role participants, who do not pre-arrange the topic of conversation". Most teams are engaged in several forms of informal communication whether they are aware of it or not (Mcloughlin *et al.*, 2018). Due to this fact, the number of informal communication interactions within an organisation is not generally known. As a result, a study will be conducted to attempt to gauge the number of informal communication interactions and determine what the key success factors in enabling informal communication are. These interactions will be observed in both virtual and physical teams in both the physical and virtual environments in which they occur. The role of informal communication is also linked to several other functions within the organisation, such as the maintenance, support, and social functions (Kraut *et al.,* 1990: 7; Hurford, 2008: 256). These roles will be incorporated into a framework to determine if informal communication has a perceived effect on the performance of the function and ultimately the organisation. The effect will be based on a comparison of the informal communication and collaboration in virtual teams against specific functions within the organisation.

The concept of virtual collaboration is loosely defined as, "two or more people who work on a mutual goal, interact from different locations, and communicate by means of information and communication technology" (Geister, Konradt, and Hertel, 2006: 459–460). Virtual collaboration is becoming more prominent as teams begin to lose geographical boundaries and operate seamlessly from wherever they are located in the world. This seamless interaction also facilitates a more productive work environment which usually leads to an organisational gain (Isaacs, *et al.,* 1997: 13-14; Lee and Mendelson, 2008: 14; Glikson and Erez, 2019).

While several technologies need to be used to accommodate these interactions, very few systems exist that can accurately address all of these needs (Rainie and Wellman, 2012; Rodriguez *et al.*, 2018). As such, a system will be implemented to accommodate as many of the discovered critical success factors, of informal virtual communication and collaboration, as possible. The purpose being for virtual teams to interact via the technology, and to try and

determine whether a unified communication technology can support informal communication and collaboration processes in a virtual team.

Based on the studies by Isaacs *et al.* (1997) and Mei et al. (2018), several key success factors have been identified in relation to a virtual system being able to support informal communication and collaboration. Unified Communication Systems (UCS) are believed to be the most appropriate means in which to facilitate these critical success factors and research will be conducted to determine whether UCSs are in fact able to meet these requirements. Riemer and Frobler (2007: 205–206) suggest that the idea behind unified communications is to relieve the user of the burden of having to juggle a large number of devices and channels in different contexts. Riemer and Frobler (2007: 209) further state that unified communications can be defined as the integration of communication technologies to improve worker's ability to interact. Results of the study should indicate whether this is a valid statement and if so, how technology aided and supported the informal communication and collaboration process.

1.3 Statement of the Problem

The overall aim of the research is to determine whether a UCS can be effective in supporting informal communication and collaboration in virtual teams.

1.4 Statement of the Sub-Problems

The first sub-problem will be to quantify what is meant by a virtual team and identify the communication challenges peculiar to virtual teams.

The second sub-problem will be to define what is meant by formal and informal collaboration and describe what the role that informal collaboration plays in the successful functioning of a team.

The third sub-problem will be to investigate what is meant by social capital and how this impacts on the successful functioning of a virtual team.

The fourth sub-problem will investigate a commercial technology-mediated communication system, to evaluate what attributes of such a system support informal communication and collaboration amongst virtual teams.

1.5 Thesis

Implementing a UCS will be effective in supporting informal communication and collaboration in virtual teams by promoting and encouraging the benefits derived by an organisation from the use of a technology-aided informal communication and collaboration solution.

1.6 Scope of the Research

The aim of the research is to investigate informal communication and collaboration, amongst virtual teams, in the organisational context. A current framework will be developed to identify the key success factors that enable and promote informal communication and collaboration. Furthermore, the research is aimed at evaluating the effects that virtual teams experience based on informal communication and collaboration that is technologically based. The research will also attempt to investigate the role that social capital plays in the informal communication and collaboration process. As part of the research, virtual teams will be equipped with a technology intervention believed to be suitable in supporting informal collaboration in an attempt to determine whether such an intervention can support effective informal communication and collaboration as discussed within the research.

The research is geared at informal communication and collaboration, and as such, the research will focus on certain situations which are outlined in the literature review. A case study will be used to evaluate the principles identified in the literature review after which the results will be discussed.

A limitation of this research is that the findings will result from one in-depth case study conducted within a South African organisation that have adapted a UCS in support of virtual communication and collaboration for virtual teams.

1.7 Importance of the Study

Critical in today's world is the concept of competitive advantage and how it can be maximised. Formerly unrecognised functions, such as informal collaboration, are now at the forefront of most organisation's action plans according to Powell, Piccoli and Ives (2004: 7-8) and Harris (2018).

Time has become an important commodity in modern business and as a result, the digital world now relies on virtual teams more than ever (Harris, 2018). Teams have evolved to the point where there is no longer a need for team members to be co-located, with a greater importance

now being placed on the skills of individuals, rather than their location (Pridmore and Phillips-Wren, 2011: 284-285).

The research will thus be aimed at addressing whether a UCS can support informal communication and collaboration processes in a virtual team. This will be achieved through constructing a current framework from the revised literature and be based on the concepts of virtual communication and collaboration in virtual teams. Once constructed, a UCS will be best selected for implementation against the framework. A case study will then be undertaken to evaluate the technology solution against this research's current framework.

Through the case study, the virtual and physical environments, in which the interactions will occur, will be observed to provide qualitative results to illustrate the informal interactions based against the developed framework.

The results will then be tabulated and evaluated to identify the shortcomings of the UCS and the impact that the informal communication and collaboration had on the target organisation and its virtual teams as defined by the case study.

In conclusion, the research will suggest the benefits and shortcomings of a UCS intervention in facilitating a set of outcomes as defined in a current framework developed from a literature review in support of informal communication, collaboration in virtual teams within an organisation. By means of an in-depth case study, this research will explore the impact of the implementation of these technologies, and the outcome for the organisation, whether positive or negative.

The impact of UCS on employee engagement has been left for future works and would be a good starting point for further research in the informal communication and collaboration field.

1.8 Research Methodology

Research Paradigm: The research was conducted using a post-positivist research paradigm (Clark, 1998: 1245). The post-positivist paradigm is most often associated with quantitative data gathering and analysis but does not exclude qualitative observations (Clark, 1998: 1245). This project includes both qualitative and quantitative data collection and analysis. This hybrid approach encompasses both data collection methods, facilitated through questionnaires and surveys, but not excluding the use of qualitative strategies. Thus, the paradigm is a necessary requirement when building and evaluating a case study that entails the use of measurements by people in a business context.

In addition to this, a combination of publications and electronic resources were used in an exploratory, mixed method research design. This design gathered evidence from a literature review before creating a framework on which questionnaires and specific questions could be based. The framework also facilitated the content of the semi-structured interviews. Both the questionnaires and interviews were then used as an instrument for data collection.

Results dataset: Qualitative and quantitative data was gathered through observations and responses from members of the sample population. Feedback was attained from participants with the aim of providing a comparable baseline between various pre-determined situations. The feedback was facilitated through several questionnaires including qualitative and quantitative elements.

Sampling: The target population was professional, computer-literate individuals working in South Africa who have access to the necessary base infrastructure to effectively utilise virtual communication and collaboration tools and techniques. By making use of a cluster sampling method as suggested by Hunt and Tyrrell (2004), companies in the Financial Services industry were considered as sample sites. The considerations included the availability of the predetermined UCS, and the presence of virtual as well as co-located teams. Of these companies, one was selected as the sample. The company had an available site for the purposes of this research work. The sample size of the research included all the members of at least four virtual teams. Thus, the researcher was be able to compare the results obtained from each sample population to evaluate the effectiveness of the informal communication in the virtual environment.

Data Gathering: A sample organisation was selected in which to conduct this research. A web link to questionnaires was distributed via email to each of the identified virtual teams and their members after their participation was requested. These questionnaires were then distributed to the teams and team members who agreed to participate in the research. The questionnaires were also used to construct relevant use cases as determined by the literature review and developed framework.

Once the allocated time limits had expired for the questionnaire's completion, post analysis of the results was undertaken, and semi-structured interviews were conducted with teams to evaluate pre-determined use cases. The semi-structured interviews were subsequently used to establish context for outlying responses, and to better understand the qualitative dataset gathered from the semi-structured interviews.

Data Analysis: The raw data was then graphed based on the Likert scale values implemented for quantitative elements of the surveys. The graphed data indicated any outlying responses which resulted in interviews with the corresponding team(s), in a semi-structured format, to engage in some further analysis based on the given answers. The semi-structured interviews and the responses were then included in the dataset as qualitative data elements and provided further understanding to the entire case study, through content analysis.

Ethical Issues: The research was required to adhere to the requirements of the Rhodes University Ethics Committee. The ethical guidelines, as provided by the Ethics Committee, were followed in the creation and administration of the survey instruments used in the course of this research work.

1.9 Definition of Terms and Abbreviations

Table 1.1: Definition of Terms and Abbreviations

Term:	Definition:
Informal communication	"A spontaneous communicative event between random, out of role participants, who do not prearrange the topic of conversation" (Kraut *et al.*, 1990: 5).
Virtual collaboration	"Two or more people who work on a mutual goal, interact from different locations, and communicate by means of information and communication technology" (Geister *et al.*, 2006: 459 – 460).
Co-presence	"The mechanisms by which possible conversation participants are brought together and are made aware of one another's availability" (Kraut *et al.*, 1990: 33).
Unified communications	"Integration of communication technologies to improve workers ability to interact" (Reimer and Frobler, 2007: 209).
Collaboration	"Collaboration is an overarching principle where participants use various means of communication to work collectively on a common outcome" (Serçe et al., 2011).
Human Communication	"Human communication comprises a system of symbols that collectively form a language" (Conway, 1995: 327).
Communication	"Communication in its simplest form is the flow of symbols, which represent information between communicants or groups of communicants" (Röcker, 2012: 1-15).
Organisational Communication	"Organisational communication is the flow of messages within a network of interdependent relationships" (Goldhaber, 1999: 36).
Effective Communications	"When communication is received correctly and results in the desired outcome, this is seen as effective communication" (Golnaz and Condia, 2012: 22).
Virtual Team	"A virtual team is defined as a group of individuals who work across time, space and organizational boundaries with links strengthened by interconnected webs of communication technology" (Lipnack, 2000).
Social Network	"Social networks are defined as a set of socially-relevant nodes connected by one or more relations" (Marin and Wellman, 2010: 2).
Virtual Communication	"The study of information, communication and action mediated by new technologies where contents, intentions or actions may be non-existent, distorted, replaced, or created – intentionally or unintentionally" (Lankhorst, 2005).
Shared Context	"Shared context is the background knowledge of past interactions that guides users in organising and shaping their interpretations of current events" (Lawson et al., 2009).

Social Capital	"Social capital is those tangible substances that count for most in the daily lives of people: namely goodwill, fellowship, sympathy and social intercourse amongst social units" (Ince and Gul, 2011, 108).
Knowledge Transfer	"Knowledge transfer is the process through which one network member is affected by the experience of another" (Argote and Ingram, 2000).
Corporate Tools	"Corporate tools can be defined as a collection of tools with common business application, aimed at modelling how the organisation works, and for facilitating the unique way in which every organisation works" (Mears, 2004).
Unified Communication System	"Unified Communication Systems are used to relieve the user of the burden of having to juggle a large number of devices and channels in different contexts" (Riemer and Frobler, 2007: 205–206).
UCS	Unified Communication Systems
IT	Information Technology
CSQ	Communication Satisfaction Questionnaire
ICA	International Communication Association
OCDAQ	Organisational Communication Development Audit Questionnaire
OSC	Organization Communication Scale
CMC	Computer-Mediated Communication
MRT	Media Richness Theory
MST	Media Synchronicity Theory
IM	Instant Messaging
CSCW	Computer Supported Collaborative Working
AHP	Analytic Hierarchy Process
IP	Internet Protocol
AD	Active Directory
SPSS	Statistical Product and Service Solution
HD	High Definition

1.10 Summary of Results

This research makes contribution in the following areas:

A UCS was confirmed to facilitate the following value generating factors:

- a UCS will be able to effectively mimic physical interactions
- a UCS will enable collaboration amongst virtual teams and their members
- networks will form in an organisation autonomously
- virtual teams will form due to the lack of available co-located resources
- informal collaboration will occur between team members with similar goals
- social capital will be generated through informal collaborations of virtual team members
- knowledge will be more readily available and distributed through informal collaboration of virtual team members
- organisations will experience greater network formation and informal collaboration by providing technology interventions
- organisations will experience gains through promoting informal collaboration in the organisation

While it became apparent that a UCS is capable of performing the required processes and functions, the individuals and teams engaging with the technology did not always make use of the full scope of the technology provided. So, the value and success of the UCS needed more context to ensure that the value generating outcomes were observed to be true continually and could be measured against a business outcome to provide a ROI measure. The current Developed Framework provided the starting point for proving this ROI measure and the following must also be observed to enable an organisation to quantify and observe actual business benefit from a UCS intervention by supporting informal communication and collaboration in virtual teams:

- Promoting a collaboration culture in the organisation
  - Create visibility of senior management using the same technologies and tools
- Enabling employees to collaborate
  - Ensuring that the appropriate technologies are available
  - Ensuring that the appropriate hardware and connections are available
  - Ensuring that teams are of the correct size, so they can generate valuable outputs both formally and informally
- Appointing collaboration leaders
  - Enabling leaders to prioritise requests
  - Enabling leaders to provide direction for their teams
  - Promote trust building activities with the systems and fellow users and team members
  - Promote network formation
- Formalise social capital creation processes
- Facilitate appropriate training and user education to effectively manage user behavioural change

Using the current Developed Framework as a blueprint and the above success enablers, an organisation should be able to effectively implement a UCS like Skype for Business and subsequently be able to prove a ROI. This ROI would typically involve being able to observe positively the thesis of this research, in that having a UCS intervention being effective in supporting informal communication and collaboration in virtual teams.

Chapter 2 – Communication

Chapter 2 will introduce the reader to basic communication theory and the role of organisational communication. This will provide context to the first sub problem of this research. Further, this chapter will quantify how communication is a core component of informal collaboration, and ultimately virtual team interactions.

2.1 Introduction

To fully understand informal collaboration, the core components of communication must first be detailed and understood. These components also provide a basis for informal communication (Puttman *et al.*, 1999: 126-128). It can be observed that virtual communication is built upon the fundamentals of communication in the same way that virtual informal communication is built upon the principles of informal communication (Bjorn and Ngwenyama, 2009: 191-192; Bonvillain, 2019). Tightly coupled with communication is the concept of collaboration. Collaboration is an overarching principle where participants use various means of communication to work collectively on a common outcome (Serçe *et al.,* 2011). This chapter will investigate both formal and informal communication to provide a relative context and the understanding necessary for this research.

2.2 Communication

Communication forms one of the core components of human interaction. Human communication comprises a system of symbols that collectively form a language (Conway, 1995: 327). Languages usually use patterns of sound or gesture to enable communication with others. Communication in its simplest form is the flow of symbols, which represent information between communicants or groups of communicants (Röcker, 2012: 1-15). There are a variety of languages in use today, both sound- and gesture-based. Examples of such languages can be seen in the form of body language, sign language, and Morse code (Ince and Gul, 2011: 114).

The concept of organisational communication is, according to Goldhaber (1999), marked by diversity. The many definitions of organisational communication reflect a wide range of approaches and perspectives. In analysing the content of these definitions, Goldhaber (1999:44) identified three common features: "Organisational communication (a) takes place within complex open systems (it is influenced by the environment and influences it as well); (b) entails all features of a message (i.e., flow, purpose, direction, and media); and (c) involves people, including their attitudes, feelings, relationships, and skills". Drawing on these features,

Goldhaber (1999: 36) proposes the following definition: Organisational communication is "the flow of messages within a network of interdependent relationships". From this definition, the following section will detail communication and the processes involved to provide this research with a basis on which the rest of the literature study can be conducted.

2.3 Communication Defined

Communication is defined by Cangelosi (2001: 100) as "the activity of conveying information through a communication medium, via a message encoded in a sending language, to a fellow communicant or group of communicants, which can be received and understood." Röcker (2012: 15) also states that "communication involves two participants who engage in the activity of exchanging a message through a communication channel that is understood by both parties and represents information rather than data". Both statements are definitive in the sense that there are a set of components and a process involved in communication. These components and process will be expanded upon below.

2.4 The Evolution of Communication

While different communication technologies have advanced rapidly, communication at its core has remained relatively constant. Communication was developed to relay information from one communicant to another (Cangelosi, 2001: 94-95).

Communication has always been about the message and the best way in which to send and receive it (Hurford, 2008: 252; Bonvillain, 2019). From about three thousand years ago, cave paintings were used to communicate between parties. Following this, pictograms were developed whereby an illustration was used to communicate the message (Johnson *et al.* 1994). Pictograms represented a major leap forward in communication as the complexity of the message greatly increased and the context of the message became more important (Bonvillain, 2019). Succeeding pictograms were ideograms. Ideograms represented data in graphical symbols, which contained a stored meaning and context in relation to the symbol. Ideograms are widely believed to have been the precursor to the writing systems developed nearly four thousand years ago (Hurford, 2008). Writing systems were able to combine both pictograms and ideograms to form a communication medium that could represent vast amounts of information with a relatively simple amount of complexity being related to the message (Cangelosi, 2001: 98).

Finally, about two thousand years ago, alphabets were developed (Bonvillain, 2019). Alphabets represent communication's greatest achievement to date, whereby they were able to provide a complex message. The message had both a semantic meaning and syntax. This ensured that the message was properly formed and could be properly understood (Johnson *et al.,* 1994; Hurford, 2008). Alphabets ensured that certain rules about communication became enforced and that communication could now be more widely spread throughout the world. While alphabets increased the amount of communication that was possible, they also increased the complexity of the message being sent and received.

Communication is now at the point where complex messages can be sent and received very easily but the semantics of the message can often be lost between communicants (Ince and Gul, 2011: 118). To enable a better understanding of the message, communicants are once again turning to symbols which can better represent the intent and suggested actions of the message and the whole communication process seems to be redeveloping itself (Johnson *et al.*, 1994).

2.5 The Process and Components of Communication

This research will refer to the Shannon and Weaver Model of Communication (1949) due to its simplicity, generality, and the ability to quantify the model. The model can be accurately used to model communication and display the components involved therein (Shannon and Weaver, 1949). The following diagram is the representation of the Shannon and Weaver Model of Communication:
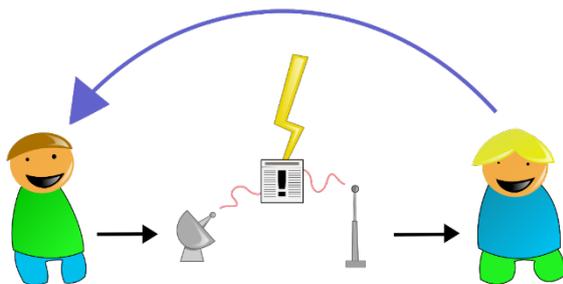
Figure 2.1: Model of Communication (Shannon and Weaver, 1949)

The above model is based on the following elements:

1. "An information source, which produces a message"
2. "A transmitter, which encodes the message into a language"
3. "A channel, to which signals are adapted for transmission"
4. "A receiver, which 'decodes' (reconstructs) the message from the signal"
5. "A destination, where the message arrives"

(Shannon and Weaver, 1949)

From the model, it is evident that any form of communication requires at least two participants. A communication event occurs when one participant wishes to communicate with another participant. A message is then encoded in the sender's language, before it is transmitted through a mutually acceptable communication channel. Following this, the message is then transmitted and received by the receiving participant. Once received, the message is then decoded by the receiver and the receiver can return the message into the information as the sender intended it (Shannon and Weaver, 1949). External factors that may influence this process are noise and feedback (Shannon and Weaver, 1949).

Noise can be described as "any interference or distortion that changes the initial message" Shannon and Weaver (1949: 32). Noise can be either in the physical form, or the semantic form. In the physical form, noise could be represented by something that physically muffles the message, while semantic noise could be in the form of differing vocabularies of the two communicants (Shannon and Weaver, 1949).

To minimise the effect of noise, feedback as an external factor is essential in the communication process (Shannon and Weaver, 1949). Feedback occurs when the receiver of the message provides recognition to the sender. Feedback will thus relay to the sender whether the message has been received and understood correctly. Without feedback, the sender would never know if the communication was successful (Shannon and Weaver, 1949). While these factors may influence communication and the process of communication, the concept of effective communication requires a much more detailed inspection which follows below.

2.6 Factors for Effective and Ineffective Communication

When communication is received correctly and results in the desired outcome, this is seen as effective communication (Golnaz and Condia, 2012: 22). Effective communication can be affected by aspects such as unintentional communication, distortion of the message or misunderstanding of the communication (Golnaz and Condia, 2012: 22). Thus, communication can be seen to be effective when it achieves the objectives set for it by the sender (Johnson *et al.,* 1994). These objectives could be in the form of; action generation, creation of understanding, and communication of data. Effective communication occurs most often when the channel that the message is sent and received in, experiences no noise interference (Conway, 1995: 327).

Every organisation faces several barriers to effective communication. These barriers prevent, in some way, the communication from achieving its desired outcome (Hurford, 2008). Barriers to successful communication often include the complexity in which the message is sent and received. This in turn can lead to message overload where too many messages are received in a small space of time and miscommunication can occur (Conway, 1995). Examples of barriers to effective communication are detailed below:

2.6.1 Physical Barriers

The most obvious barrier can be seen to be that of physical barriers. These are barriers created by nature and the natural environment (Hansen, 1999). An example specific to this research is the natural barrier created by staff who are located in different buildings or who are located at different sites. Physical barriers can also come in the form of outdated technology which prevents the communicants from effectively communicating (Golnaz and Condia, 2012).

2.6.2 System Design Barriers

Many organisations believe that their structures and systems are mostly flawless. Golnaz and Condia (2012) suggest that most organisations have problems and shortcomings in terms of the structures and processes that are employed in the organisation. The most common system design barrier occurs when staff do not receive the required training and are unable to effectively communicate this to anyone because of a poor organisational structure (Johnson *et al.,* 1994).

2.6.3 Attitude Barriers

Attitude barriers are focused around individuals and occasionally teams within an organisation (Hansen, 1999). These barriers can occur when there are personality conflicts between communicants, poor management of communicants, resistance to change by communicants, poor attitude towards communication through lack of motivation, amongst others.

2.6.4 Ambiguity Barriers

Ambiguities coupled with the complexity of a message are the two biggest factors that affect communication. Ambiguity barriers may appear when communicants send messages that could be interpreted in several different ways (Golnaz and Condia, 2012). Each interpretation can result in different actions and as a result, confusion and misunderstanding can occur. Complexity barriers occur in much the same way but are usually as a result of one of the communicants using difficult or context-specific words that lead to people misinterpreting the communication or being confused as to the actions required (Conway, 1995).

2.6.5 Presentation of Information

Presentation of information barriers are very closely related to the environment in which the communication takes place (Johnson *et al.* 1994). These barriers can occur when one of the communicants does not consider the other communicants and their context before delivering their message. Based on the presentation of information barriers, several other barriers can then easily occur (Lawson *et al.,* 2009).

2.6.6 Feedback

While most of the barriers mentioned above do not promote effective communication readily, feedback is the key aspect in effective communication (Shannon and Weaver, 1949). When communicants respond to a received message, this response is labelled as feedback. Feedback can be transmitted in a number of ways, but the most important part of feedback is that it enables the sender of the communication to gauge the effectiveness of their message (Shannon and Weaver, 1949).

Thus, based on the response received by the sender of the communication, they are able to judge if a barrier(s) to communication has affected the message or if the communication was understood and further communication and action can take place (Lawson *et al.,* 2009). Feedback is essential to keep the communicant's channel of communication open and it also helps to promote further communication based on the mutual understanding that develops between the communicants (Shannon and Weaver, 1949). While there seem to be many barriers to effective communication, researchers such as Lawson *et al.* (2009) suggest that effective communication has a huge part to play in successful organisations. The following section will explore body language and its effect on communication.

2.7 Nonverbal Communication

Dael, Mortillaro, and Scherer (2012: 99-101) argue that communicants can glean accurate information about target communicants' states, traits, and personal characteristics from very short excerpts—thin slices—of their behaviour or appearance. These thin slices from part of the concept of body language and subsequently the larger theme of non-verbal communication which can be defined as follows: "Nonverbal communication between parties is communication through the sending and receiving of wordless cues. This communication includes the use of visual cues such as body language, distance and physical environments/appearance, of voice and of touch" (Goldin-Meadow and Alibali, 2013: 259-260). While it has been noted that communication is the process of sending and receiving

messages, non-verbal behaviour includes all communicative acts except speech. "Non-verbal behaviour is facilitated through several gestures which illustrate the relationship between verbal and non-verbal behaviour" (Goldin-Meadow and Alibali, 2013:261).

"Non-verbal communications are typically sent with intent and used with regularity among members of a social community that are generally interpreted as intentional" (Holler, Schubotz, Kelly, Hagoort, Schuetze, and Ozyburek 2014:1512). "Communication depends on the message, the situation or the environment, and the counterpart. The environment may contribute in understanding by creating a mutual harmonic atmosphere or may disturb the relationship by creating a noise-filled atmosphere" (Bonvillain, 2019: 56). Non-verbal events are thus most important in the structuring and occurrence of communication and the regulation of the message and response interactions. Non-verbal signs help regulate the system of communication by providing a cueing hierarchy and priority among communicants (Holler *et al.,*2014). Non-verbal signs also help to signal the flow of interaction and provide meta-communication context and feedback.

An important concept of communication is that of signals. "A signal is a special original element that can be perceived by sight, sound, touch, and smell. The fifth sense, taste, is not of much practical use in communication" (Holler, Turner, and Varcianna, 2013:694). "Use of signals depends mainly on knowledge and empathy. Empathy is related to the skills of observation and listening. Three elements of a signal are the signal itself, what the signal refers to, and the signal interpreter" (Bonvillain, 2019:57). "The signal is the crucial link between sender and receiver. Signals thus include the use of body language, sometimes without the communicants being aware of it" (Dael, Mortillaro, and Scherer, 2012:101). Signals help to further define the condition and constraints present within the communication. "Time, place, and arrangement may provide cues to the participants as to who is in the system, the possible interaction pattern, and the appropriate and non-appropriate communication content" (Bonvillain, 2019:58-58). "Signals can sometimes communicate content more efficiently than linguistic messages but are usually in complementary redundancy to the verbal flow" (Holler, Turner, and Varcianna, 2013:1515).

"Non-verbal communication, body language and paralinguistic clues can account for more than sixty-five percent of human communication" (Meadors and Murray, 2014:210). "During interactions, it has also been estimated that communicants draw from sight (eighty-three

percent), hearing (eleven percent), smell (three percent), touch (two percent) and taste (one percent) to understand the message being sent" (Meadors and Murray, 2014:212).

"Every interaction is interpreted through an internal filter composed of history, past experiences, education, bias, context, culture, expectations and goals. These internal filters are also known as the context of the interactions" (Meadors, and Murray 2014:213-214). "Perception, which is primarily contextual, can also affect the message received. Interpretation and opinions are formed during reception of the message and can be influenced by delivery of the message and the communicants' context. The same interaction's appearance or communication can be, and often are, interpreted differently in varying circumstances" (Holler *et al.,* 2014:696). It is therefore important to understand the extent to which non-verbal communication occurs in communication and further, the extent to which communication plays a role in the organisation.

2.8 The Role Communication Plays in the Organisation

The effectiveness of communication in the organisation has often been likened to a building block for successful organisations (Golnaz and Condia, 2012). This link is implied because of the number and complexity of communications and communication channels that can be found in an organisation. Managers in an organisation have been estimated to spend as much as six hours per day engaged in communication activities (Hansen, 1999). Conway (1995) argues that this communication, if effective, can lead to some of the following benefits for the organisation:

- **Motivation**: effective communication can promote motivation by ensuring that communicants are sure about the actions that the messages suggest, know how to perform the required actions, and have open return communication channels to provide constructive feedback to further enhance the motivation.
- **Information source**: effective communication is used as a source of information about the organisation. This occurs because effective communication enables feedback to occur and reach management who can then direct the organisation to achieve specific outcomes for the betterment of the organisation as a whole.
- **Social aspects**: humans are a naturally social species and as a result, effective communication promotes socialisation, work-place bonding, and positive attitudes towards communication and the organisation.
- **Control**: effective communication can result in organisational management being able to exert a measure of control based on their communications and the actions they suggest. The organisation can also benefit from this control by having clearer communication channels defined and promoting a healthy environment where communication is encouraged, and feedback is constructive.

Conway (1995)

Communication plays a vital role in the organisation in the sense that it binds the organisation and its functions together. An effective communication system within an organisation promotes several aspects of the organisation and can be used as a good measure for gauging how the organisation is performing as a structure, based on the feedback received (Lawson *et al.,* 2009).

2.9 Measuring Organisational Communication

"Due to the varying definitions of communication, a variety of different organisational communication measurements have also been developed. The most widely used measures are grouped into two main categories" (Downs *et al.*, 1994:64). "These categories are process instruments (e.g., measuring issues of conflict management, team building, and communication competence) and comprehensive instruments (involving an overall approach to communication)" (Downs *et al.*, 1994:64). Validated instruments that have been implemented frequently in organisations include:

- The Communication Satisfaction Questionnaire (CSQ) (Downs and Hazen, 1977:66), "which emphasizes the relationship between communication and job satisfaction".
- The Communication Audit Survey (also known as the International Communication Association (ICA) audit survey), "identified as one of the most comprehensive attempts to measure all aspects of organisational communication" (Goldhaber and Krivonos, 1977:42).
- The Organisational Communication Development Audit Questionnaire (OCDAQ) (Wiio, 1975:12), "which determines the efficiency of the communication system for achieving an organization's goals".
- The Organization Communication Scale (OSC) (Roberts and O'Reilly, 1974:322), "which compares communication practices across organizations".

Downs *et al.* (1994) argue that two concepts need to be identified in the development of an organisational-communication measure. "Firstly, a key factor in measurement development is the identification of a background or starting point that can serve as a common reference point, allowing comparison with other approaches" (Downs *et al.*, 1994:66). "Specifying a background that can be used in any approach to organisational communication increases the possibility of comparing results and identifying the status of the communication within the organisation. Secondly, the concept concerns the problem of designing an instrument that will be used only once, with no further attempt to certify its consistency" (Downs *et al.*, 1994:66-67). "Thus, a key issue becomes the development of an instrument that is easy to use, requiring frequent validation" (Downs *et al.*, 1994:67).

2.10 Conclusion

Communication is now one of the most essential aspects of an organisation (Hurford, 2008). Communication occurs between most employees and in a variety of conditions (Cangelosi,

2001: 94-95). Communication has evolved significantly from simplistic cave painting forms to complex messages with inherent semantics (Conway, 1995). The core concept of communication has remained constant throughout the evolution (Cangelosi, 2001: 94-95). Communication is in the process of reverting back to its simplistic roots, enabling better understanding (Lawson *et al.,* 2009). Underpinning this evolution has been the expansion of communication channels and the accompanying complexity of the message (Lawson *et al.,* 2009). Communication can now be effective or just as easily, ineffective – owing to barriers that can impede the process (Golnaz and Condia, 2012). If an organisation is able to establish effective communication processes, they can greatly benefit from such activities. Lawson *et al.* (2009) state that effective communication not only benefits the organisation directly, but indirectly provides the organisation with the ability for informal communication activities to occur.

Chapter 3 will now follow with a deeper look into how teams have begun to form as a result of consistent communication. These teams have also evolved over time and make use of several forms of team type and communication type on a day-to-day basis.

Chapter 3 - Modern and Virtual Team Composition

Chapter 2 quantified communication and the role it plays in an organisation. From Chapter 2, it is clear that communication has a central function in the operation of teams. To complement this observation, Chapter 3 expands on how modern and virtual teams are formed and operate specifically in the informal context. Chapter 3 will also further quantify sub problem 1 through the identification of how teams fundamentally rely on communication and how team classification and proximity challenges become influencing factors on this communication.

3.1 Introduction

Since the industrial revolution, teams have been evolving and becoming increasingly important in the organisation (Lamont, 2010). While many organisations focus on process improvements, often the greatest gains can be observed from effective teams (Ahmed, 2007). Teams are now constantly being redefined so as to best serve the organisation. These redefinitions now focus on including the best possible members (Lamont, 2010). With the rapid advancement of technology, teams face another form of redefinition. Current definitions now principally include the fact that distance is no longer a factor in team make-up (Olaniran, 2008).

3.2 Defining a Modern Team

Current organisations who rely on teams rather than individuals, aim to achieve several benefits for doing so. "The organisations aim primarily to facilitate an integration of information" (Harris, 2018:1). "This integration of information can then result in more informed decisions and more coordinated effort occurring. The result of this has then been noticed to improve organisational performance" (Deeter-Schmeltz and Ramsey, 2003:410).

"Teams are viewed as information processors that process relevant and available information to perform a variety of cognitive tasks such as problem solving, judgment, inference, and decision-making" (Hinsz, Tindale, and Vollrath, 1997:45; Harris, 2018:1). According to these authors, "information processing at a group level involves information, ideas, and cognitive structures that are shared amongst team members". This group level processing also involves sharing of information, which affects both individual- and team-level outputs (Harris, 2018). Research on team sharing of information has shown that "teams that engage in more information sharing and integration reach better decisions" (van Ginkel and van Knippenberg, 2008:83).

Previously, traditional teams were very static in their make-up and followed a strict formal structure (Bochenek and Ragusa, 2004). This structure dictated specific positions which needed to be filled before the team could operate effectively (Noran *et al.*, 2014). Traditional teams were thus of a hierarchical nature.

Modern teams increasingly follow a flatter structure (Harris, 2018). These flatter structures are embracing the advances of technology and use it to their advantage (Noran *et al.*, 2014). This structure favours competency over hierarchy. These teams will typically be comprised of members, regardless of their location (Lea *et al.,* 1997). Functional requirements now dictate what needs to be done. Seldom do modern teams have specific roles – rather a dynamic team leader is responsible for allocating the diverse resources of the team, where necessary (Lamont, 2010). Typical organisations will comprise of teams of the following nature:

- Scheduled
- Cross functional (cross organisational boundaries)
- Peer (networks between people of the same profession)
- External (partners outside the organisation)
- Project

(Otubanjo *et al.,* 2010)

3.3 The Benefits Gained by the Use of Teams

The teams identified earlier are aimed at more accurately mapping the organisation's functions to available staff. The benefit of this is that employees become more efficient because they are practicing their native skill set (Choi *et al.,* 2008). Employees should also be more motivated as they are performing tasks which are of interest to them. Dynamic allocation of employees and their talents, results in members being able to be part of several teams where a member will exercise a similar field of expertise in all organisational functions while not over working themselves (Choi *et al.,* 2008).

3.4 Virtual Teams

A virtual team is defined as "a group of individuals who work across time, space and organisational boundaries with links strengthened by interconnected webs of communication technology" Lipnack, (2000: 674). "Over the last twenty years, globalisation and innovations in technology have taken the widespread organisational use of teams in a new direction, toward virtuality", according to Minton-Eversole (2012:1). Minton-Eversole (2012:1) also state that "sixty-six percent of multinational organisations use virtual teams and forty-six percent of all organisations use virtual teams".

Martins *et al.*, (2004: 815) states that "virtual teams are complex, adaptive, and require dynamic systems that exist in the larger context of people, tasks, technology, and setting. A unique feature of virtual teams is that they allow members to work together regardless of time, space, and place".

"Within the domain of virtual teams, technological advancements continue to change the way in which team members interact and enable those individuals who previously could not be connected to work together as a team" (Harris, 2018:1). Accordingly, virtual teams provide great promise to organisations.

3.5 Virtual Teams' Evolution:

Cross functional teams have a structured workflow by design (Riemer and Frößler, 2007). As a result, these teams are mainly focussed on document decisions and delivery, giving and receiving help, and taking or leaving messages. External teams are similarly of a formal nature. The teams focus on task-orientated communication while not being co-located (Sarker and Sahay, 2003; Foster, Abbey, Callow, Zu1, and Wilbon, 2015). External teams are thus involved in several meeting arrangements and focus on taking and leaving messages (Sarker and Sahay, 2003; Foster *et al*., 2015).

According to Lamont (2010), the future of teams lies in peer teams. These teams offer supportive communication and are focussed mainly on giving and getting help and reporting news and progress (Riemer and Frößler, 2007). It is believed that the future lies in these teams because the teams are observed to have longer periods of interaction (Sarker and Sahay, 2003; Foster *et al*., 2015). The longer interaction periods are due mainly to the teams not being co-located. The teams are also more socially directed and because of the ease of establishing them, organisations are favouring these types of teams (Sarker and Sahay, 2003; Foster *et al*., 2015).

The evolution of peer teams, based on globalisation, has resulted in virtual teams (Ubell, 2010). These virtual teams comprise members who are not co-located and interact mainly via technology (Harris, 2018). Expertise through an organisation can now be deployed anywhere in the organisation (Ubell, 2010). Virtual teams are informal in nature and are engaged in ad-hoc communication in preference to formal meetings. Technology enables these teams to interact immediately and in a worldwide fashion (Williams *et al.*, 2006). Decisions can thus be made by the most appropriate people in the organisation. Organisations now place a huge emphasis on the establishment of these virtual teams. The emphasis is a direct result of the

evolution of organisational teams and the further development of technology to support these teams (Harris, 2018).

3.6 Virtual Team Barriers

Currently, virtual teams face four main barriers:

- Structural
- Social
- Technical
- Legal factors

(Serçe *et al.,* 2011)

In summary of the work by (Serçe *et al.,* 2011), Table 3.1 illustrates the main components of each of the above barriers.

Table 3.2: Virtual Team Barriers

Barrier	Component
Structural (Serçe et al., 2011)	"Geographical Dispersion" "Different Time Zones" "Unbalanced Power" "Unbalanced Expertise" "Multi-disciplinary Setting" "Lack of Clear Leadership" "Lack of Incentive"
Social (Serçe et al., 2011)	"Weak Ties" "Lack of Interpersonal Awareness" "Multi-lingual Setting" "Emotional Behaviour" "Lack of Mutual Trust" "Diversity Setting" "Lack of Absorptive Capacity"
Technical (Serçe et al., 2011)	"Lack of Media Naturalness" "Lack of Common Description" "Multi-platform Setting" "Lack of Meaning" "Unbalanced Technological Usage" "Lack of Contextualised Mode"
Legal Factors (Serçe et al., 2011)	"Unbalanced Intellectual Property Rights approach" "Different Investment Regulations" "Different Contractual Settings" "Lack of Common Security Rules"

Knowing that most organisations now contain multiple dispersed teams within the organisation, it is vital to minimise the effects of these barriers and their sub components (Serçe *et al.,* 2011). Selective barriers and their subcomponents, relevant to this research, will now be discussed and detailed below. Due to the availability of IT technologies globally, work has become more globally organised, resulting in the promotion of geographically dispersed teams

(Sarker and Sahay, 2003; Foster *et al*., 2015). "Technology has thus compressed geographical distance and as such, time zones are no longer considered as significant factors affecting virtual collaboration" (Foster *et al*., 2015:269).

Based on a study by (Serçe *et al.,* 2011:494) the authors suggest that "the perception of distance becomes more subjective as long as users stay connected". The lack of mutual trust and effective leadership are the factors that lead most, to the creation of structural barriers. It has become apparent from the study that "virtual teams and networks demand more leadership, not less" (Serçe *et al.,* 2011: 492) in order to become efficient and effective.

The main cause for distance becoming a challenge is highlighted in the failure of organisations being able to provide effective leadership within virtual teams (Sarker and Sahay, 2003; Foster *et al*., 2015). This failure then leads to a lack of team member trust, not only in each other, but in the virtual collaboration tools themselves (Ubell, 2010; Serçe *et al.,* 2011). To negate distance as a factor in virtual collaboration, a generally accepted practice was devised by Serçe *et al.* (2011). The practice involved the effective training of management positions on the new technologies and the most effective ways of implementing these technologies.

3.7 Participation and Learning Within Modern Teams

As stated previously, modern teams depend on trust between members (Sarker and Sahay, 2003; Foster *et al*., 2015). Brown *et al.* (2004: 128) claim that "trust is the lubricant of commerce, essential to negotiations, and has been related to competitive advantage". From this, it is clear that modern day organisations would do well to develop trust between their members, both physically, and non-physically, co-located. Trust is gained by team members who are of the opinion that what they say in an interaction is observed, understood and taken seriously (Harris, 2018). Effective management can facilitate this in a physically co-located team, but several hardships occur when trying to achieve this same trust between virtual teams (Sarker and Sahay, 2003). Thus, users who are familiar with face-to-face interaction will experience some ambiguity and uncertainty in virtual interactions, which is likely to cause doubts in the user's mind and constrain their interactions over the system (Harris, 2018).

Virtual interactions focus on trust because virtual collaboration will only be effective if both users are willing to cooperate and interact openly in carrying out certain tasks, solving various problems, and actively learning throughout the whole process (Serçe *et al.,* 2011). To encourage participation within a virtual team, it is necessary for team members to accept

collaborative technology and to be accustomed to how to interact and achieve outcomes with the software provided (Saunier, Balbo, and Pinson, 2014).

To further encourage participation, behavioural studies by Flores *et al.* (2009), show that users often used interrupt signals to illustrate that they had something to contribute. Based on the length of time the user had been waiting, the faster the signal began to animate to catch the facilitator's attention. This mechanism proved effective as users were of the belief that they could actively contribute, and their contributions would be heard and dealt with immediately (Flores *et al.,* 2009).

Once trust mechanisms have been installed, users have been observed to more effectively learn from the system and the other users using the system because of the ties that have now been created between both parties (Harris, 2018). Learning thus increases at an exponential pace as users develop skills based on the combined social, intellectual, and emotional capital that is located within their specific team (Ubell, 2010).

3.8 Measuring Modern Team Performance

With the realisation that "most teams are to some extent virtual, a great deal of research over the last decade has focused on mechanisms to enhance virtual team success" Ubell, (2010:53). For example, Boros, Meslec, Curseu, and Emons (2010:541) emphasised "the need for members to feel that they are equal and connected to improve cooperation and conflict management tactics". Likewise, "virtual teams that establish goals early in their life cycle have demonstrated increased cohesion and performance" Brahm and Krunze, (2012:595). Similarly, "a positive social atmosphere and reinforcing predictable communication patterns is essential for virtual team success" Coppola *et al.*, (2004:96). Horwitz *et al.* (2006) discuss the value of creating strong relationships, whereas Cummings and Haas (2012:317) demonstrate "the need for more dispersed teams to have members spend more time on the focal team task". Rice, Davidson, Dannenhoffer, and Gay (2007:571) detail how "having formal and structured procedures and processes can increase effectiveness".

Through the analysis of Hollenbeck *et al.* (2012:6), and their identification of more than forty-two different team types, "they found three, widely used, underlying dimensions, which they propose as a framework for describing teams: skill differentiation, authority differentiation, and temporal stability". They define skill differentiation very broadly as "any social-informational differentiation that may result in people bringing a unique perspective to the team" Hollenbeck *et al.* (2012:6). This dimension captures an array of variations "from

differences in culture and gender to differences in experience and education" Hollenbeck *et al.* (2012:6). Authority differentiation is defined as "differences in authority to make decisions from full leader control, to complete self-management" Hollenbeck *et al.* (2012: 57). "Temporal stability refers to the stability of team membership and expectations about working together from stable, ongoing teams to short-term, ad hoc teams" (Hollenbeck *et al.*, 2012:57).

To address concepts such as the above, Hollenbeck *et al.* (2012:57) suggests a "dimensional scaling approach, which if consistently applied to team research, would allow researchers to better describe the nature of teams studied, the boundary conditions associated with relationships between variables, and the mediating/moderating conditions". "Following this, the authors suggest that the use of continuous, normally distributed, differentiating dimensions, as opposed to dichotomous or nominal types, would increase statistical power for detecting team-related effects" (Hollenbeck *et al.*, 2012:58).

Further to the above, "a distinctive factor of a team's virtuality, could influence team processes, emergent states, outcomes, and even other contextual factors" Hollenbeck *et al.* (2012:57). Effects could range from nothing, to complex direct and indirect interactions. Associations might be positive or negative (Hollenbeck *et al.*, 2012). Foster *et al.* (2015:272) also argue that "virtuality is an important contextual variable that should be taken into consideration in all teams and team research". "They propose that virtuality is a significant contextual variable and a condition that can help researchers more fully understand and assess teams" Foster *et al.*, (2015:273). Context plays an important role in these methodologies and can "have both subtle and powerful effects on research results" Johns, (2006: 6). Consideration of context can help:

- "Explain study-to-study variation"
- "Describe situations in which phenomena or relationships apply"
- "Reduce consideration of isolated, and thus potentially misleading, situational forces"
- "Facilitate aggregation and synthesis of information across studies (e.g., meta-analyses)"

Hollenbeck *et al.*, (2012:9).

With regard to the methodologies of virtuality, geographic dispersion has been measured as a single item, asking team members to state how many times they met face-to-face (Kirkman, Rosen, Tesluk, and Gibson, 2004). Suh and Shin (2010) also methodised geographic dispersion at the dyadic level, asking each team member to indicate whether they work at the same location as each person on their team, before using these scores to arrive at a team-level measure of geographic dispersion.

For technology use, a common methodology is to have team members allocate the percentage of communication that occurs via various Computer-Mediated Communication (CMC) tools (Rapp *et al.,* 2010), which can then be weighted on the basis of media richness to calculate virtuality (Ganesh and Gupta, 2010).

"Most models of virtual team effectiveness include contextual variables, similar to those found in team effectiveness models" (Furst, Blackburn, and Rosen, 1999; Martins, Gilson, and Maynard, 2004; Powell, Piccoli, and Ives, 2004; Webster and Staples, 2006), and this research will also make use of the virtuality methodology as suggested by Rapp *et al.*, (2010). Based on the above models and methodologies, teams can and will need to be evaluated for their effectiveness.

3.9 Conclusion

Several case studies have indicated how virtual teams are now synonymous with modern teams (Sarker and Sahay, 2003; Serçe *et al.,* 2011; Flores *et al.,* 2009; Bjorn and Ngwenyama, 2009; Harris, 2018). The best skilled employees are nowadays tasked with achieving the organisation's objectives in teams that are no longer co-located (Sarker and Sahay, 2003). The distance factor between individuals is becoming less and less of a problem as managers begin to effectively lead these new virtual teams and develop trust between the users of the system and the functionality it provides (Ubell, 2010; Serçe *et al.,* 2011; Harris, 2018). Several methods have been built into virtual collaboration systems to ensure that all members can participate in the interactions and not feel overwhelmed by either their team or the technology. The result of virtual teams has led to a major increase in productivity because labour can now be more dynamically allocated which ensures that the most appropriately qualified employees are tasked to achieve objectives which fall most appropriately within their skills range (Sarker and Sahay, 2003). The effects of this increased productivity now have a framework against which they can be measured to illustrate their results to an organisation (Hollenbeck *et al.*, 2012). With the detailing of modern and virtual teams from Chapter 3 being complete, Chapter 4 will now build on this base and provide quantification of informal communication that occurs between these modern and virtual teams. Further, components that are effective in promoting this informal communication will also be identified to ensure that the breadth of sub problem 1 is addressed.

Chapter 4 - Informal Communication

Chapter 2 quantified how communication is a core component of informal collaboration, and identified the factors that cause effective communication, including message format and transmission medium. Chapter 3 followed and identified how this communication creates and facilitates modern and virtual team interactions. Chapter 3 also explained how modern and virtual teams operate specifically in the informal context. Chapter 4 will now investigate informal communication and why it has been largely misunderstood, and how it plays a vital part in providing the platform for virtual communication and collaboration to occur. These investigations will further contextualise and provide quantification for sub problem 1, while also laying the groundwork for sub problem 2.

4.1 Informal Communication

"Employees increasingly function as part of multiple teams with different goals, forming interdepartmental relationships with colleagues who may not be geographically collocated" Sarker and Sahay, (2003:16). Internet-based communication technologies "enable employees to collaborate remotely with co-workers and are partly responsible for accelerating the movement toward informal work and communication in organisations" Rainie and Wellman, (2012:4). "Thus, understanding the structure of informal networks requires the synthesis of data from a variety of media" Dennis, Fuller, and Valacich, (2008:580). "Notably, it has been found that the omission of informal communication data from consideration, leads to an incomplete reconstruction of employees' informal networks" Olguín, (2009:44).

Informal communication has been inaccurately documented and is mostly misunderstood (Leinonen *et al.,* 2005). Furthermore, informal communication has been poorly translated into computer based systems and as a result, these systems are unable to accurately cater for the needs of today's organisation (Choi *et al.,* 2008). Informal communication's value to an organisation is also largely undervalued (Lawson *et al.,* 2009). This chapter aims to investigate informal communication and why it has been misunderstood. The lack of appropriate computer systems which can replicate informal communication will also be investigated. The chapter will highlight the potential value that an organisation can gain from effective informal communication.

4.2 Defining Informal Communication in the Organisation

The majority of work done within any organisation requires some sort of communication with others (Johnson *et al.,* 1994). A degree of cooperation is also required in order to complete individual as well as group tasks. Formal organisational structures enable this cooperation and communication to occur to a degree (Fay and Kline, 2008), however, up to thirty percent of an individual's work day is spent in unplanned communication (Lawson *et al.,* 2009). This unplanned communication forms the basis of informal communication within an organisation. Only recently has the impact of informal communication been noted (Nishimoto and Matsuda, 2007; Lewis, 2019). As such, many organisations have previously underestimated the potential value of informal communication and are now looking to exploit informal communication methods.

4.3 The Informal Communication Process

As per Johnson *et al.* (1994: 116), informal communication can be defined as: "a spontaneous interaction between random, out of role participants who do not prearrange the topic of conversation." Furthermore, informal communication is spontaneous, dyadic and occurs over relatively short periods of time (seconds) (Fay and Kline, 2008).

From these definitions, it is evident that informal communication is qualitative in nature and is thus relatively difficult to model. Several models have been developed in an attempt to accurately model informal communication. Crampton *et al.* (1998) suggests that the following points are common to all the models:

- "Informal communication is: frequent, brief, unscheduled, dyadic"
- "Supported by shared objects"
- "Intermittent"
- "Lacking in formal openings or closings"
- "Dependant on physical proximity"

Crampton *et al.* (1998)

A common characteristic of informal communication is that individuals engage in multiple intermittent and interleaved communications simultaneously (Kratzer *et al.,* 2008; Lewis, 2019). In a similar fashion, informal communication is often described as concurrent threads running on a computer (Lawson *et al.,* 2009). The context sensitive and simultaneous nature of informal communication leads to this comparison. It has also been observed that these interactions can occur where there is a history which is implicitly shared between the participants, also known as stored context (Fay and Kline, 2008). While informal

communication will lack uniformity amongst organisations, it may certainly have a large impact on efficiency within organisations (Kratzer *et al.,* 2008; Lewis, 2019). Fay and Kline, (2008) suggest that communication can be separated into the following groups:

- "Scheduled"
- "Intended"
- "Opportunistic"
- "Spontaneous"

Fay and Kline, (2008)

The majority of current research has concentrated on scheduled communication as this follows the formal nature of most organisations. However, it is important to note that up to ninety percent of interpersonal interactions in the workplace are not pre-planned (Lee, 2007). This suggests that more research is needed in the area of informal communication which includes opportunistic and spontaneous communication as the cornerstones of informal communication.

4.4 Effective Informal Communication

While informal communication is common-place in organisations, the difficulty often lies in making this communication effective (Johnson *et al.,* 1994; Lewis, 2019). There is a subtle line between informal communication and socialising. Employees must be encouraged to engage in effective informal communication as often as possible. Informal communication channels relay information rapidly between communicants, facilitating feedback (Johnson *et al.,* 1994; Fay and Kline, 2008). As a result, barriers to the free flow of information should be removed within the organisation. Employee interaction should be promoted where possible. Open plan offices are believed to facilitate informal communication optimally (Fay and Kline, 2008; Lewis, 2019).

Managers need to develop new approaches to cater for informal communication. The approaches should include informal feedback as a way in which to base decisions (Nishimoto and Matsuda, 2007). This feedback should be communicated as speedily as possible, both formally and informally. Communicants being able to practice informal communication is also vital in the organisation. As a result, management can support informal communication by implementing policies such as the "open door" policy (Otubanjo *et al.,* 2010). This policy encourages employees to interact with their managers in an informal manner. Supplying sufficient information through formal communication channels is also important as this is the base that informal communication expands on (Otubanjo *et al.,* 2010).

4.5 Informal Communication and its Role in the Organisation

Informal communication is directly and indirectly involved in several areas of the organisation (Lewis, 2019). Direct informal communication promotes cohesiveness within the organisation (Lawson *et al.,* 2009). Employees who share and discuss information in informal interactions develop a sense of unity. Furthermore, informal communication can be used to identify problems or lack of cohesion within the workplace (Lee, 2007). In the organisation, informal communication performs the following functions:

- "Tracking people"
- "Taking or leaving messages ("covering")"
- "Making meeting arrangements (commitment plans of others)"
- "Delivering documents (check actions associated with the document)"
- "Giving or getting help (spontaneous offers of help)"
- "Reporting progress and news (updates about relevant information)"

(Johnson *et al.* 1994)

From the above functions it can be seen that informal communication is indirectly involved in the social and maintenance functions of the organisation (Johnson *et al.* 1994). The social function is most often realised in organisations as informal communication helps employees feel their contributions are valued (Kratzer *et al.,* 2008; Lewis, 2019). The maintenance function is realised by informal communication in aligning groups to common goals and keeping groups updated in terms of news and other group activities (Kratzer *et al.,* 2008). Natural checks that are performed during these functions are in effect an informal case of supervision (Fay and Kline, 2008). Consolidating contact with ex-teammates is achieved by the reporting of team progress and news (Crampton *et al.,* 1998). The physical proximity of team members in organisations promotes frequent face-to-face communication. This communication is informal in nature and used indirectly in the negotiation and planning phases of most projects (Lee, 2007).

4.6 Challenges to Informal Communication

The core challenge to informal communication comes from the traditional structure of organisations (Johnson *et al.,* 1994). Most organisations have a formal structure resembling some sort of hierarchy. This formal structure filters down into the organisation's communication structure. As a result, vast amounts of resources are dedicated to the formal aspects of communication, while informal communication is largely neglected (Fay and Kline, 2008). Several studies have shown that negative impacts are more likely to occur when the opportunity for ad-hoc communication is reduced (Lee, 2007; Lawson *et al.,* 2009). Informal

communication is now acting as a vital cog in the organisation on which emphasis must be placed to ensure that the organisation can sustain a competitive advantage (Kratzer *et al.,* 2008; Lewis, 2019).

Informal communication by definition has a rich channel of interaction (Choi *et al.* 2008). The challenge for the organisation is to keep the channel rich to prevent it becoming a formal communication channel which is relatively impoverished when compared to the informal channel (Lewis, 2019). Much research has been done into systems that could possibly support informal communication (Lawson *et al.,* 2009). The result of the research was that informal interactions are very poorly supported by technology. Among the most prominent of factors was the difficulty systems had with regenerating the context of interactions and related documents. The systems also battled to accurately display presence information (Lawson *et al.,* 2009). A second failing of these systems was their inability to ensure document availability (Dittman, Hawkes, Deokar and Sanikar, 2010). Over sixty percent of informal communication is document-based or sensitive. The systems were unable to provide sufficient document availability leading to the neglect of the systems (Dittman *et al.,* 2010).

Informal communication can result in the rapid spread of information (Lewis, 2019). However, should the base information for the informal communication be incorrect, this can lead to the true information being distorted by the informal communication (Lee, 2007). The challenge is to ensure, as much as possible, that the available base information is correct. Informal communication does not follow an official path within the organisation (Johnson *et al.,* 1994). Thus, informal communication is unregulated and may lead to incorrectness and misinformation (Kratzer *et al.,* 2008).

4.7 Knowledge Transfer Through Informal Communication and Weak Ties

Noting that informal communication is unregulated, many managers have great difficulty in ensuring that knowledge is transferred through informal communication. Research by Johnson *et al.* (1994) has indicated that knowledge transfer is more optimal in informal communication. The reason for this is the fact that knowledgeable professionals are contacted with specific questions rather than having to decide what they think is important (Lewis, 2019). Current knowledge management systems require knowledge professionals to input their knowledge into these systems (Lewis, 2019). This then becomes reusable explicit knowledge. The knowledge professionals lack the time to sufficiently cover all topics and are often unsure as to what content should be inputted (Lawson, *et al.,* 2009). The result is that users of the

knowledge management system have gaps in the information they require. A better method is thus to transfer the knowledge through informal communication (Lawson, *et al.,* 2009). In this way, a user can interact directly with a knowledge professional and tacitly obtain knowledge pertinent to a desired topic.

Weak ties are formed by team members that are actively involved in informal communication (Lawson, *et al.,* 2009). Crampton *et al.* (1998) suggest that groups with weak ties perform better on the whole and are more efficient. These weak ties are often formed with members outside of the physically located group (Nishimoto and Matsuda, 2007). This helps to reduce the group's tendencies to become insular and negatively stereotype other groups. Weak ties are present in an organisation to enhance information flow and the permeability of the organisation's boundaries (Nishimoto and Matsuda, 2007). This will cause the group to be more accepting of innovation and creative ideas. At this point, it should be remembered that informal communication is supplementary to formal communication and cannot replace it in any way (Johnson *et al.,* 1994).

4.8 Social Networks

Social networks are defined as "a set of socially-relevant nodes connected by one or more relations" (Marin and Wellman, 2010: 2). Social networks are critical components of organising and enabling groups to achieve mutual and individual goals. Social networks are established through weak ties being created throughout an organisation (Carr and Zube, 2014). "Social network analysis approaches outcomes as a reflection of network structure, articulating how structural and social factors influence individuals and the organisations they comprise" Carr and Zube, (2014:39). Resnick (2001:661) suggested that "an effective way to examine networks was through the study of how actors used network connections to enable the exchange of information, which in turn creates and reinforces norms within the network".

"Due to lower physical, social, and psychological barriers to interaction as in previous sections, members of virtual groups often communicate informally in ways that circumvent formal organisational structure and channels of communication" Kiesler and Sproull, (1992:97). Sometimes associated with "water cooler moments" or "office gossip" (Grebow, 2002; Bailey and Leland, 2006), "the casual situations surrounding informal communication may offer several benefits over formal intragroup communication" Bailey and Leland, (2006:6). "Informal communication can transcend differences in knowledge or language to facilitate knowledge sharing. Individuals at different levels of an organisational hierarchy often use

different language and conceptualise problems differently based on their experience and organisational understanding" Clark and Brennan, (1991:2), and as a result, "they may formally communicate regarding a particular issue using disparate language, retarding the process of knowledge exchange" Weick, (1979:3) when compared with informal communication.

4.9 Media Facilitation of Informal Communication

"Multiple theories have arisen out of the desire for a greater understanding of how media facilitates effective communication within an organisation" (Fulk and Boyd, 1991; Putnam, Phillips, and Chapman, 1999). "The Media Richness Theory (MRT), is one of the most commonly applied frameworks within the organisational context. This theory ranks a variety of media by their ability to process rich information. The richness of information depends on its ability to change understanding within a certain period of time. To this end, face-to-face communication is ranked highest, while numeric documents are ranked lowest. The alignment between the richness of the information being communicated and the chosen medium results in a reduction of uncertainty or ambiguity with regard to information held within the organisation" Daft and Lengel, (1986:555-560). An alternative to MRT was proposed by Dennis *et al.* (2008: 575), which is called the Media Synchronicity Theory (MST). Here the theory focuses on each medium's ability to foster "a shared pattern of coordinated behaviour among individuals as they work together" Dennis *et al.* (2008: 576). "The authors do not directly compare the media considered via a ranking system, but instead assign high communication performance to an alignment between the level of synchronicity supported by the chosen media and the type of communication process. For example, conveyance processes that involve the transmission of new information can be effectively communicated by media that supports low levels of synchronicity, while convergence processes, or those intended to align the perspectives of multiple parties regarding known information, are best supported by media with high levels of synchronicity. The MST framework is appropriate when investigating communication within organisations because content required for organisational performance should be transmitted by media that supports the information. It has been noted that employees will develop a tacit understanding of the appropriateness of conveying different types of information over varying media channels" Orbach, *et al.*, (2015:508-518). Furthermore, "communication behaviour within each team becomes relatively stable among individuals, given the length of time the division has been operational and employees' previous exposure to the various media examined" Orbach, *et al.*, (2015:519).

4.10 Conclusion

Informal communication is playing an increasingly important role in the organisation, while at the same time, formal communication still forms the backbone of any organisational communication (Lee, 2007; Lewis, 2019). It is clear that informal communication plays an important part in the dissemination of knowledge and the overall functioning of teams (Lawson, *et al.,* 2009). Organisational managers would do well to observe this and align their management styles to this trend. Allen (2000) and Hurst *et al.* (2015) have "demonstrated that the probability of communication between a pair of employees depends on their departmental and project relationships, the size and growth of these groups, and the proximity between their workstations. The author goes on to describe a series of spatial attributes that can facilitate communication within the organisation, suggesting the avoidance of linear forms and vertical separation while encouraging the use of layouts that facilitate visual contact between employees".

With the identifying factors for sub problem 1 being detailed and quantified through Chapters 2, 3 and 4, Chapter 5 will now elaborate on the virtualisation of communication. Further, Chapter 5 will serve as the link between sub problem 1 and 2, through the definition of the concept of collaboration both physically and virtually, which communication can facilitate.

Chapter 5 - Virtual Communication and Collaboration

Chapter 4 articulated informal communication and its role within the organisation, highlighting the challenges in achieving effective informal communication. Knowledge transfer and its place within an organisation was also discussed in relation to sub problem 3 and will be further detailed in Chapter 6. Chapter 5 will now identify the components of virtual communication and collaboration in order to address and contextualise parts of sub problem 2, while also providing the base for Chapter 7 to complete the quantification of sub problem 2.

5.1 Virtual Communication

Virtual communication has come to the forefront of modern communication due to the advent of the Internet (Lawson *et al*., 2009). While virtual communication has been used for some time, it has previously been too expensive or limited by technology (Lankhorst, 2005). The Internet revolution brought with it a variety of technology upgrades and substantially reduced the cost of virtual communication (Kikuchi and Coleman, 2012). Virtual communication has now become the norm for communicants who wish to communicate visually with people from around the world using video and voice over Internet technologies (Lawson *et al.,* 2009; Glikson and Erez, 2019).

5.2 Virtual Communication Defined

Virtual communication is defined by Lankhorst (2005: 28) as "the study of information, communication and action mediated by new technologies where contents, intentions or actions may be non-existent, distorted, replaced, or created – intentionally or unintentionally".

Modern technology allows more communicants to communicate in an ever-increasing number of ways. "As a result, virtual communication has arisen due to the rapid development of mobile technology and communication" Lankhorst, (2005:3). This technology and communication is based on a multitude of media and forms of expressions such as: speech, text, images, and multimedia (Lankhorst, 2005; Orbach *et al*, 2015).

5.3 The Development of Virtual Communication

The need for virtual communication has developed not only from the advancement of technology, but also through the better understanding of human nature and the requirements for interactions (Orbach *et al*, 2015). As discussed in Chapter 2, body language plays an important role in the communication process and communicants have the need to visually observe each other instead of just hearing them in order to achieve more effective

communication. It has been suggested that as much as fifty-five percent of human communication is visual, and that video Internet traffic will account for up to sixty-nine percent of data traffic (Cross and Parker, 2004).

Virtual communication can be defined as "the utilisation of technology for the transmission of communication messages to distant or remote locations, where the content, intentions, or actors may either be non-existent or be distorted, replaced or created in another form" Orbach, *et al.,* (2015: 510). Virtual communication at its essence is about the combination of communication and available technologies (Trout, 2011).

When combined successfully, this virtual communication will enable the communicant(s) to feel more connected to other communicant(s) through whichever method of communication they may choose (Trout, 2011; Glikson and Erez, 2019). The feeling of being more connected is attributed to the trust that is developed between communicants. Studies by Cross and Parker (2004) and (Glikson and Erez, 2019) have shown that developing trust in the communication cycle can greatly increase the effectiveness of communication and the relevant systems through which the communication takes place.

5.4 How the Virtual Office works

Davenport and Pearlson (1998: 52) state that "Work is not a place you go, it's something you do," which has particular relevance to virtual communication. Modern communicants have been able to establish a "virtual office" where they are connected to other communicants visually and virtually. The term "virtual office" refers to a variety of communicating abilities all rolled into one remote environment (Jeffrey *et al.,* 2003). This remote environment facilitates virtual communication between communicants and has become the new enabler for organisations who have dispersed employees and teams.

Inexpensive portable technologies have solved many problems previously faced by virtual communication but have also created many new ones (Jeffrey *et al.,* 2003). Many virtual communicants believe that virtual communication is a means of control by the other party and as such, fail to develop a level of trust in the communication process. Virtual communication is also infrastructure intensive and is thus not suitable all over the world as some locations are more technologically developed than others. Virtual communication does have drawbacks, but on the whole, the general cost savings and associated benefits of virtual communication cause most organisations to adopt some form of virtual communication system (Cross and Parker, 2004; Orbach *et al*, 2015).

While it is evident that virtual offices are the new go-to for organisations, this has in no way compromised the need for face-to-face and visual communication between communicants (Jeffrey *et al.*, 2003; Ferrazzi, 2014). Thus, the modern organisation will recognise that virtual offices may be able to seamlessly facilitate dispersed communicants and their communication needs, but the highest bandwidth and most content rich networks can be found around the water cooler, so to speak (Davenport and Pearlson, 1998).

5.5 Virtual Teams

"Virtual teams represent a means of effectively researching how an organisation's structure and its flow of informal communication affects an individual's interactions for two reasons" Glikson and Erez, (2019:233).

First, "organisational systems coordinate individual's activities and naturally archive transmitted messages, affording a reliable record of all intergroup interactions" (Han and Kamber, 2006; Glikson and Erez, 2019).

Second, "unlike the discrete backstage informal communication in co-located organisations, all of the channels that virtual organisational members use for informal communication may be monitored" Glikson and Erez, (2019:235). Consequently, "the informal communication and influence of online groups is more accessible, affording a unique opportunity to assess network correlation via a group's informal communication" Carr and Zube, (2014:40).

Based on the above, "an individual's own presence in, and interaction within a group may affect how others influence that group member" Glikson and Erez, (2019:236). "As individuals become more experienced, they may become more self-efficacious in their perceived ability to accomplish specific goals" Bandura, (1997:2). Concurrently, "the longer individuals are with a group, the more they may perceive themselves to be a member of that group, and consequently the more they will adhere to the group's normative behaviours and benefit from group collaboration" (Reicher, 1984; Jackson and Welch, 2007).

5.6 The Need for Virtual Communication

"Since communication is a core element in creating a collaborative culture, it has become one of the on-going challenges that team members face and that is essential to the success in any organisation" (Gautier, Kubaski, Bassanino, and Fernando, 2009). Virtual communication enables communicants around the world to communicate at any time and in any place (Jeffrey *et al.,* 2003). Virtual communication saves organisations the cost of having communicants

travel to face-to-face meetings through the use of technologies such as video conferencing (Bassanino *et al.*, 2001). Virtual communication thus helps an organisation to streamline their communication process and achieve more effective and efficient outcomes based on the communication (Trout, 2011; Glikson and Erez, 2019).

Some of the benefits of virtual communication that an organisation can experience, as per Trout (2011) are as follows:

- "Savings on travel times and costs"
- "Enabling communication between parties who would usually not communicate because of the distance between the parties"
- "Increasing communication flow and strictures"
- "Supporting knowledge creation and management"

(Trout, 2011)

5.7 What is Virtual Collaboration?

Virtual collaboration can be described as "two or more people working towards a common goal without the use of face-to-face interaction" Olaniran (2008: 131). Virtual collaboration thus "enables many people to collaborate on many ideas, topics or projects in both synchronous and asynchronous time" Lamont, (2010:57).

The backbone of virtual collaboration is seen as the concept of sharing (Lawson *et al.,* 2009). Thus, a global environment should be available where the skills of the entire team are utilised to share ideas related to infinitely different topics. Virtual collaboration thus enables dynamic innovation and creativity without the traditionally associated physical environments required for such functions (Glikson and Erez, 2019).

The management of virtual collaboration can however be particularly difficult because of the dispersed nature of teams (Brown *et al.*, 2004). The main problem associated with virtual collaboration is often observed to be communication breakdown. Communication breakdown usually occurs as a result of a lack of understanding and shared context between users (Brown *et al.,* 2004).

Shared context is the second concept on which virtual collaboration hinges (Lawson *et al.,* 2009). Shared context "is the background knowledge of past interactions that guides users in organising and shaping their interpretations of current events. Users need to develop a shared context and common language for making sense of each other's interactions" Glikson and Erez, (2019:301).

5.8 The Development of Virtual Collaboration

Initially, collaboration was simply defined as the sharing of, and teamed interaction with, documents (Olaniran, 2008). As technology developed, shared workspaces became available for newly developed virtual teams so that they could more effectively achieve the same outcomes but across distance (Olaniran, 2008). Shortly thereafter, technology developed again and Instant Messaging (IM) and voice chat became available so that collaboration could now happen between dispersed users in order to negate the need to be physically located in the same room. Technology evolved again to the point where video chat, forums and scheduling capabilities all became available to virtual collaboration users (Serçe *et al.,* 2011).

Virtual collaboration is still developing at a rapid pace because of the benefits that organisations can gain from effectively deploying virtual collaboration technologies. Current technologies are completely customisable to the organisation and include things such as:

- "Wiki's for the distributed form of information which is open to comment"
- "The integration of social media and networks, which provides a user rich interface from which users can virtually collaborate in a more personal manner"
- "The use of the Cloud (distributed computing) to ensure that the technologies and applications are available to users wherever they are located and whenever they are needed"

(Jackson and Welch, 2007; Huvila *et al.,* 2010)

In short, virtual collaboration has developed to the stage where the emphasis is no longer on the technology itself but on the people, who use the technology (Glikson and Erez, 2019). Historically, collaboration was document-centric but presently, virtual collaboration seems to be more about focusing on the connections between people (Ubell, 2010; Foster *et al.*, 2015).

5.9 The Need for Virtual Collaboration

"Digitally enabled virtual workspaces have demonstrated great potential for multiuser interaction in purposes such as product design (Shyamsundar and Gadh, 2002), decision making (Jackson and Welch, 2007) and scientific exploration and analysis (Heer and Agrawala, 2009)". "These workspaces explore how tasks conducted by two or more people using collaborative technologies can work together to realise a shared goal" Olaniran, (2008:124). "In order to engage with the participating stakeholders, these working environments must support individuals with the ability to communicate and interact with each other's content intuitively and interactively" (Woo, Lee, and Sasada, 2001; Foster *et al.*, 2015).

Collaborative technologies, sometimes referred to as "groupware", have developed rapidly in the last few years due to their deployment to support groups of individuals engaging in collaborative tasks (Jackson and Welch, 2007). Much of this expansion has been fuelled by the dramatic increase in Internet penetration in countries around the world, making it possible for globally distributed teams to work on projects (Jackson and Welch, 2007).

With the majority of teams now being virtual teams, it is essential to establish common groups in the form of a shared context (Glikson and Erez, 2019). Failure to do so can result in serious breakdowns in both collaboration and communication (Beinlich *et al.,* 2002).

As discussed in Chapter 3, knowledge has been identified by many organisations as a key resource and its retention, creation, and distribution is a major issue for most organisations. "Knowledge sharing is another fundamental function of virtual collaboration which is also closely related to the shared context which will be experienced by users of virtual collaboration tools" Beinlich *et al.,* (2002:69). Virtual collaboration thus supports knowledge management by being a "process of consensus building where knowledge is created and shared, and vice-versa" Lamont (2010: 77).

The key driver for virtual collaboration is the benefit that can be derived for the organisation in terms of virtual interactions (Jackson and Welch, 2007; Foster *et al.*, 2015). Dispersed skills and knowledge can now be brought to bear on joint projects that span global operations. The importance of such scope is that the best possible employees are engaged with projects that best suit their work roles and skills, resulting in optimum utilisation of labour and efficient outcomes with regards to the goals of the projects (Ubell, 2010).

Virtual collaboration technologies also support the rapid formation and continuing development of communities of interest (work groups), common goals, and relationships between users (Sarker and Sahay, 2003). Ultimately, users will derive benefit for the organisation because they will be engaged in challenging projects which suit their skills base and they are able to attain job satisfaction by working with top professionals from throughout the global organisation, meaning the performance and efficiency of employees is increased (Jackson and Welch, 2007; Glikson and Erez, 2019).

5.10 Virtual Collaboration Versus Virtual Communication

Virtual collaboration is the direct spin-off of organisations chasing an increasingly efficient operating environment (Sarker and Sahay, 2003). With modern teams now being

geographically separated, virtual collaboration techniques have developed in order to facilitate the interactions between non-co-located users (Jackson and Welch, 2007). Several technologies are available to aid in this pursuit and are discussed later along with their benefits and shortcomings (Rodriguez *et al*., 2018). The need for virtual collaboration tools has been stressed as vital for the organisation by many authors and the relevance of this statement and the associated deployment procedures are also just as important (Otubanjo *et al.,* 2010; Rodriguez *et al*., 2018).

When compared to virtual communication, virtual collaboration is similar in nature (Otubanjo *et al.,* 2010). The difference occurs where virtual collaboration is most often engaged after initial virtual communication has taken place (Cisco Systems, 2008). Virtual collaboration has the defining attribute of participants sharing a common goal (Sarker and Sahay, 2003). When compared to virtual communication, virtual collaboration requires participants to engage each other via a technology medium. This then leads to the participants working towards a common goal, whereas virtual communication need not observe the same principle (Cisco Systems, 2008).

5.11 Deploying Virtual Collaboration in the Organisation

Using technology to mediate interactions and communications is essential to virtual teamwork and collaboration (Rodriguez *et al.,* 2018). However, these interactions and communications can be highly influenced by the available collaboration technologies and the organisational context in which users find themselves (Flores *et al.,* 2009).

Vital to virtual collaboration is a common information-sharing space, comprising a common directory in which users can create and share work objects, amongst other users of the system (Rodriguez *et al*., 2018). While virtual collaboration technologies can be enablers for the organisation, the use of virtual collaboration tools is determined by how users adapt the technologies to their specific organisational work requirements (Jackson and Welch, 2007). These technologies, if not managed correctly, can in fact constrain users from effectively achieving their outcomes (Rodriguez *et al*., 2018).

Organisations have quickly learnt that to successfully deploy collaborative environments, they must address issues around infrastructure, scalability, security, and organisational resistance to change and sharing (Kratzer *et al.,* 2008).

"Although virtual collaboration is considered critically important for teams in order to produce better quality products with reduced cost and time" Maj and Issa, (2007:8), "many human and organisational barriers exist that hinder successful collaboration among partners". As indicated by Patel, Pettitt, and Wilson (2012:22), "the important factors that are essential for collaboration are culture, trust, the interaction processes, teams and tasks". "The study of CMC has been the main focus of the Computer Supported Collaborative Working (CSCW) for many years. This research has shown that a typical CSCW platform should support information sharing, information exchange, decision-making and control protocol" Schmidt and Rodden, (1996:8-9) for both individual and cooperative work.

Saad and Maher (1996:185) argued that "workspaces with the aim of providing space for exploration can enhance and support multi-perspective collaboration". "Multi-perspective collaboration combining public with private spaces can allow for rearranging a task into subtasks for parallel execution" Stefik *et al.*, (1987:42), "providing privacy during cooperative sessions" Beaudouin- Lafon, (1990:9), "and enabling users to self-explore different interests and viewpoints" (Sarin and Greif, 1985; Rodriguez *et al.*, 2018).

As such, Riemer and Frößler (2007) developed a set of guidelines to both smooth the implementation process of virtual collaboration technologies and speed up the rate at which the change is accepted in the organisation.

Table 5.3: Virtual Collaboration Implementation Guidelines

Guideline	Purpose
1.) Create a shared outcome, common goal, or purpose	Provide users with a vision of where their actions will lead and motivate them to achieve the outcomes
2.) Establish a leader for each group or community	The leadership role will ensure that interactions do not decay into chaos and become unproductive
3.) Provide infrastructure relevant to the technologies	Ensure that users are able to utilise the technologies to their full value and to maximise the benefit that the users and the organisation can gain from the technologies
4.) Establish management procedures and training courses	Ensure that managers are able to effectively manage the virtual teams and provide team members with the necessary training so that they can confidently interact with the software and achieve their desired goals in an optimal manner
5.) Create a high-level champion	The champion will ensure that an environment that encourages knowledge sharing and collaboration is implemented and maintained

A final consideration when deploying virtual collaboration tools should also include the availability of translucence. Translucence refers to the ability of a virtual collaboration tool to permit invisible, but important, social clues as to the current engagement of a user (Jackson and Welch, 2007). These clues enable collaborators to monitor and interpret each other's actions whilst collaborating.

These clues may include, but are not limited to: presence indicators, a "glancing" feature, turn-taking abilities, and notifications (Riemer and Frößler, 2007). While translucence is an important feature of collaboration tools, care should be taken to ensure the features are provided in a low-effort and seamless way that does not impact on the user and the primary task with which they were engaged in (Riemer and Frößler, 2007). Thus, the main objective which can be gained from translucence is the ability to avoid and/or recover from communication and collaboration breakdowns.

5.12 Conclusion

Virtual communication has now become essential to providing communicants with a more realistic, distance-based communication environment (Rodriguez et al., 2018). This virtual communication has developed to a point where dedicated virtual offices have now been created to provide the facility for it (Flores *et al.,* 2009). Savings on travel time and cost has been a major factor promoting virtual communication as has the alleviation of the distance factor between communicating parties (Glikson and Erez, 2019). Organisations have also developed a need for virtual communication as it actively supports knowledge creation (Trout, 2011). This knowledge creation can be of material value to an organisation and will be further quantified in Chapter 6 which follows, in order to address sub problem 3 of this research. Also identified in Chapter 5 was that developing a shared context and translucence functionality coupled with an organisational acceptance and infrastructure to facilitate virtual collaboration are some of the challenges that need to be addressed before the full benefits of virtual collaboration can be realised (Jackson and Welch, 2007). These identified factors will be further addressed in Chapter 7 to complete the investigation into sub problem 2. Finally, Chapter 5 also identified the fact that once organisations implemented virtual communication, it became apparent that virtual collaboration was occurring simultaneously (Rodriguez *et al.*, 2018. It was further identified that virtual collaboration tools are a necessity for organisations wishing to maximise competitive advantage and utilise division of labour as effectively as possible (Riemer and Frößler, 2007; Ubell, 2010). The identification and evaluation of these tools will be conducted in Chapter 8 in order to address sub problem 4 of this research.

Chapter 6 – Social Capital in the Communication Process

Chapter 5 investigated communication and collaboration and how both of these processes can be achieved both virtually and physically. Chapter 5 also identified an important factor where organisations have developed a need for virtual communication as it actively supports knowledge creation (Trout, 2011). Chapter 6 will quantify this social capital and evaluate if it does in fact occur and if so, what impact and effects it may facilitate in an organisation. Chapter 6 will thus be used to address sub problem 3 of this research and particularly how this social capital can be of material value to both teams and the organisation at large.

6.1 Introduction

"There are many definitions and forms of social capital, common to all is the concept of a relationship with others; a link among individuals within a community of sorts", Ince and Gul (2011: 109). "These relationships are an essential component of social capital as they bind individuals within organisations and groups" Golnaz and Conida, (2012:22).

6.2 Social Capital Defined

"The term social capital can be traced back to the early twentieth century" Golnaz and Coniada, (2012:21). The term was used to stress that community cooperation is essential to operate successful schools in the United States of America, (Boyaci *et al.*, 2009). In a more modern sense of the definition, Ince and Gul (2011: 112) defined social capital as, "those tangible substances that count for most in the daily lives of people: namely goodwill, fellowship, sympathy and social intercourse amongst social units".

A second definition which clarified in terms of the word 'substances', is used to illustrate that the substances were social capital and referred "to the currency that results from the social networks that humans enjoy and from the resources generated from relationships present in such networks" (Lipnack and Stamps, 1997; Jokismovic *et al.*, 2018).

Social capital is thus dependant on these resources (Jokismovic *et al.*, 2018). They are generated in a continuous cycle which is not unlike the communication cycle (Golnaz and Conida, 2012). The process is defined as follows: "the reproduction of social capital presupposes an increasing effort of social ability, a continuous series of exchanges in which recognition is endlessly affirmed and reaffirmed", Hurford (2008: 251-252).

"Social capital can thus be seen as an aggregate of actual or potential resources that arise from a durable network of institutional relationships of mutual acquaintances" (Golnaz and Conida, 2012; Jokismovic *et al.*, 2018).

Fishbach, *et al.* (2009) suggest that key to the concepts of social capital are the factors of trust, communication and the network that it appears in. As Powell (1991: 24) observes: "the most useful information is that which is obtained from someone whom you have dealt with in the past and found to be reliable". "You trust information that comes from someone you know well" Jokismovic *et al.,* (2018:55). "Thus, informal networks may become powerful relays of knowledge that is often deemed to supersede or negate organisationally produced knowledge" (Powell, 1991; Jokismovic *et al*., 2018). "Such exchanges are however, largely hidden and thus evade the normal management and control processes within organisations" Jokismovic *et al*., (2018:56).

6.3 Social Capital and the Communication Process

Social capital is very difficult for most organisations to measure and as a result, is usually defined along a continuum from informality to formality, before being measured (Cisco Systems, 2008). "Social capital could thus be regarded as an asset that could be converted into some other form of capital asset" Fukuyama (2000: 141). Fukuyama (2000: 141-143) proposes a model whereby the manner in which social interactions occurred could be plotted on a continuum and then translated into a hierarchical graph.
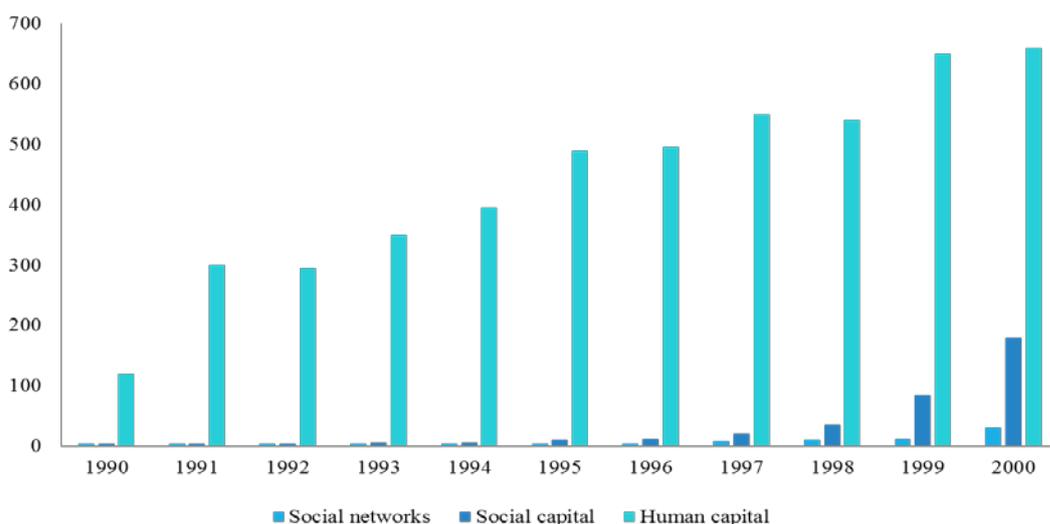
In virtual communication and collaboration environments, social capital has seen a large trend of growth (Fishbach, *et al.*, 2009). Figure 6.2 shows that social networks and social capital are relatively new concepts and have become progressively more intrinsic in the workplace (Golnaz and Conida, 2012). Figure 6.2 shows the steady rise of social capital from the late 1990s is an indicator of the value organisations are beginning to place on social capital (Isham *et al.*, 2002). The development of social capital is largely based on trust. "The links, shared values, and societal norms enable this trust, and therefore result in an organisation generating social capital" Dulal *et al.* (2011: 129). Figure 6.2 demonstrates that human capital is levelling out. Organisations now need to look towards building social capital in order to sustain a learning organisation, and the benefits derived therefrom (Golnaz and Conida, 2012). Both social networks and social capital have seen steady growth as organisations are able to derive more and more value from these concepts (Golnaz and Conida, 2012). Dulal *et al.* (2011) presume that while human capital will remain relatively static in the coming years, social capital, and particularly social networks, will begin to expand at an exponential rate. These expansions are also presumed to have the same exponential effect for the organisation (Dulal *et al.,* 2011).

6.3.1 Formal Social Capital

Formal social capital requires more planning and intentionality (Boström, 2002). Formal social capital is often referred to as the 'structured dimension' because of the way it is defined through its structures of networks and the nature of the network of ties between its communicants (Boström, 2002).
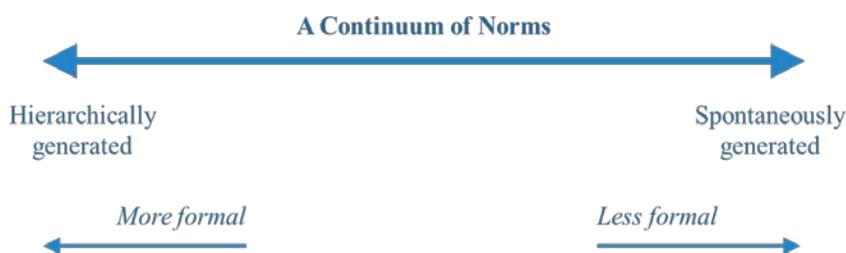
Figure 6.3: Continuum of Norms (Fukuyama, 2000)

6.3.2 Informal Social Capital

Dulal *et al.* (2011) found that informal social capital seems to require little prior commitment or preparation. Informal social capital also tends to be generated more spontaneously and is less formal in comparison to formal social capital. The relational dimension as defined by

Fukuyama (2000: 159-160) is: "The relational dimension relies on trust, identity and roles. The relational dimension is thus the context of the message and can include hidden word meanings and context-sensitive descriptions and explanations." The relational model is another way of defining the context of informal social capital.

Informal social capital thus has underlying motives which stress the concept of sharing (Jokismovic *et al*., 2018). It is evident that the exchange of information in the relational dimension is highly dependent on social relationships (Jokismovic *et al*., 2018). While trust is an important enabler in informal social capital, it is not always possible in the informal environment because of the time it takes to develop a level of trust (Huvila *et al.* 2010).

6.3.3 Informal Networks and Social Capital

"Informal networks can allow for 'non-knowledge' (Seidl, 2007; Jokismovic *et al*., 2018) to be challenged, as evidence from other contexts and other perspectives are brought to bear on the constrained observations that are present within an organisation". "The issue then becomes one of whether the organisation absorbs and responds to this knowledge, or not" Jokismovic *et al*., (2018:56). "The interactions between individuals generate a set of connecting fabrics that both exist and are perpetuated beyond the control and sphere of any single organisation" Orbach *et al.*, (2015:511). In these 'informal networks', "knowledge is created and disseminated and serves to shape the views and behaviours of individuals within the network" (Fischbacher-Smith and Fischbacher-Smith, 2014). "This, in turn, creates social capital and knowledge that is the possession of the individual (and the network) and not, necessarily, their organisation" Jokismovic *et al*., (2018:57). It should be noted that "not all of this information is necessarily actionable" Seidl, (2007:17).

It is also conceivable that within the informal network there is also the "potential for disinformation and failure as the knowledge communicated may be inaccurate, decontextualised, or out of date, thereby leading to inappropriate actions" (Fischbacher-Smith and Fischbacher-Smith, 2014). "Such failures can migrate quickly and create multiple 'pathways of vulnerability' (Smith, 2005) in which the potential for failure can be embedded and remain undetected across a range of connected organisations. Informal networks are therefore an important but essentially neglected element of an organisation's communication and collaboration portfolio as there is a largely under-explored 'dark side' to them" Orbach *et al.*, (2015:521).

6.4 Knowledge Transfer and Informal Communication

New knowledge can often be an important stimulus for organisational change and improvement (Jokismovic *et al.,* 2018). Knowledge transfer is defined by Argote and Ingram (2000: 155) as: "the process through which one network member is affected by the experience of another."

"Knowledge transfer often manifests itself through changes in current knowledge or performance of the organisation" Hansen, (2002:234). While this knowledge/performance may not always originate from within the organisation, the impact is nonetheless pivotal. Knowledge has been defined as a dominant feature in the post-industrial society (Inkpen and Tsang, 2005).

With the above in mind, it is crucial to gain "an understanding of the types of knowledge that exist within an organisation" Seidl, (2007:17). This understanding should then lead organisations "to foster internal structures that will facilitate and support social capital generation in all organisational domains" Boyaci *et al.,* (2009:677).

6.4.1 Knowledge Types

Lipnack and Stamps (1997: 56-61) established a basic list of knowledge types that are common to most organisations as listed below:

- **"Embrained knowledge** is knowledge which is dependent on conceptual skills and cognitive abilities. This could be considered as practical, high-level knowledge, where objectives are met through perpetual recognition and revamping. Tacit knowledge may also be embrained, even though it is mainly subconscious."
- **"Embodied knowledge** is action oriented and consists of contextual practices. It is more of a social acquisition, as to how individuals interact in and interpret their environment creates this non-explicit type of knowledge."
- **"Encultured knowledge** is the process of achieving shared understandings through socialisation and acculturation. Language and negotiation become the discourse of this type of knowledge in an enterprise."
- **"Embedded knowledge** is tacit and resides within systematic routines. It relates to the relationships between roles, technologies, formal procedures and emergent routines within a complex system."
- **"Encoded knowledge** is information that is conveyed in signs and symbols (books, manuals, databases, *et cetera*) and decontextualised into codes of practice. Rather than being a specific type of knowledge, it deals more with the transmission, storage and interrogation of knowledge."

Lipnack and Stamps (1997: 56-61)

What is evident from the above is that organisations, and indeed individuals within organisations, can vary greatly in the degree to which they create and retain knowledge (Lipnack and Stamp, 1997). The way organisations interact, communicate and are structured also play a major role in the types of knowledge generated. Fukuyama (2000: 141-143) shows how organisations with good formal structures and communication processes tend to generate more embrained and embedded knowledge, while less formal organisations with more informal communication are more prevalent with embodied and encultured types of knowledge.

While authors such as Boström (2002: 24-25) and Jokismovic *et al.*, (2018) state that social capital, and knowledge are definable assets, it is widely agreed that evaluating these concepts provides a major hurdle to most organisations. Not only is social capital difficult to measure, there are several barriers to its creation and retention as detailed below.

- **"Trust:** The relational dimension has been discussed above as a key influencer of social capital generation. However, the initial lack of trust that communicants may have will result in a serious barrier to social capital generation".

- **"Organisational norms (cooperation):** Many organisations prescribe processes and practices that are prohibited to the generation of social capital. These could include practices that prevent employees from effectively cooperating and achieving social capital".

- **"Obligations and expectations:** Often obligations and expectations on, or of an individual will alter their behaviour. These alterations can lead to a situation where they become a barrier to social capital creation instead of a promoter of social capital generation.

- **Race and culture:** The differing races and cultures of the communicants is the most common barrier to social capital generation. Different races and cultures communicate in differing manners and will often battle to share a common relational dimension in conversation".

- **"Developing shared meanings:** A shared meaning becomes a barrier to social capital generation when communicants establish different meaning for messages instead of a commonly understood meaning. This ambiguity can thus become a major barrier to social capital creation".

- **"Distance:** Both distance and time zone differences can be a barrier to social capital creation. The time zone concept can prohibit communicants from communicating, due to time zone differences. The distance concept can prohibit messages from reaching communicants in a timely fashion to promote trust and shared context".

Nahapiet and Ghoshal, (1998).

6.4.2 Culture, Race and Language Barriers

Though Fishbach *et al.* (2009) might agree with Coleman (1990) that "social capital in the abstract is a neutral resource, their work shows how it can be used practically to produce or

reproduce inequality, demonstrating for instance how people gain access to powerful positions through the direct and indirect employment of social connections".

6.5 Evaluating Social Capital

Putnam (2005: 43-44) suggests that "social capital can be transformed from a resource possessed by individuals to an attribute of collectives, focusing on norms and trust as producers of social capital to the exclusion of networks".

When the barriers as mentioned above are overcome, social capital still remains very difficult to classify and measure. Bullen and Onyx (1998: 46-60) show how social capital can fall into several different categories and for the purposes of this research, social capital has been listed as having eight generic elements:

- "Participation in the local community"
- "Proactivity in a social context"
- "Feelings of trust and safety"
- "Neighbourhood connections"
- "Connections to family and friends"
- "Tolerance of diversity"
- "Value of life"
- "Work connections"

Bullen and Onyx (1998: 46-60)

These eight elements help organisations define social capital into a more generic brand of knowledge. Bullen and Onyx (1998: 47) show that this is important due to the differing techniques for measuring different types of knowledge.

Coleman (1990: 16-17) identifies "consensus building as a direct positive indicator of social capital. Consensus implies "shared interest" and agreement among various actors and stakeholders to induce collective action. Collective action is thus an indicator of increased social capital".

Fleming *et al.* (2005: 220-222) show how "social capital is not equally available to all, in much the same way that other forms of capital are differently available. Geographic and social isolation limit access to this resource. Second, not all social capital is created equally. The value of a specific source of social capital depends in no small part on the socio-economic position of the source within society ". On top of this, Portes (1998: 6-7) has "identified four negative consequences of social capital: exclusion of outsiders; excess claims on group members;

restrictions on individual freedom; and downward levelling norms", which will be detailed later.

6.5.1 Measurement of Social Capital

Due to many differing definitions of social capital, there is no widely held consensus on how to measure social capital. As a result of difficulties in quantitatively measuring social capital, different metrics exist for different functions of social capital (Fleming *et al.,* 2005).

The measuring of social capital is often context-specific and conducted with metrics designed specifically for the measurement (Jokismovic *et al*., 2018). An example of this can be seen in research conducted into rural Tanzanian homes where families with higher income levels achieved greater collaboration in collective organisations, thus accumulating social capital due to altruistic gains (Dulal *et al.,* 2011). They saw that even in high poverty indexes, families throughout the country had more collaboration in collective organisations. These homes accumulated social capital because of the individual benefits it created for the homes (Dulal *et al*., 2011). Furthermore, it was found that due to increased social capital levels, the individuals had better agricultural practices than those with low social capital collaboration (Dulal *et al*., 2011). Due to better market-related information (arisen from shared information) they were also identified to be more risk aware Boyaci *et al.* (2009: 672). Additionally, the relationship between cooperation and interaction (i.e. social capital) and influence in the public sphere, as seen in the increased participation levels in schools, can be seen Boyaci *et al.* (2009: 672-673).

Measuring social capital is also dependant on the cohesion of a group (Bullen and Onyx, 1998). Again, there is no single definitive way to determine or measure the level of cohesion within an organisation. As a result, several network models have been made popular in their attempt to operationalise social capital. Arguably the most dominant of the models is Burt's Constraint Measure (2000: 340-342) which highlights the role of the tie strength between organisational members and the cohesiveness of the members.

An organisation's relation to the rest of society can also affect its measurement of social capital (Jokismovic *et al*., 2018). "Strong internal ties can, in some cases, weaken the group's perceived capital in the eyes of the rest of society" Jokismovic *et al*., (2018:59). The common cases in this scenario are organisations where a common goal of crime, intolerance, and/or intolerance can hinder the measurement of social capital (Boström, 2002).

Boyaci *et al.* (2009: 677-679) suggest that one of the pivotal reasons why social capital is so difficult to measure is due to social capital being neither an individual, nor an organisational level phenomenon. The authors argue that social capital emerges across all levels of analysis as organisational members participate in their various roles throughout the organisation (Boyaci *et al.*, 2009).

Boyaci *et al.* (2009: 681) also argue that "the concept of social capital may be misleading because unlike financial capital, which is a resource held by an individual, the benefits of social capital are not held by members but are results of the participation of members within the organisation to the benefit of the organisation".

6.5.2 Geography in Relation to the Measurement of social capital

Geographic factors increasingly play a role in modern social capital. These factors are comprised primarily of space, place, and territory and their relationships to each other and the organisational members found within each (Frank *et al.* 2004).

Putman (1993: 36) was the leading author in suggesting that geographical concepts could mould the social capital of an area because of the influence that the concepts had over the people and their relationships in the specific geographic areas. Putman (1993: 38-40) provides an example of the above in a case study where "a lack of social capital in the south of Italy was due to historical geographic development rather than the consequences of a set of contemporary socio-economic conditions".

Giddens (2009) developed a theory where social capital and the actions produced as a result thereof, are a direct result of the social connections and ties that stem from organisational members when they are diffused over space. Continuing on this, Huvila *et al.* (2010: 296-299) argue that the constant change in organisational atmosphere will bring about a never-ending cycle of redefined social capital. The same authors then go on to state that this constant evolution of social capital causes significant difficulty in measuring social capital and providing a baseline measure of social capital (Huvila *et al.* 2010).

The main area where geography can be seen as a contributing factor to social capital is the sphere where volunteerism and government support of organisations influence an area's social capital (Huvila *et al.* 2010). Firstly, the differences in demographics of volunteers can result in varying degrees of involvement based on geographic location (Fleming *et al.*, 2005). Secondly, the placement of government organisations affects social capital based on the type of

organisation that is placed in a particular geographic territory. Thirdly, as supported by Boström (2002: 518-519), "the involvement of government organisations in specific areas raises the involvement of organisational members in organisation and communities". This in turn will then raise the social capital developed in that particular area. Since every area differs, the same institution placed in two different areas will produce differing sets of social capital as defined by Bullen and Onyx (1998: 50-53).

There are cases when social capital can be created in the negative sphere and this will be detailed below (Dulal *et al.,* 2011).

6.6 Negative Social Capital

Negative social capital is the result of organisations whose aims, and goals are to revolt against established norms, such as criminal organisations or gangs, and in the process, generate negative ties and relationships between organisational members (Dulal *et al.,* 2011: 128-130).

Furthermore, the generation of negative social capital can often be a repetitive cycle where the negative social capital causes organisational members to move to other areas and take their social capital with them (Lipnack and Stamps, 1997). This as a result causes further generation of negative social capital (Lipnack and Stamps, 1997).

Most negative social capital is a result of groups becoming isolated and removed from established norms (Dulal *et al.,* 2011: 131). "To combat the generation of negative social capital, organisations can try and "bridge" social capital by encouraging the development of ties and relationships within an organisation to the point where organisational groups become more homogenous and as a result, turn negative social capital generation into positive social capital generation" Frank *et al.,* (2004:157).

Putman (1993: 40) suggests that negative social capital can also be associated with a lack of trust and common understanding. Putman's (1993: 39-41) study on American Society illustrated that areas, where immigration is high, have an inherent lack of positive social capital. Putman (1993), went on to state that the main reason for the lack of positive social capital, was the lack of trust and a shared context by the members of a particular area. Negative social capital generation also occurred due to the formation of differing organisations within the area, which were unable to agree on common goals because of these trust issues (Fleming *et al.,* 2005).

From the study by Fleming *et al.* (2005: 220-223), it is clear that negative social capital is prevalent when there is a lack of trust and when organisational members withdraw themselves from organisational groups and relationships and create an atomised organisation rather than a cohesive and tightly knitted organisation. The study challenged existing norms in the sense that previous research as per Putman (1993: 39-41) stated that exposure to diversity in the organisation strengthens social capital.

The following section will further explore the statement above and investigate the effects that social capital, both positive and negative, have on an organisation.

6.7 Effects of Social Capital on the Organisation

Two main formal benefits for an organisation can be observed when evaluating social capital (Nebus, 1998; Dulal *et al.,* 2011). The first benefit is information. "Social capital facilitates access to broader sources of information and improves the information's quality, relevance, and timeliness" Uzzi, (1997:487). Network research by Nebus (1998) has shown that network ties help communicating parties gain access to information about relevant topics as need be. The benefit for an organisation is the acquisition of new skills and knowledge (Nebus, 1998). This has been observed most often in inter-organisational networks as researched by Nebus (1998). A direct result of this knowledge and skill acquisition is stated by Uzzi (1997: 489): "the transfer of fine-grained information among organisations helps them to better forecast future demands and anticipate customer preferences."

Social capital's second formal benefit, as argued by Nebus (1998:491), is that "social capital between independent business units within a multinational organisation facilitates the transfer of information". Hansen (1999:86) shows that "weak ties created by this process facilitate the cost- effective search for new information". "Strong ties can also facilitate the cost-effective transfer of complex information and tacit knowledge" Nebus, (1998:490). This new knowledge and the transfer thereof has considerable positive benefit for the organisation as a whole (Coleman's, 1988).

Social capital can also establish informal benefits (Jokismovic et al., 2018). Influence, control, and power constitute a second type of benefit gained by an organisation through social capital (Nebus, 1998). In Coleman's (1988) "Senate Club" example, "some senators are more influential than others because they have built up a set of obligations from other senators, and they can use those credits to get legislation passed. Such power benefits allow certain communicants to get things done and achieve their goals". Burt (1992:1) "focuses on power

benefits that accrue to managers who bridge disconnected groups and illustrates that the cost of bridging these gaps is far outweighed by the benefit gained by the organisation".

The second informal benefit of social capital is solidarity (Ouchi, 1980; Jokismovic et al., 2018). "Strong social norms and beliefs, associated with a high degree of closure of the social network, encourage compliance with local rules and customs and reduce the need for formal controls" Ouchi, (1980:139). Ouchi (1980:140) thus argues that "team-based organisations benefit from lower monitoring costs and higher commitment". Nelson's (1989) study of inter-team ties in organisations supports this argument. Nelson (1989:3) shows that "frequent interactions between teams permit faster dispute resolution and prevent the accumulation of grievances and grudges".

Krackhardt and Hanson (1993:107) observed a third informal benefit of social capital in that "a trust network can transmit more sensitive and richer information compared to other types of networks. The benefit was observed because of the solidarity that a trust network instils in its members". "Important forms of solidarity can also emerge from weak ties, or at least weak ties that bridge otherwise unconnected teams" Hansen, (1999:233).

Several organisations with highly cohesive sub-units have all displayed similar attributes in that managers tend to be less absorbed by narrow-minded conflicts (Jokismovic et al., 2018). This then results in managers being more attentive to the organisation's over-arching goals (Jokismovic et al., 2018).

6.8 Conclusion

Social capital plays an important role in communication, both physical and virtual (Golnaz and Conida, 2012). While social capital is not guaranteed as an output of communication and collaboration processes, it has been observed positively in organisations that promote communication (Lipnack and Stamps, 1997; Jokismovic et al., 2018). Taking this a step further, social capital has become a very important part of the organisation as new skills and knowledge can be obtained through the acquisition of social capital (Ouchi, 1980). Social capital can occur in both formal and informal communication and collaboration environments (Nebus, 1998; Fleming et al., 2005). While social capital is very difficult to measure as it is often subjective in its result sets (Boström, 2002), several studies have confirmed that there are diverse benefits that an organisation can gain from obtaining increased amounts of social capital (Krackhardt and Hanson, 1993; Uzzi, 1997). Through Chapter 6, sub problem 3 has been addressed through the identification of what is meant by social capital and how this impacts on the successful

functioning of a virtual team. Further, Chapter 6 also highlighted that key to social capital are the concepts of informal collaboration and their place within the organisation (Hansen, 1999). These concepts will be further investigated in Chapter 7, which follows, and will be added to the already identified factors in Chapters 2, 3, 4 and 5 to completely address sub problem 2.

Chapter 7 – Informal Collaboration

Through the factors already identified through Chapters 2, 3, 4 and 5, and in quantification of sub problem 2, Chapter 7 will investigate how these factors can support and encourage informal communication and collaboration within an organisation. The investigations of Chapter 7 will provide the conclusion of the investigation for sub problem 2 in defining what is meant by formal and informal collaboration and describing the role that informal collaboration plays in the successful functioning of a team. Chapter 7 will now quantity and investigate informal collaboration following which, the factors from sub problem 2 will be considered in Chapter 8 in addressing sub problem 4 of this research.

7.1 Introduction

In most organisations, networks flourish spontaneously due to human nature (Huxham, 2015). "This nature includes mutual self-interest which leads individuals to share ideas and work together even when they are not required to do so" Huxham, (2015:1038). "As these individuals connect around shared interests and knowledge, they build networks that can range in size from less than a dozen to in excess of hundreds of people" Lom and Sullenger, (2011:56).

Most organisations have several differing informal networks (Mcloughlin *et al*., 2018). These networks organise and reorganise themselves and extend their reach in several ways using several various technologies available in the marketplace (Huxham, 2015). "As networks widen and deepen, they can mobilise talent and knowledge across the enterprise" Mcloughlin et al., (2018:139). These networks thus form the basis for informal collaboration.

The main assumption in the concept of informal collaboration is that "individuals rarely have sufficient resources to pursue their activities and reach their goals" Lom and Sullenger, (2011:56). Thus, collaboration is needed in order to exchange resources with others (Mcloughlin et al., 2018). "This collaboration can be in the form of providing resources that are abundant and\or acquiring others that are scarce. It has been noted that the more resources an individual is able to gather, the more likely it is that they will accomplish their goals or improve their performance" Mcloughlin et al., (2018:139). "The above forms the base of the resource exchange theory which is particularly helpful in exploring collaboration in organisations where multiple individuals interact to reach their individual goals, both formally and informally" Huxham, (2015:1039).

"Both organisational and technological concepts shape the context in which informal collaboration occurs" Whitley, (2000:5). "Interactions may be the consequence of formal interactions and/or cooperation or they may occur in a more informal way" Huxham, (2015:1040). In both cases, these "interactions usually entail some form of knowledge and/or information exchange between the individuals involved" Whitley, (2000:6).

"Collaboration can become very complex and as such, organisations may require the integration of several specific types of knowledge and therefore they need to interact with several individuals at the same time" Lom and Sullenger, (2011:57). This is achieved through the use of networks where different information sources reinforce each other in a complementary way (Whitley, 2000).

7.2 Network Formation

A collaborative network is a network which is made up of several individuals that have similar goals, operating environments and social capital (Rodriguez *et al*., 2018). These networks are largely autonomous and geographically dispersed (Rodriguez *et al*., 2018). The key feature of a collaborative network is the fact that they collaborate to better achieve common goals by making use of interactions that are supported by computer technologies (Huxham, 2015).

To better understand collaborative networks, it is necessary to understand how they are formed (Mcloughlin *et al*., 2018). Simply put, "a collaborative network is a community in which occasions for personalised encounters abound" Rethmeyer, (2005:118). "Critically, the number of occasions for personal encounters is an important contextual condition for the emergence of collaboration" Mcloughlin *et al*., (2018:140). To contextualise network formation, a model of network formation was developed by Parung and Bititci (2008) and is summarised as follows: "Stage one is characterised by the discovery of collaborative opportunities; stage two by the exploration of these opportunities; and stage three by the crystallisation of collaborative relations" Parung and Bititci, (2008:657).

7.2.1 Stage One: Discovery of Collaborative Opportunities

"Any personal encounter is occasioned one way or the other" Rethmeyer, (2005:118). Parung and Bititci (2008:658) have observed that "individuals of several different communities seize any occasion and routinely exploit it as an opportunity for sharing information". "Gossip, current visions, research ideas, work plans and concerns are the kinds of information which are literally shared" Parung and Bititci, (2008:658). "Such institutionalised behaviour may be part of the opening and closing' rituals which normally envelop the official business and methods

of interaction; or it may reflect a conscious effort to inform and be informed by the majority of community members" Parung and Bititci, (2008:658-659). In either case, as a result, "each individual of the community stays in touch, personally and intellectually, with a rather large and diverse group of individuals" Parung and Bititci, (2008:670).

Due to "personal encounters being used as an opportunity for sharing of information, these encounters are the breeding grounds for new ideas and commitments" Rethmeyer, (2005: 119). "In the process of mutually sharing all sorts of information, new meaning and significance may suddenly surface" Mcloughlin *et al.,* (2018:140). Unexpectedly, individuals begin working together informally based on the information shared (Parung and Bititci, 2008). This working together thus forms the basis of collaboration (Parung and Bititci, 2008).

7.2.2 Stage Two: Exploration of Collaborative Opportunities

At this stage, the feasibility of collaboration begins to be understood (Parung and Bititci, 2008). Initial substantiation of the network and its individuals begins. "As the loose ideas from the information exchange in the network gradually become substantiated, and more firmly conceived, shared 'projects' materialise" Parung and Bititci, (2008:670). "At this stage the community will start to recognise that something more than just networking is taking place. Collaboration may now be claimed to exist" Parung and Bititci, (2008:670-671).

7.2.3 Stage Three: Crystallisation of Collaborative Relations

"Once the collaboration of stage one becomes known within the wider community, a different kind of dynamic becomes apparent" Parung and Bititci, (2008:671). "The informal network acts as a 'centre of gravity', in the sense that the attention and effort of other individuals is attracted" Berardo, (2009:522). "The result is an intensification of information exchange around the collaboration network itself" Parung and Bititci, (2008:672). Subsequently, it has been observed that there is an increased likelihood that further links and ideas will be created. "Collaboration breeds collaboration, and the collaborative relations expand in multiple directions, adding new individuals and new content to the network" Parung and Bititci, (2008:672).

From the model, it is evident that much collaboration emerges from purely accidental opportunities (Parung and Bititci, 2008). This type of collaboration is more commonly known as informal collaboration (Parung and Bititci, 2008). "An unplanned co-presence at an event can provide the occasion and opportunity for sharing information which can result in the whole process eventually engaging individuals in close collaboration" Rethmeyer, (2005:119).

Importantly, individuals did not consciously attend the event with informal collaboration intent, nor interact during the event with such precise intentions (Berardo, 2009). Regardless of this lack of intent, there was still an observed discovery of a potential collaborative partner based on the context of the interactions as per the study from Parung and Bititci (2008).

The study by Parung and Bititci (2008:674) also focused on "the ways in which networks tend to attract more individuals and grow in complexity". Interestingly, individuals will engage in normal behaviour whether or not informal collaboration networks exist. This normal behaviour includes the continued search for opportunities in which information can be shared, and the assumption that any other individual can and might join the network in a collaborative sense (Parung and Bititci, 2008). What has been noted to change after a network has been formed, is that new information now gets circulated amongst the relevant individuals (Parung and Bititci, 2008) ; Mcloughlin *et al.,* 2018). "In the process of sharing this information, other individuals may collaborate and discover a possible role in the network" Parung and Bititci, (2008:674).

Summarising network formation begins with the fact that networks are based on the individuals that are loosely coupled and variable in number (Mcloughlin *et al*., 2018). "Normally, the individual's interaction is free, driven more by informal opportunities than by precise intentions and organisational strategies" Parung and Bititci, (2008:672). "When occasionally shared 'projects' emerge, interactions crystallise into something more durable, committing forms of relationships and networks" Mcloughlin *et al.*, (2018:138). "On such occasions, elements of structure and order can be recognised, if only temporarily. While they exist, these crystallised relationships act as 'centres of gravity', in the sense that they seem to attract more individuals, more often than not resulting in the quite complex formations of collaboration" Parung and Bititci, (2008:671-674). However, it is important to "add that first, many such 'centres of gravity' exist at any point in time, and second, being part of one such 'crystal' of collaboration does not seem to prevent (in terms of time or loyalty) any individual from participating fully in any other current stream of interaction and collaboration" (Rethmeyer, 2005; Parung and Bititci, 2008).

7.3 Measuring Networks

"When an organisation is able to harness and balance both formal and informal structures, they have the potential to create an organisation that is more efficient and innovative compared to the norm" Rethmeyer, (2005:118). "However, even though individual employees may be able

to identify local patterns of collaboration, broader configurations of informal collaboration tend to be far less visible to the organisation as a whole" Huxham, (2015:1039).

"Network survey and analysis allows an organisation to gather a wide range of data from individuals about their collaborations" Lin Russel, Knutson, and Crowley, (2013:260) — "for example, where they look for information and expertise, which individuals they engage with on routine decision making and how much time they invest in specific collaborations" Lin Russel, Knutson, and Crowley, (2013:260-262).

"In addition to providing critical information about the network, network analysis also helps an organisation to detect structural problems" Mcloughlin *et al*., (2018:140). "When organisations are able to understand the broad patterns of informal collaboration and what makes for effective networks, an opportunity exists to reduce collaborative costs and network inefficiencies" Lin Russel, Knutson and Crowley, (2013:262-263). An organisation can work to improve collaboration networks in four critical ways:

1. **"Attain benefits of scale through effective global collaboration:** Organisations can construct virtual teams to leverage diverse expertise and drive adoption of new ideas across geographies. By carefully studying collaboration challenges across functions and geographies, they can identify gaps and enhance productivity and best practice in targeted ways".
2. **"Drive work force engagement and performance:** Uncovering the network characteristics of high performers can show individuals, who play similar roles, how to improve their own performance. This can also help leaders identify the individuals who energise the organisation and how to leverage their contributions".
3. **"Align collaboration with business partners and external stakeholders:** organisations need to know how effectively their functions serve the needs of business stakeholders. By creating a detailed map of the existing cross-departmental relationships, they can see where innovations are occurring, where sufficient support is being provided and where investments should be made".
4. **"Minimise network inefficiencies and costs:** Although collaboration is often seen as a virtue, too much collaboration at too many organisational levels can be a negative. It is important to reduce network connectivity at points where collaboration fails to produce sufficient value".

Parung and Bititci, (2008).

Clearly, in order for the improvement of collaboration networks to be measured, a metric need be established to compare the results of the collaboration network. Parung and Bititci (2008), make use of the IDEF0 (IDEF-zero: (Icam DEFinition for Function Modelling, where 'Icam' is an acronym for Integrated Computer Aided Manufacturing)) technique (Maull, Childe,

Bennett, Weaver and Smart, 1995; Ross and Schoman, 1977) "in the development of metric for collaborative network systems. IDEF0 is one of the IDEF families that is widely accepted as one of the process analysis tools". According to Ross and Schoman (1977:9), "the IDEF0 modelling is used to analyse whole systems as a set of interrelated activities or functions".

Parung and Bititci (2008) illustrate five elements of the IDEF0 model as displayed in Figure 7.4 below. The figure "shows the IDEF0 basic model that might be modified in different applications. The activity (or process) of the basic model is represented by the box. Inputs are shown as arrows entering the left side of the activity box, while the outputs are shown as exiting arrows on the right-hand side of the box. The arrows flowing into the top portion of the box represent constraints or controls of the activities. Mechanisms are displayed as arrows entering from the bottom of the box. These arrows also defined as ICOM's, the acronym of Inputs, Controls, Outputs and Mechanisms. According to Pandya *et al.* (1997), IDEF0 should be easy to use to understand how the model works because it only consists of a few symbols, just arrows and boxes" Parung and Bititci, (2008:654-659).
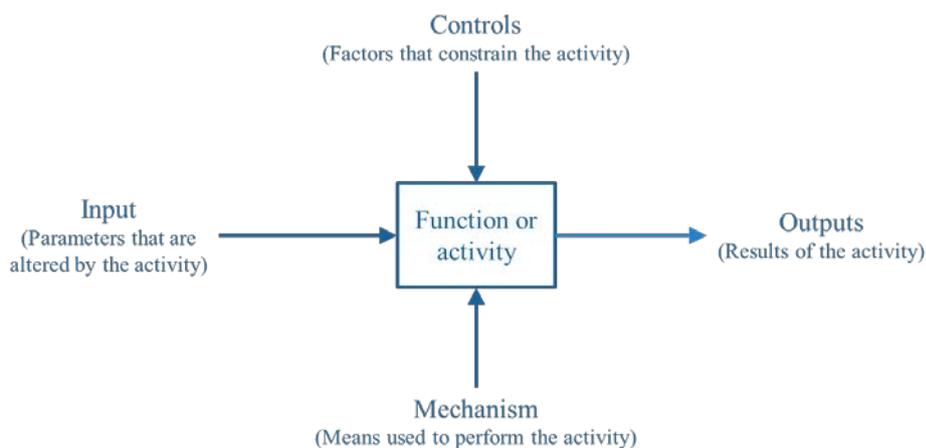
Figure 7.4: IDEF0 Basic Model

Application of IDEF0 into a collaborative network system measure as per Parung and Bititci (2008) is shown in Figure 7.5 below. "This figure shows a structured representation of the functions and processes in a collaborative network. Inputs for creating value activities in the collaborative network are contribution resources from partners. Outputs of the activities are added value for stakeholders. Mechanisms to the activities are inter-organisational attributes, and control for the activities is collaboration agreements between partners. Inputs of the collaborative network are transformed into defined outputs using the relationships attributes as mechanism under the agreements as constraints of the network. In this case, IDEF0 becomes a

suitable tool for visualisation of a complex collaboration system" Parung and Bititci (2008:655-670).
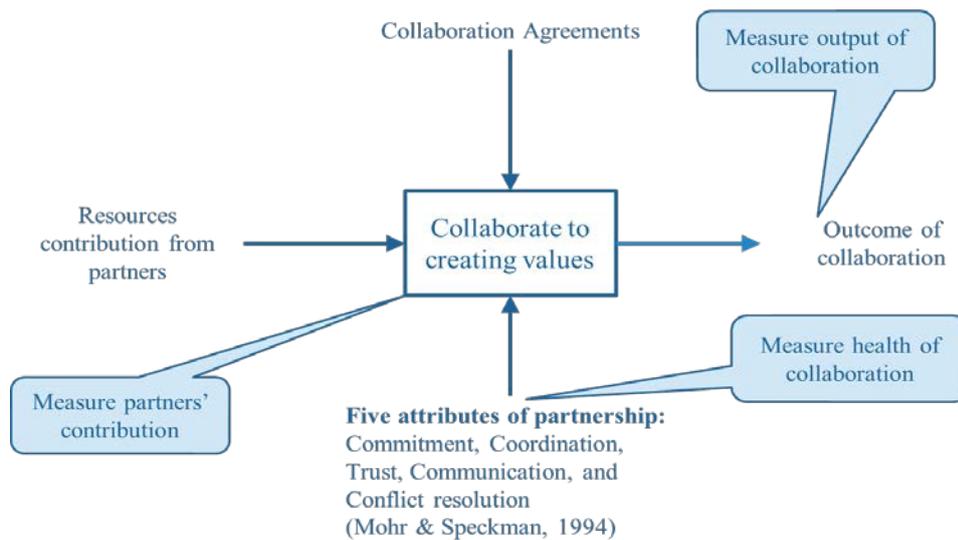
Figure 7.5: IDEF0 Applied Model

7.4 Measuring the Contribution

As outlined above, "the main inputs to the model for creating value activities in the collaborative network are the contribution of its partners" Parung and Bititci (2008:669). Das and Teng (1998:22) stated that "participants could contribute in four critical resources; physical, financial, technology and managerial resources". Gulati and Singh (1998:789) believe that "partners bring capital, technology, or partner's specific assets", while Edvinsson (1997:5) stated that "intellectual and social capital are as important as financial capital in providing truly sustainable earnings for an organisation".

In addition, work by Edvinsson and Malone (1997) and Mouritsen, Larsen and Bukh (2001) "declare social capital as a significant factor in increasing companies' values". "Social capital consists of human capital, relational capital and organisational capital" Pablos, (2002:293). "Human capital is the abilities that individuals bring to an organisation" Mcloughlin *et al.*, (2018:138). "Relational capital is the value of an organisation's relationships with its customers" (Edvinsson and Malone, 1997; Mcloughlin *et al.*, 2018). "Organisational capital or structural capital institutionalises an individual as an organisational asset with the use of the following tools: databases, computer networks, patents, and so on" Pablos, (2002:293-294).

This research is focused on the concepts that generate value for an informal collaborative network, and the term 'value generators' will be used. "Value generators can be categorised into financial assets, physical assets, human capital, relational capital and organisational

capital" Pablos, (2002:294). The difficulty lies in how to measure individuals' contributions. Thus, a "conceptual methodology to measure participants' contribution in collaborative networks was developed" by Parung and Bititci (2008) and is explained below.

7.5 The Process of Measuring Contributions

Measuring an individuals' contribution is a clearly defined problem and "involves multiple, potentially conflicting, participants' goals, and it is likely to involve a large number of factors to be considered" Parung and Bititci (2008:655). Thus, Parung and Bititci (2008:655) suggest "the process of measuring participants' contribution by the use of a formal and systematic procedure in the decision-making process, using one of the multi-criteria decision aids". According to Berardo (2009:522), "all problems and decisions are multi-criteria in nature; multi-criteria analysis begins when an individual feels that the issue matter enough to explore the potential of formal modelling". To measure an individuals' contribution in an informal collaborative network Pablos (2002) proposes using multi-criteria decision aids in the form of the Analytic Hierarchy Process (AHP).

"Even though it has attracted some controversy; the application of the AHP as a decision aid in various fields is continued" Huxham, (2015:1039). In this research, the AHP was selected "due to its simplicity and ease of implementation resulting from the user-friendly software" Parung and Bititci, (2008:656) and inclusion of qualitative and quantitative factors. The AHP structures the decision problem in levels, which correspond to:

- "Understanding of the situation"
- "Goals, criteria"
- "Sub criteria"
- "And alternatives"

Parung and Bititci, (2008)

"By breaking down problems into levels, the decision maker can focus on smaller sets of decisions" Saaty, (1980:3). "From paired comparisons made on the basis of the individual's beliefs, available facts, attitudes and other attributes, a scale of relative priorities can be derived for elements in a group that share a common property in the hierarchy" Rethmeyer, (2005:119).

"The AHP derives scales for each level, and these are transferred into the ratio scales, which are made corresponding to the hierarchical weighing process. The expressions of qualitative judgments and preferences are expressed in appropriate linguistic designations associated with the numerical scale values in order to get a meaningful outcome" Saaty, (1980:2-4). "This method can also be applied for establishing parameter weights in the hierarchical structure of

environmental effects at each level. A scale of importance estimation has verbal judgements ranging from equal to extreme importance: equal, moderately, strong, very strong and extremely important. The numerical judgments corresponding to these linguistic descriptions are (1, 3, 5, 7, 9), with compromises (2, 4, 6, 8) between these judgments" Saaty, (1980:2-5). "The AHP uses the principal eigenvector (weight vector) to solve the problem of deriving the ensemble-resultant weights from the weight ratio matrix" Saaty, (1980:5).

"To start the measuring process, a problem is decomposed into a multi-level hierarchical structure, which is comprised of value generators and their factors" Saaty, (1980:5). "The second step is to prioritise the value generators and factors" Saaty, (1980:5). The AHP has been used in this research to" demonstrate the process of weighing value generators and factors in an informal collaborative network. All value generators and factors are weighted using pair-wise comparisons with respect to the mutual objectives" Parung and Bititci, (2008:656-657). "The third step is to assess the individuals' contribution in each factor. In this step, partners take part in the discussion in order to make assessment about partner's contributions of each factor for the past collaboration 'project'. Before making an assessment, partners must define a contribution rating of each factor [Very strong contribution; Strong contribution; Moderate contribution; Poor contribution; No contribution at all]. Each rating corresponds to the numerical values [1.00; 0.75; 0.50; 0.25; 0.00]. The last step is to measure individuals' contribution. All of the paths that lead from the top of the hierarchy to the participant performance are identified. Then all of the weights in each path are multiplied together and the results for different paths are added in order to calculate the contribution of each participant organisation" Saaty, (1980:5-6).

"The AHP tool attracted much criticism from authors who have questioned its underlying axioms, inconsistencies imposed by a one to nine scale and meaningfulness of responses to questions" Watson and Freeling, (1982:6). Further, Belton and Gear (1983, 1985) revealed that "AHP could suffer from rank reversal". Belton and Gear have also argued that the "AHP lacks a firm theoretical basis". According to Dyer (1990a: 276, b: 252): "The defences of these criticisms have been provided", for example, by Saaty and Vargas (1984), Harker and Vargas (1987, 1990) and then Saaty (1990). These authors "presented theoretical works and examples of the application of the AHP. They also remarked that the AHP is based upon a firm theoretical foundation. They argued with examples in the literature and the day-to-day operations of various fields that the AHP is a viable and usable decision-making tool".

7.6 Measuring the Outcomes of the Collaborative Network

"Earlier work on the measurement for inter-organisational relationships namely collaboration, focuses on performance measures" Rethmeyer, (2005:119). Some works desire qualitative measures, like the work on satisfaction by (Mjoen and Tallman, 1997), while others desire quantitative measures, such as profit, revenues and cost by (Lom and Sullenger, 2011).

However, "due to the multifaceted objectives of most organisations, it is difficult to measure informal collaboration performance in a single criterion" (Gulati and Singh, 1998; Mcloughlin *et al*., 2018). The outcome of the collaboration usually associates with the performance of the individuals associated with the collaboration (Mcloughlin *et al*., 2018). In a simple perspective, "performance measurement is often linked to the efficiency and effectiveness of an organisation to satisfy its customers" Neely, (1999:207). Effectiveness can be seen to refer to the extent to which "organisational informal collaboration requirements are met, while efficiency is a measure of how economically the organisations resources are utilised when providing a given level of informal collaboration" (Rethmeyer, 2005; Mcloughlin *et al*., 2018).

Logically, an "informal collaborative network is one "virtual" organisation, although it is formed from several virtual teams" Rethmeyer, (2005:120). Therefore, "all performance measurement systems for an individual organisation can be applied to an informal collaborative network organisation with some modification, including the balanced scorecard methodology" (Lin Russel, Knutson and Crowley, 2013). Through the balanced scorecard methodology, "informal collaborative networks can measure their financial and non-financial values for customers, employees and shareholders" Berardo, (2009:529). "In order to evaluate individuals' benefits in participating in informal collaborative networks, output measurement before and after the informal collaboration should be obtained" Berardo, (2009:529-530). Following this, Parung and Bititci (2008:660) observe that "it is beneficial for an organisation if its output after informally collaborating is greater than the outputs before informally collaborating".

7.7 Benefits to the Organisation

"The substantial increase in demand for "knowledge workers" has created and will continue to create a "skills gap" in the economy, because this type of demand already exceeds the available supply of qualified workers" Berardo, (2009:530). Other factors include "the confluence of an aging workforce, declining job security and the continued demand by industry for a more flexible workforce, which has led to a considerable emphasis on the importance of informal

collaboration in the organisation" Berardo, (2009:531). Participating in informal collaborations is one of the increasingly popular strategies for organisations to gain access to complementary resources, to share risk and cost, and to promote better opportunities (Rethmeyer, 2005; Mcloughlin *et al.,* 2018). Several benefits can be observed by an organisation engaging in informal collaboration as per Berardo (2009), and these benefits can be grouped into two main concepts as follows:

7.7.1 Building Lateral Networks

Rethmeyer (2005) and Berardo (2009) show how" virtual teams addressed cross-organisational issues and because they were composed of employees from around the world, team members were able to gain visibility both within their teams and externally". "Network analysis from the study showed that team members were more frequently sought out for their expertise and insights, and that others in the organization often turned to them to discuss new opportunities or to solve difficult problems" Huxham (2015:1040). As a result, "individuals participating in virtual teams were fifty-five percent more likely to be cited as top performers during the organisation's annual performance review process than those who didn't participate" Berardo, (2009:531).

7.7.2 Reducing Network Silos

The research by Berardo (2009) also indicates that network analysis can also help an organisation to assess the health of cross-organisational collaboration, while also suggesting improvement opportunities. The same study confirmed that "having a detailed view of the networks of connections among team members provided the organisation with a variety of options for altering the configurations and dynamics of virtual teams to make them more successful" Berardo, (2009:531-532). "In determining the best intervention strategies for a particular virtual team, it is helpful to be able to visualise the existing network configuration" Mcloughlin *et al*., (2018:141). "For example, in a forty-person team made up of fragmented subgroups that were only sparsely connected, improving collaboration efficiently meant finding ways to connect the "peripheral connectors" — that is, individuals who linked two or three other members to the rest of the team. That meant identifying a small number of new connections that would have the biggest positive impact on team connectivity (without overburdening the most central connectors or creating major collaboration burdens for other team members)" Parung and Bititci, (2008: 658).

7.8 Conclusion

From Chapter 7, it is evident that most organisations place a large emphasis on the process of network formation (Huxham, 2015; Mcloughlin *et al.,* 2018). These networks help to bring individuals together with the aim of achieving a common goal that would otherwise be impossible due mainly to geographical dispersion (Lom and Sullenger, 2011). Measuring networks has become increasingly difficult due to the number of factors available to measure (Rethmeyer, 2005; Parung and Bititci, 2008; Berardo, 2009). Thus, as Parung and Bititci (2008) suggest, an applied version of the IDEF0 model in conjunction with the AHP can be effectively used to measure both the network and the contributions made therein. Measuring the outcome of these collaborative networks can lead to several benefits to organisations which can be increasingly built on if the same process is repeatedly followed (Berardo, 2009 ; Lin Russel, Knutson and Crowley, 2013).

With Chapter 7 concluding the investigation into sub problem 2 of this research, it is important to highlight several factors that were raised in Chapter 5. These factors will now be combined with the factors from the investigation into sub problem 2 and Chapter 8 will address sub problem 4 of this research in investigating a commercial technology-mediated communication system, to evaluate what attributes of such a system support informal communication and collaboration amongst virtual teams.

Chapter 8 - Virtual Collaboration Technologies in Support of Virtual Teams

Through the identification and quantification of sub problem 2 (Chapters 4, 5 and 7) of this research, several factors have been identified in the definition of what is meant by formal and informal collaboration. There has also been articulation of the role that informal collaboration plays in the successful functioning of teams. Chapter 8 will now investigate the required technologies that will enable virtual collaboration and communication to be facilitated in the organisation. Where the technologies are available, Chapter 8 will also investigate if the technologies are suitable for addressing a virtual team's collaboration needs. Thus, the investigations in Chapter 8 will be used to address sub problem 4 of this research, after which, a current Developed Framework for this research will be constructed in Chapter 9.

8.1 Introduction

Virtual collaboration is supported by several types of technologies, both synchronous and asynchronous, and real-time systems (Riemer and Frößler, 2007; Seagate Technology LLC, 2014a; Mei *et al*., 2018). The challenge to most organisations is how to identify and successfully implement the appropriate technologies in the most efficient manner (Mei *et al*., 2018). Key factors have been identified and most virtual collaboration systems will provide the basics. Teams can often derive additional functionality use from a system, based solely on the finer points of differentiation between two systems (Otubanjo *et al.,* 2010). UCSs also offer a wide range of seamlessly integrated applications which are able to address most organisational needs (Jackson and Welch, 2007; Seagate Technology LLC, 2014a; Mei *et al*., 2018).

8.2 Features for Virtual Collaboration Technology

Through several case studies, (Sarker and Sahay, 2003; Williams *et al.*, 2006; Rutter *et al.*, 2009; Mei *et al*., 2018), a generic list of suggested features has been developed in order to appropriately facilitate virtual collaboration and the infrastructure it requires. In terms of infrastructure, it would be desirable for organisations to have a central collaboration area which is always available for users to create and share objects in (Mei *et al*., 2018). This would also lead to a virtual system being able to support some sort of shared context (Mei *et al*., 2018).

High-speed connectivity on the Local Area Network (LAN) is required. A speed of at least 100Mb/s is expected while a broadband Internet connection of at least 4Mb/s is a definite necessity (Sarker and Sahay, 2003; Giakoumis, Mavridou, Votis, Giannoutakis, Tzovaras, and Hassapis, 2015). Back-up, recovery, email and scheduling facilities in terms of physical servers

would also be essential to the effective implementation of virtual collaboration technologies (Mei *et al*., 2018). High definition web cameras and available sound devices also need to be installed for users of the systems so that they can utilise both audio and video functionality of the systems (Sarker and Sahay, 2003; Williams *et al.*, 2006; Rutter *et al*., 2009; Baird, Mayer and Smyth, 2013; Mei *et al*., 2018).

Once the physical requirements are met, it is suggested that optimal virtual collaboration systems would contain most of the following features as part of their offering:

- In order to achieve successful message delivery, it is necessary to guarantee the availability of the message recipients. This guaranteed availability will also ensure that interactions can take place without hindrance (Ahmed, 2007).

- Translucence in the form of a "glancing" feature should be made available to establish what the user is currently engaged with and whether it is appropriate for them to be interrupted (Riemer and Frößler, 2007). In the case of the user being unavailable for interaction, message leaving abilities should be incorporated to facilitate interaction at a later time or date.

- A presence setting should be available from which a user can specify their current activity and level to which they are available to be interrupted (Jackson and Welch, 2007; Baird, Mayer and Smyth, 2013). Video should be used in conjunction with the presence function to further facilitate the translucence abilities of the system. Thus, the system should be symmetrical in terms of interaction and warn users before the interaction occurs.

- The storing of conversations, usually in the central collaboration area, should be made possible to serve as both a form of minutes and as a source of context regeneration (Schauer, 2008). Object availability and processing should be made available, such as screen sharing, document interaction and seamless email capabilities (Mei *et al*., 2018).

- Where possible, recognition of "public" places should be facilitated with privacy and access controls being integrated system wide, with a single sign-on type of facility (Schauer, 2008). Integrated IM, desktop video, and video and audio-conferencing functions should also be included. Wireless Voice over IP and IP-enabled contact centres would future-proof the organisation to some degree (Serçe *et al.,* 2011).

Table 8.4: Summary of Required Technologies

Summary of required technologies:	Details
• High speed LAN connectivity	Not less than 100Mb/s
• Broadband internet connection	At least 4Mb/s
• Backup and recovery facilities	
• Email and scheduling facilities	
• High Definition web cameras and coupled sound devices such as microphones and speakers	

Table 8.5: Summary of Virtual Collaboration Features

Summary of virtual collaboration system features:
Representation of availability of recipients
Translucence in the form of "glancing"
Message leaving abilities
Presence settings
Video
Symmetrical design for interaction between users (two-way communication)
Ability to store conversations
Object availability and processing
Instant Messaging
Conferencing facilities
Wireless voice over IP
IP enabled contact centres
Recognition of public places (security controls)

8.3 Unified Communication Technologies

While the previous section introduced the individual features considered appropriate for supporting virtual team collaboration, the following section introduces Unified Communication Technologies (UCS). UCSs typically offer an integrated solution with many of the aforementioned features and capabilities (Mei *et al*., 2018). In terms of this research, the following UCSs have been identified which would be able to meet the majority of the above requirements. These systems are: Microsoft Skype for Business, Cisco Jabber, and IBM Lotus Sametime. The systems have been developed by large corporations to address the needs of their employees and subsequently, outside users, in their attempt to further facilitate virtual collaboration and interaction.

UCSs were chosen in this research as they were able to provide the simplest corporate solution to the problem of seamlessly integrating several applications to achieve the complete range of virtual collaboration functionality needed to conduct the research (Jackson and Welch, 2007; Schauer, 2008; Baird, Mayer and Smyth, 2013; Mei *et al*., 2018).

8.4 How the Technologies Address Users' Needs

Unified communication is commonly understood to consist of telephony, IM, video, multimedia conferencing and application sharing (Jackson and Welch, 2007; Mei *et al*., 2018). These elements form the 'core platform' of the technology and can be combined with the powerful communication and collaboration concept of presence (Jackson and Welch, 2007; Flores *et al.,* 2009). In a relatively short space of time, organisations have evolved from tolerating the Internet, to reinventing themselves as E-Businesses using Internet technologies. This change was brought about by network convergence, the concept where voice, video and data are all combined onto a single Internet Protocol (IP) (Jackson and Welch, 2007; Mei *et al*., 2018). From this convergence, communications are seen to be always-on, implying a level of reliability not generally associated with general purpose business applications such as email (Seagate Technology LLC, 2014b).

Unified communication has also inspired communication convergence, where the full potential of IP multimedia networking is leveraged to make a significant change in the way people communicate and collaborate (Schauer, 2008; Mei *et al*., 2018). A rich inter-human web has now become apparent due to the role communication convergence has played in enriching how users communicate and collaborate in the real-time virtual organisation (Jackson and Welch, 2007).

In turn, unified communication has also led to application convergence, where business has been transformed by extending the unified communications offering to encompass a broad range of business applications including customer service, supply chain management, enterprise resource planning and work flow systems (Schauer, 2008).

On the whole the technologies are able to meet the user's needs as they develop (Mei *et al*., 2018). However, much emphasis is placed on the outcomes of the use of virtual collaboration technologies rather than on the development of the technologies themselves (Mei *et al*., 2018). The shift in the marketplace is now for the technologies to become more readily able to facilitate a user's needs. This shift enables a user to be more proactive rather than responsive with regard to virtual communication and collaboration (Rutter *et al.*, 2009; Seagate Technology LLC, 2014a).

8.5 Unified Communication Technology Comparative Features

While there are many different standalone tools that maybe integrated to support virtual team collaboration (Jackson and Welch, 2007), this research has already discussed under limitations, that it is specifically looking at the role that UCSs play in support of virtual team collaboration in general, and more specifically informal collaboration amongst virtual team members. As such, Table 8.3 will detail each identified technology and compare the feature set of each (Seagate Technology LLC, 2014a; Seagate Technology LLC, 2014b; Mei *et al*., 2018).

While the list of UCSs in Table 8.6 is not exhaustive, they represent some of the most commonly used tools. Also indicated in Table 8.6 overleaf, are many features common to the three solutions identified.

Table 8.6: Comparison of Unified Communications Technology Features

Features	Skype for Business	Cisco Jabber	IBM Lotus Sametime
Video conferencing	- Group HD video meetings - Turn instant messaging conversation or audio call into video call - Add participants mid video call - Record audio and video in meetings - Toggle between full window and compact version - Interoperable with other vendors' video teleconferencing systems	- Softphone with group HD video calling/meetings - Video calls can be placed to other UC clients or other standards-based video endpoints like a video conference room - Desk phone video - Expand video to full screen - Add contacts to video call - Start video call within IM	- Web conferences/Instant Meetings - Third-party telephony (e.g., click-to-call) or multi-way video - Video chat (native point-to-point video)
Voice	- Check audio quality before call - Use computer mic and speakers or headset for audio device - Switch audio device mid call - Make calls with desk phone - Call holding, forwarding, muting - Rate call quality - Call contacts from Word	- IP voice volume control - Transfer from desktop to mobile without interruption - Add others to call - Add video - Visual voicemail - Call transfer, holding and muting	- Use computer mic and speakers or headset for audio device - Make calls with desk phone - Transfer from desktop to mobile without interruption
IM and Presence	- Group IM - Add contacts mid conversation - Manage multiple IM conversations at once - Add audio, video and share files via IM - Automatically saves IM history; view or continue previous IMs - Presence based on Outlook calendar - Stress message importance - IM within a meeting - If someone calls, you can start an IM instead of taking call	- Manage multiple IM sessions at once - Group or individual chat within or outside your organization - Presence automatically changes - Rich presence - IM and presence capabilities across other IM clients - Message history kept between you and each contact -- voice messages, calls, emails - Move from IM to text, call, email or start WebEx meeting - Custom presence status capability	- Presence - Instant Messaging chat - N-way chat - Chat history - Business card display - Spell Check
Sharing and Collaboration	- Share desktop and programs during meeting - Hand control of desktop to others in meeting so they can make changes to files	- Desktop and file sharing lets others view content on your screen for real-time collaboration - VPN-less remote access	- Multiple Sametime communities - Set geographic location - Screen capture tool - Send File (File Transfer)

	• Select which participants can download shared files		
Meetings and Scheduling	• Check contacts' availability before scheduling meeting • Set meeting restrictions on participants • Schedule meetings in Outlook • Join meetings from desktop and Web browsers • Up to 250 people in meetings	• Launch WebEx sessions from calendar view • Reminder pop-ups for meetings • Escalate to WebEx meeting from Jabber • Contact search	• Reminder pop-ups for meetings • Join meetings from desktop and Web browsers
Platforms	• Android, iOS, Mac, Windows and Web clients	• Android, BlackBerry, iOS, Mac, Windows	• Android, iOS, Mac, Windows and Web clients
Interoperability	• Interoperability with third-party dial-in conferencing providers • Integrates with Office apps and consumer Skype	• Integrated with Microsoft Outlook and SharePoint • Initiate communications within desktop apps • Jabber SDK available	• Full Sametime client or any external clients • Sametime Toolkits (including embedded IM through ST Links)

8.6 Corporate and Freeware Tools

While the above technologies may present a solution to the virtual collaboration requirements of a virtual team, the type of technology can often have a major impact on the decision to adopt it (McRoberts, 2014). As such, a comparison must be done in order to determine the appropriate licensing model for a technology in the form of a corporate or freeware tool (Messmer, 2004; McRoberts, 2014). Differentiating between these different types of tools is of vital importance. Organisations must understand the differing attributes of each tool platform, and only then will they be able to understand the limitations and abilities of each tool they wish to implement (Peterson, 2000).

8.6.1 Corporate Tools

Corporate tools can be defined as "a collection of tools with common business application, aimed at modelling how the organisation works, and for facilitating the unique way in which every organisation works" Mears (2004: 8). "Corporate tools are aimed at solving organisation-wide problems and also look to improve the organisation's productivity and efficiency by providing business logic support and functionality to users of the tools" (Feller *et al.,* 2001; Giakoumis, *et al.*, 2015).

Corporate tools have recently been forced to adapt their business strategies and development cycles to compete with what are essentially "free" products (Messmer, 2004). To compete effectively against these types of products, corporate tools have to develop a product that provides a higher value as perceived by their users, so they can charge a price for the tool (Giakoumis, *et al.*, 2015). This is the core attribute of all corporate tools and will be further elaborated on below.

To make corporate tools attractive to users, product decisions are made by the corporate tool's development team which determine the tool's features and associated benefits that the users will receive (Messmer, 2004). This also means that the tool's developers will associate a price with the product which may or may not be market related. These decisions all affect the adoption of the tool in the market and the profits of the tool (Mears, 2004; Giakoumis, *et al.*, 2015).

Corporate tools are thus aimed enterprise-wide and with the entire user-base in-mind (Giakoumis, *et al.*, 2015). Corporate tools aim to meet all of the business' requirements rather than just a subset as is the case with freely available tools (Roberts *et al.,* 2006). Corporate tools have a big drawcard in the fact that they have large support divisions which can rectify user's problems and provide support for the chosen tool(s) (Feller *et al.,* 2001).

8.6.2 Freeware Tools

While freeware tools are easily available to an organisation, it should be remembered that certain limitations on the tools may exist (Feller *et al.,* 2001). With most freeware tools, there is no guarantee that the developers will continue with their development of the tool (Feller *et al.,* 2001). There is also no assurance that the tool's developers have a roadmap for adopting the tool in future situations. Freeware is also not certain to develop in the way the organisation may need it to (McRoberts, 2014).

From this, freeware tools are obviously aimed at specific situations rather than organisational-wide implementation (Feller *et al.,* 2001). Freeware tools thus differ from corporate tools due to how and why they are selected and implemented. Essential to how and why corporate/freeware tools are implemented is the concept of licensing as explained below (Messmer 2004; McRoberts, 2014; Giakoumis *et al.*, 2015).

8.7 Tool Selection and Motivation

A research survey of one hundred and forty North American organisations conducted by Roberts *et al.* (2006) found that forty-six percent of respondents were using open source software and fourteen percent had planned to bring open source into their data centres. "Thirty-nine percent of the companies surveyed said they had no plans for open source software, citing lack of skills and lack of support as primary inhibitors" Roberts *et al.,* (2006:986).

From this it can be seen that while the software itself may be free, there are costs associated with the service and support, the efforts to bring internal IT staff up to speed on new technology, and the integration challenges with existing infrastructure (Lee and Mendelson, 2008; Giakoumis *et al.*, 2015).

The bottom line is that open source software should be evaluated in the same way as any commercial offering (Roberts *et al.,* 2006). Traditionally, most organisations are relatively slow to adopt change and have extensive tool evaluation periods. Thus, while many organisations may be making use of freeware tools, corporate tools still dominate the market (Roberts *et al.,* 2006).

For the purposes of this study, a corporate tool has been selected due to a number of reasons. Key amongst these reasons was the fact that corporate tools and environments provide a stable base in which to conduct a research experiment (Giakoumis *et al.*, 2015). Corporate tools are also facilitated organisation wide and all users have access to these tools (Roberts *et al.,* 2006).

A corporate tool was also chosen because of the support available to both the users as well as the researchers so as to provide effective and accurate research outputs. Corporate tools are generally used

holistically, and this should help to ensure that users do in fact make use of the tool so as not to skew the results of the research (Peterson, 2000).

The chosen corporate tool and its functionality are detailed below.

8.8 Microsoft Skype for Business

It was decided to make use of the Microsoft Skype for Business UCS, not only because of its vast range of features that are able to address many of the topics raised in this research paper, but also because of the dominance that Microsoft has in the South African marketplace. As a result, several organisations have already implemented and are using the technology which makes conducting the research more feasible.

The Microsoft Skype for Business platform is prevalent amongst large organisations in the South African market and has been successfully integrated with many existing Microsoft products which users are familiar with. A detailed discussion of the product and its features follow:

8.8.1 Introduction

After the initial installation of the client software, a user is presented with the following home screen. The screen is designed along the lines of both Microsoft Office Communicator (Skype for Business's predecessor) and MSN Messenger.
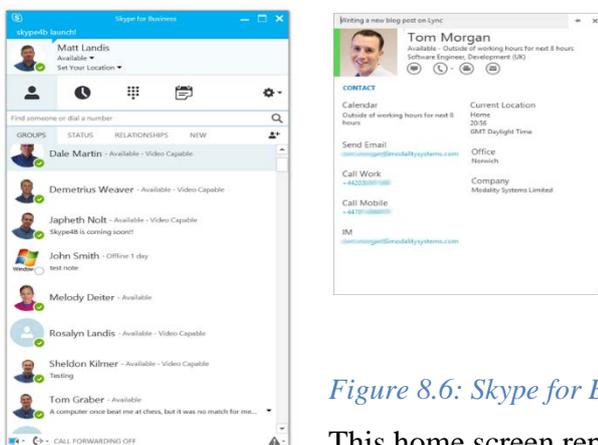
Figure 8.6: Skype for Business Contacts Screen

This home screen represents all of the available contacts within the network, and a detailed contact card is available when a user hovers over a particular contact. The coloured indicators on the sides of the profile pictures indicate a user's current presence settings. Green indicates that a user is available for interaction, yellow indicating that a user is away from their desk, and red indicating a user is engaged in an interaction and wishes not to be disturbed.

The top of the home screen is the user's own personal settings, where both a social status and physical location may be entered. The four tabs on the screen represent the contacts of the users, the social updates that other users have posted, current conversations the user is engaged in, and the final tab

representing the Microsoft Exchange integration with the related emailing and enterprise voice features (if installed).

8.8.2 Capabilities

To investigate the capabilities of the system, a number of scenarios were developed to test each of the aforementioned functions. The first scenario was the Instant Messaging (IM) scenario. Both users involved in the IM exchange can interact via the text function incorporated within Skype for Business. The IM function can also handle file transfer as illustrated below:
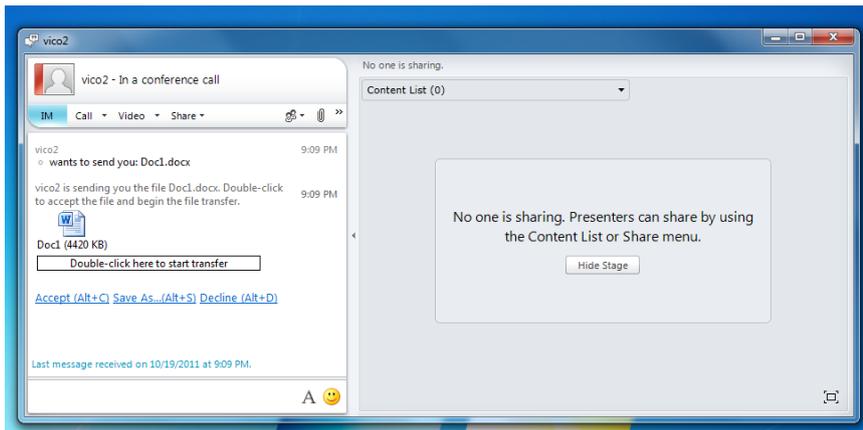
Figure 8.7: Instant Messaging Screen with File Transfer

Following this, the IM can be transformed into a video chat by selecting the video tab and enabling the video feed for each user. Skype for Business illustrates its unification abilities by enabling video and audio, as well as IM to be incorporated in the same interaction. The video call can have several more users added to it, causing it to become a video conference with minimal effort. The focus of control can be granted to specific users based on their level of interaction in the current video conference. The user who initiated the interaction can specify which users are presenters and which users are just attendees.
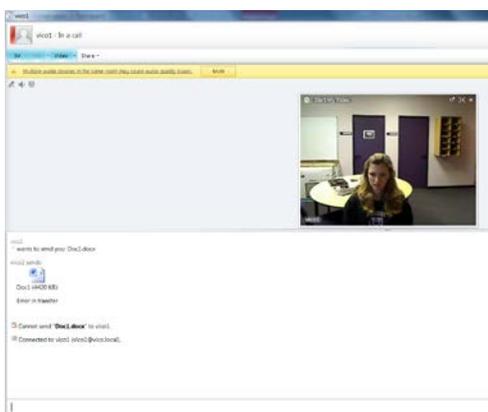
Figure 8.8: Instant Messaging Screen with integrated video

Should the interaction require it, features such as a whiteboard can be added to the interaction where participants may collaborate centrally on the shared whiteboard as displayed below:
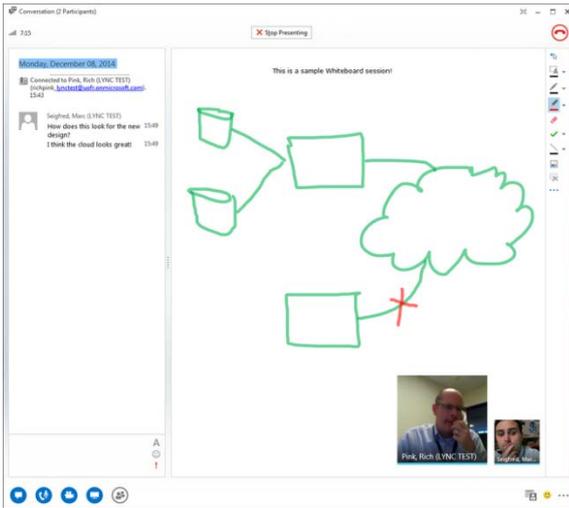
Figure 8.9: Skype for Business Whiteboard screen

Participants are thus able to add their contributions to a central collaboration space and each user is responsible for their own contributions. The whiteboard and all of its additions can be saved and distributed seamlessly through the Microsoft Exchange integration for future work and comment. The left-hand side illustrates the participants in the interactions and the drop-down list shows all of the available interactions that the user is currently engaged in. A further example of a collaborative interaction is the poll feature. This feature can be used to decide on a course of action in a democratic way. An example follows:
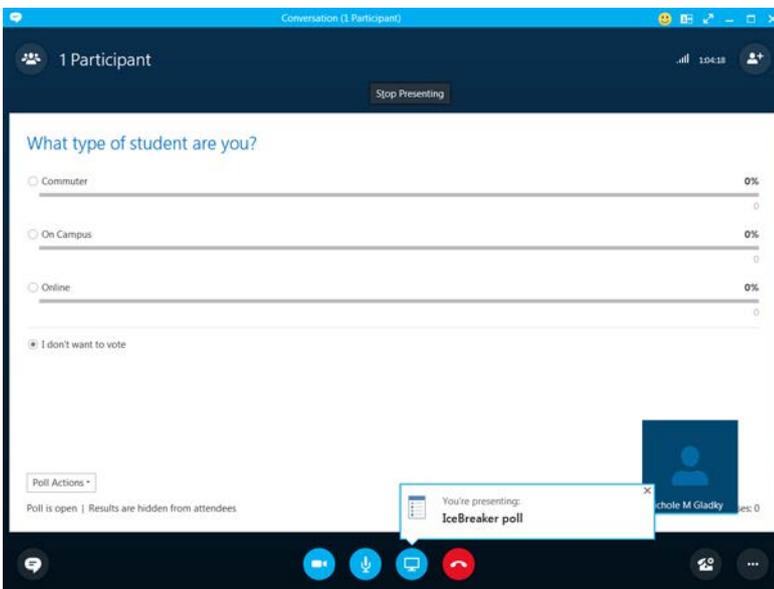
Figure 8.10: Skype for Business poll Option

The customised poll can be created and shared instantly with all of the participants having the chance to vote as illustrated below:
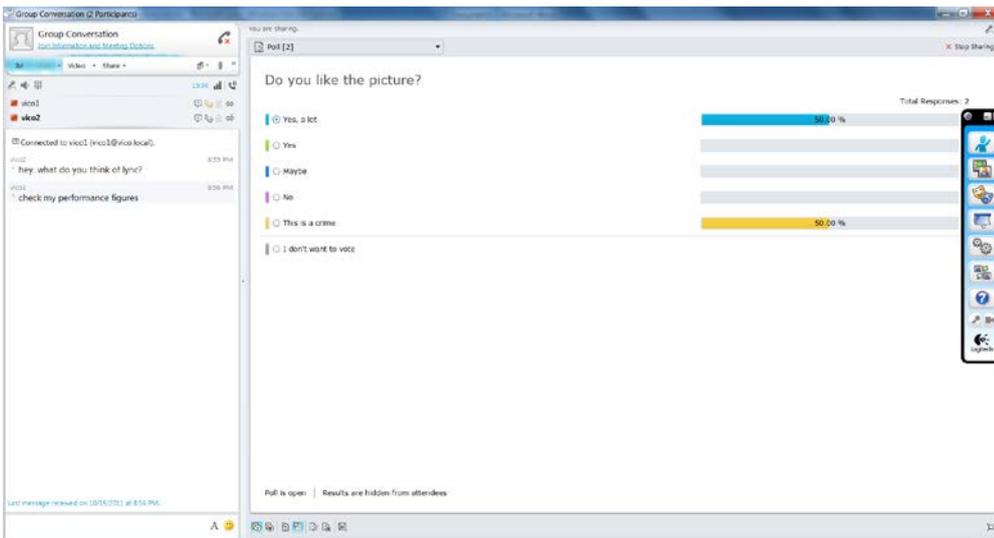
Figure 8.11: Skype for Business Poll Results

Results of the poll can be hidden from certain members to ensure that confidentially and anonymity is kept. Further sharing objects includes sharing of a user's desktop and specific programs. Both of these options include a control function where the user who initially shares their desktop or program may grant another user the right to directly interact with environment. This can be seen as the giving and getting of help function as specified in the literature review earlier. The sharing of a desktop and/or program would look as follows:
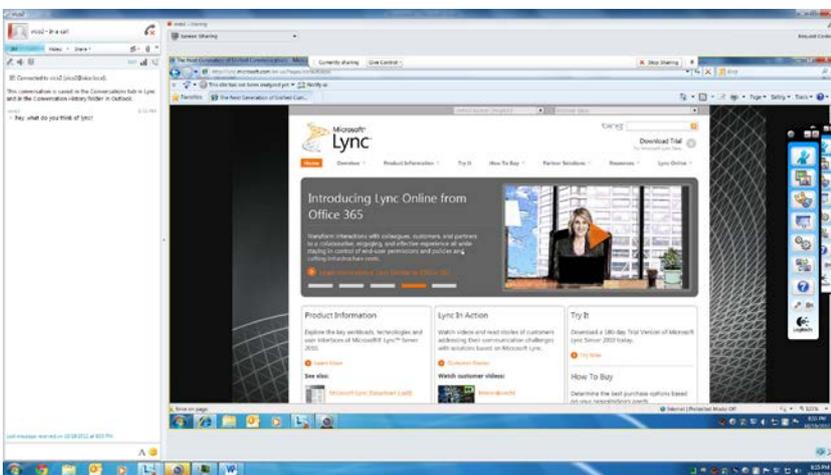
Figure 8.12: Skype for Business Desktop Sharing Screen

The control function is located centrally at the top of the screen and the initiating user may regain control of the interaction at any time. To demonstrate how Skype for Business integrates with other Microsoft products, Microsoft Word was opened and under the Review tab, two tabs (Share Now and Send by IM) have been added. These tabs link directly to the related functions in Skype for Business and as an example, if a user were to click on the Send by IM tab; they would be presented with the following screen:
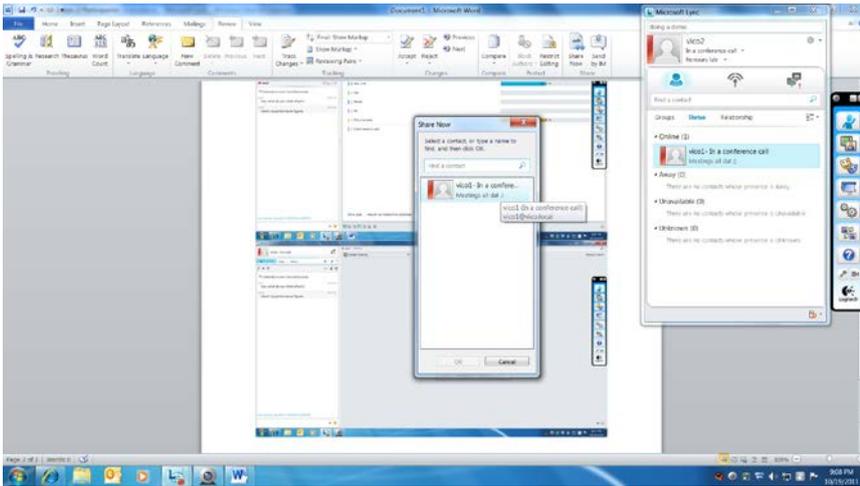
Figure 8.13: File Transfer and Collaboration from within Microsoft Word

From this screen, a user is easily able to share their document and send it to a user(s) of choice. The Share Now tab works in exactly the same way except that Skype for Business will share the Microsoft Word application and the specified users will be able to directly interact and collaborate with the document.

8.8.3 Reliability

Many organisations have claimed that reliability is now a major factor in the determination of which software they ought to invest in. A preliminary reliability benchmark was conducted on the Skype for Business environment and the following was observed. A full HD video and audio interaction was left on-going for the period of one week. The interaction was monitored three times daily to ensure that there was no lag experienced and that the interaction was still performing optimally. During the period, the connection was never dropped and even though the allocated bandwidth varied slightly, Skype for Business was able to maintain the interaction without lag or loss of quality. Next, the system was left unattended for a period of three weeks. During this time the test was aimed to discover if the server was stable without the input from a user. After the period, all four machines were still running and had not leaked memory or shut down for any reason whatsoever. This was considered impressive and it would indicate that the Skype for Business server is reliable and does not require vast amounts of human interaction to maintain the server and ensure that it has optimal uptime. The Skype for Business client application also includes some reliability features. For example, when multiple audio output devices are detected, the software attempts to compensate for the echo and notifies the user of the actions it is taking. This helps to ensure that the user will experience the most optimal interaction possible. Skype for Business also scales down the quality of the video interactions when connection and bandwidth restrictions are experienced. Skype for Business will even skip certain video frames to ensure that the video output and audio output match each other.

8.8.4 Integration

Microsoft Skype for Business as a platform is a UCS with fully integrated functionality. As an alternative, there are several freeware tools available to achieve subsets of the same functionality. Some of the tools that could complete the same functionality as Microsoft Skype for Business are as follows:

Table 8.7: Alternative Tools and Technologies

Tool	Functionality Achieved
TeamViewer	Collaborative environment and desktop sharing
Google Talk	Instant messaging
Dropbox	File collaboration and sharing

From this, it can be observed that while freeware tools may address specific problems, corporate tools are better suited to address organisational problems holistically and seamlessly. Choosing a corporate tool will enable many features to be available, creating a seamless experience when compared to their freeware counterparts.

8.9 Conclusion

In conclusion it can be observed that virtual collaboration technologies are dominated by unified communications solutions because of the way in which they are able to remove the barriers between, voice, email, conferencing, video, and IM (Jackson and Welch, 2007; Schauer, 2008; Baird, Mayer and Smyth, 2013; Mei et al., 2018). This has allowed for instantaneous people-to-people communications (Sarker and Sahay, 2003). As a result, a reduced decision time is experienced with increased levels of productivity and the ability to provide simple and consistent user experiences across several mediums of communication (Jackson and Welch, 2007). There is no one-size-fits-all solution with regards to a unified communications solution (Seagate Technology LLC, 2014b; Mei et al., 2018). Consequently, much time needs to be spent on understanding which steps to follow to effectively execute a full-scale deployment across the organisation, minimising risk and cost to the organisation (Jackson and Welch, 2007). While virtual collaboration seems to be the obvious way forward, it must be noted that the Internet did not achieve its influence over human forms of communication overnight (Seagate Technology LLC, 2014b). There was a slow but steady adoption period where the use of email and other web-based tools began to gain popularity and familiarity (Rutter *et al*., 2009). As people increasingly began to use these tools, the more the technologies became embedded in the user's lives (Seagate Technology LLC, 2014a; Mei et al., 2018). Those early adopters of the web-based tools were able to gain a significant advantage over later adopters in terms of familiarity and optimal methods of use for the available tools (Serçe *et al.,* 2011).

With the factors identified in Chapter 8 and in quantification of sub problem 4 of this research, a unified communications tool was chosen for this research. A description and motivation of the tool will be provided based in the current Developed Framework that follows in Chapter 9, and through components of the research methodology detailed in Chapter 10. Chapter 9 will now consolidate the results of the investigations into sub problems 1, 2, 3 and 4 of this research and construct them into a current Developed Framework.

Chapter 9 – Current Developed Framework

Chapters 2 through 8 provided a literature review based around the 4 sub problems of this research, and ultimately in determination of the thesis of this research: Implementing a UCS will be effective in supporting informal communication and collaboration in virtual teams by promoting and encouraging the benefits derived by an organisation from the use of a technology-aided informal communication and collaboration solution. Chapter 9 will now present the current Developed Framework which has been constructed through the identification and quantification of several factors of the 4 sub problems of this research. Following Chapter 9, Chapter 10 will be used to detail the research methodology that will be used to evaluate the thesis of this research against the current Developed Framework of Chapter 9.

9.1 Introduction

This chapter will be used to craft a current Developed Framework in support of informal communication and collaboration and to reflect current virtual communication and collaboration environments in association with virtual teams, as reviewed in the literature. This current framework will form the basis of a case study with the aim of investigating whether a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. The findings of the literature review chapters are thus combined to create a current Developed Framework. The concepts from each of the above chapters have been summarised below before being tabulated for later comparison.

9.2 Sub Problem 1

To address the initial sub problem of describing what is meant by a virtual team and identifying the communication challenges peculiar to virtual teams, several concepts were detailed. The base component of this research was communication as it forms one of the core components of human interaction. Human communication comprises a system of symbols that collectively form a language (Conway, 1995: 327). Languages usually use patterns of sound or gestures to enable communication with others (Röcker, 2012: 1-15). Communication in its simplest form is the flow of symbols, which represent information between communicants or groups of communicants (Röcker, 2012: 1-15; Harris, 2018).

Communication is found to occur both formally and informally (Conway, 1995: 327). As such, in Chapter 2, research by Hurford, (2008) presented a set of results from previous formal communication experimentation. The results are summarised below:

Communication as a process is key to this research and Kratzer, Gemünden *et al.* (2008) illustrate how formal communication forms a core component of any firm, team, and/or interaction. Fay and Kline (2008) confirmed that formal communication on the whole can be divided into several groups as follows:

- "Scheduled"
- "Intended"
- "Opportunistic"
- "Spontaneous"

Fay and Kline (2008)

Informal communication is a spontaneous form of formal communication, and due to its qualitative nature, is very difficult to model accurately (Johnson *et al.,* 1994). Crampton *et al.* (1998) argue that the following points are common to all informal communication models:

- "Informal communication is: frequent, brief, unscheduled, dyadic"
- "Supported by shared objects"
- "Lacking in formal openings or closings"
- "Dependant on physical proximity"

Crampton *et al.* (1998)

In terms of the organisation, informal communication is involved in several areas, and promotes both cohesiveness and unity within the organisation (Lawson *et al.,* 2009; Harris, 2018). Function-wise, (Johnson *et al.,* 1994) explain how informal communication may perform several of the following functions:

- "Tracking people"
- "Taking or leaving messages ("covering")"
- "Making meeting arrangements (commitment plans of others)"
- "Delivering documents (check actions associated with the document)"
- "Giving or getting help (spontaneous offers of help)"
- "Reporting progress and news (updates about relevant information)"

Johnson *et al.,* (1994)

A second concept raised to address the sub problem was that of modern and virtual teams. Since the industrial revolution, teams have been evolving and becoming increasingly important in the organisation (Lamont, 2010). Teams are now constantly being redefined so as to best serve the organisation (Harris, 2018). These redefinitions now focus on including the best possible members (Lamont, 2010). With the rapid advancement of technology, teams face another form of redefinition. Current definitions now principally include the fact that distance is no longer a factor in team make-up (Olaniran, 2008; Harris, 2018).

Chapter 3 used findings from the following authors: Lamont (2010), Ubell (2010), and Serçe *et al.* (2011) to suggest the factors and composition of modern teams both physical and virtual. These combined factors will form a key component for the current Developed Framework and are detailed below:

Traditionally, process improvement has been the major aim of most organisations (Lamont, 2010). However, recent trends have suggested that the greatest performance and organisational gains can be achieved through effective teams (Ahmed, 2007; Glikson and Erez, 2019).

Modern teams have embraced technology and use it to their advantage to flatten the structure of these teams (Noran *et al.*, 2014). Functional requirements now dictate who forms part of the team regardless of the distance between members (Lea, 1997; Glikson and Erez, 2019).

(Otubanjo *et al.,* 2010) suggest the following as examples of teams which are likely to be found in most organisations:

- "Scheduled"
- "Cross functional (cross organisational boundaries)"
- "Peer (networks between people of the same profession)"
- "External (partners outside the organisation)"
- "Project"

Otubanjo *et al.* (2010)

Ubell (2010), describes how the peer team has evolved to the point where organisations now contain several virtual teams. These virtual teams are not co-located and interact mainly though technological means (Williams *et al.*, 2006; Ubell, 2010).

It is critical for an organisation to negate distance as a factor if they are looking to create virtual teams (Ubell, 2010). In so doing, the organisation will be able to leverage the benefits that virtual teams have to offer (Ubell, 2010; Glikson and Erez, 2019). Achieving effective teams is often difficult as several barriers are apparent (Bonvillain, 2019). Serçe, (2011) describes the four main barriers of distance, as follows:

- "Structural"
- "Social"
- "Technical"
- "Legal factors"

Serçe, (2011)

9.3 Sub Problem 2

This sub problem examined what is meant by formal and informal collaboration and described the role that informal collaboration plays in the successful functioning of a team. In Chapter 4 Johnson *et al.* (1994), Crampton *et al.* (1998), and Lawson *et al.* (2009) presented their findings on informal and formal communication in the organisation. These findings suggest that:

Formal and informal communication are relatively well-established concepts. Through technology and virtualisation, they have been adapted and amended to the point where we now have virtual communication and collaboration being more prominent concepts.

Ubell (2010) states that virtual communication enables many individuals to virtually collaborate on several assignments and projects in both a synchronous and an asynchronous fashion.

Virtual collaboration usually occurs when:

- "Teams of a distributed nature interact"
- "Two or more non-co-located people work towards a common goal"
- "Communication occurs without the use of face-to-face interaction"

Lamont (2010)

Lawson, *et al.* (2009) indicates that the following concepts are both critical to virtual collaboration and its successful utilisation:

- "Sharing"
- "Shared context"

Lawson, *et al.* (2009)

In terms of sharing, virtual collaboration enables dynamic innovation and creativity without the need for co-location in physical environments, while, shared context enables past knowledge of previous interactions to be available to organise and shape current interactions (Lawson, *et al.,* 2009; Mcloughlin *et al*., 2018).

As discussed in Chapter 5, Isaacs *et al.* (2008), suggests several key points in relation to a virtual system and its support of informal communication and collaboration. The points are as follows:

- "Availability of recipients needs to be guaranteed"
- ""Glancing" function should be present to enable speedy connection establishment"
- "Message leaving abilities should be present"
- "Recognition of public places should be facilitated"
- "Video should be used to maintain presence settings"
- "The system should be symmetrical about interaction and warn users before interaction can occur"

- "The storing of conversation should be made possible"
- "Document availability and processing should be present"
- "Privacy and access controls should be incorporated"

Isaacs *et al.* (2008)

From the sub problem definition, it was necessary to discuss the concept of virtual collaboration. Lamont (2010), Ubell (2010), Serçe *et al.* (2011), and Mcloughlin *et al.*, (2018) suggest findings on virtual communication and collaboration as presented in Chapter 5. After reviewing the literature, the current Developed Framework was expanded to include the suggested factors. Some of these factors include:

A collaborative network is a network which is made up of several individuals that have similar goals, operating environments and social capital (Huxham, 2015). These networks are formed through three stages:

- "Stage one: discovery of collaborative opportunities"
- "Stage two: exploration of collaborative opportunities"
- "Stage three: crystallisation of collaborative relations"

Huxham (2015)

Improving collaboration can be achieved in a number of ways as suggested by Lin Russel, Knutson, and Crowley (2013), below:

- "Attain benefits of scale through effective global collaboration"
- "Drive work force engagement and performance"
- "Align collaboration with business partners and external stakeholders"
- "Minimise network inefficiencies and costs"

Lin Russel, Knutson, and Crowley (2013)

Participants in informal collaboration were observed to contribute in the follow ways as per Das and Teng (1998):

- "Physical resources"
- "Financial resources"
- "Technology resources"
- "Managerial resources"

Das and Teng (1998)

Parung and Bititci (2008) suggested four steps for measuring informal networks and their associated collaborations:

- "A problem is decomposed into a multi-level hierarchical structure, which is comprised of value generators and their factors"

- "Prioritise the value generators and factors"
- "Assess the individuals' contribution in each factor"
- "Measure the individuals' contribution"

Parung and Bititci (2008)

Finally, Berardo (2009) demonstrated that the following two categories of organisational benefits may be experienced when informal collaboration occurs in an organisation:

- "Building Lateral Networks"
- "Reducing Network Silos"

Berardo (2009)

The final leg of the sub problem included informal collaboration. Thus, in Chapter 7, informal collaboration and network formation was detailed by Rethmeyer (2005), Huxham (2015), and Mcloughlin *et al*., (2018). Network and collaboration measurement was then explained by Parung and Bititci (2008). Berardo (2009) concluded Chapter 7 by explaining the benefits an organisation can experience from informal collaboration. These factors as described below are included in the current Developed Framework.

Informal collaboration is based on network formation which begins with the fact that networks are based on individuals that are loosely coupled and variable in number (Mcloughlin *et al*., 2018). "Normally, the individual's interaction is free, driven more by informal opportunities than by precise intentions and organisational strategies" Parung and Bititci, (2008:656).

"Both organisational and technological concepts shape the context in which informal collaboration occurs" Whitley, (2000:4). "Interactions may be the consequence of formal interactions and/or cooperation, or they may occur in a more informal way" Parung and Bititci, (2008:656). In both cases, these interactions usually entail some form of knowledge and/or information exchange between the individuals involved (Parung and Bititci, 2008; Mcloughlin *et al*., 2018).

Most organisations have several differing informal networks (Mcloughlin *et al*., 2018). "These networks organise and reorganise themselves and extend their reach in several ways using several various commercial technologies" Huxham, (2015:1039). "As networks widen and deepen, they can mobilise talent and knowledge across the enterprise" Mcloughlin *et al*., (2018:138). These networks thus form the basis for informal collaboration. The main assumption "in the concept of informal collaboration is that individuals rarely have sufficient resources to pursue their activities and reach their goals" Lom and Sullenger, (2011:56).

Through several case studies, (Sarkern and Sahay, 2003; Williams *et al.*, 2006; Rutter *et al.*, 2009; Mei *et al.*, 2018), a generic list of suggested features has been developed in order to appropriately facilitate virtual collaboration and the infrastructure it requires:

- "High speed LAN connectivity"
- "Broadband internet connection"
- "Backup and recovery facilities"
- "Email and scheduling facilities"
- "High Definition web cameras and coupled sound devices"

Sarkern and Sahay (2003); Williams *et al.* (2006); Rutter *et al.* (2009); Mei *et al.*, (2018)

Schauer, (2008) summarises a list of virtual collaboration system features as follows:

- "Guarantee of availability of recipients"
- "Translucence in the form of "glancing""
- "Message leaving abilities"
- "Presence settings"
- "Video"
- "Symmetrical design about interaction between users"
- "Ability to store conversations"
- "Object availability and processing"
- "Instant Messaging"
- "Conferencing facilities"
- "Wireless voice over IP"
- "IP enabled contact centres"
- "Recognition of public places (security controls)"

Schauer (2008)

"Unified communication is commonly understood to consist of telephony, IM, video, multimedia conferencing and application sharing, combined with the powerful concept of presence" (Flores *et al.,* 2009; Mei *et al.*, 2018).

Measuring an individual's contribution in a virtual team is a clearly defined problem and "involves multiple, potentially conflicting, participant goals, and it is likely to involve a large number of factors to be considered" Rethmeyer, (2005:119). Thus, Parung and Bititci (2008:659) suggest "the process of measuring participant's contribution by use of a formal and systematic procedures in the decision-making process, using one of the multi-criteria decision aids". According to Berardo (2009:526), "all problems and decisions are multi-criteria in nature; multi-criteria analysis begins when an individual feels that the issue matters enough to explore the potential of formal modelling".

To begin measuring the effectiveness of informal collaboration, there is a need to contextualise network formation, in the form of a model of network formation as developed by Parung and Bititci (2008:656-659) and is summarised as follows: "Stage one is characterised by the discovery of collaborative opportunities; stage two by the exploration of these opportunities; and stage three by the crystallisation of collaborative relations". Based on this model, measuring an individuals' contribution in an informal collaborative network, Pablos (2002) proposes using multi-criteria decision aids in the form of the AHP. Following this, Parung and Bititci (2008), make use of the IDEF0 technique (Ross and Schoman, 1977; Maull *et al.*, 1995) "in the development of a metric for collaborative network systems. IDEF0 is one of the IDEF families that is widely accepted as one of the process analysis tools". According to Ross and Schoman (1977:8), "the IDEF0 modelling is used to analyse whole systems as a set of interrelated activities or functions".

9.4 Sub Problem 3

This sub problem was primarily concerned with social capital, and how this impacts on the successful functioning of a virtual team and ultimately the organisation. The Social Capital concept was presented by Bullen and Onyx (1998) and Boström (2002) in Chapter 6. These concepts played a major role in the formation of the current Developed Framework as they have a major role in the communication process and collaboration environment, despite being largely external factors. The main contributing elements are detailed below.

"Social capital can be seen as the concept of a relationship with others; a link among individuals within a community of sorts" Boström, (2002:511). Thus, Social Capital is the glue that creates the bonds between communicants, whether they be communicating and collaboration formally, informally, or in the virtual space (Boström, 2002; Jokismovic *et al*., 2018).

Fishbach *et al.* (2009) illustrate that key to the concept of social capital are the factors of trust, communication and the network that it appears on. Bullen and Onyx (1998) illustrate how formal social capital requires planning and intentionality compared to informal social capital which has underlying motives and stresses the concept of sharing.

Social capital is also referred to "as an aggregate of actual or potential resources that arise from a durable network of institutional relationships of mutual acquaintances" Golnaz and Conida, (2012:22). This aggregation is a result of the sharing and shared context developed during the communication and collaboration processes of team members (Jokismovic *et al*., 2018).

Social Capital has been listed as having eight generic elements (Bullen and Onyx 1998):

- "Participation in the local community"
- "Proactivity in a social context"
- "Feelings of trust and safety"
- "Neighbourhood connections"
- "Connections to family and friends"
- "Tolerance of diversity"
- "Value of life"
- "Work connections"

Bullen and Onyx (1998)

As discussed in Chapter 6, Boström (2002) established a basic list of knowledge types that are common to most organisations, based on Social Capital generation, as listed below:

- "Embrained knowledge"
- "Embodied knowledge"
- "Encultured knowledge"
- "Embedded knowledge"
- "Encoded knowledge"

Boström (2002)

Social Capital generation is a greater challenge in virtual teams and is not always possible in an organisation. As such, the following barriers to creation exist (Nahapiet and Ghoshal, 1998):

- "Trust"
- "Organisational norms (cooperation)"
- "Obligations and expectations"
- "Race and culture"
- "Developing shared meanings"
- "Distance"

Nahapiet and Ghoshal, (1998)

9.5 Sub Problem 4

Sub problem 4 investigated and described a commercial technology mediated communication system in an attempt to highlight what attributes of such a system support informal communication and collaboration amongst virtual teams.

This sub problems was addressed in Chapter 8 which considered the currently available technology interventions and their ability to support the communication and collaboration challenges faced by virtual teams. These technologies will form the backbone of the current Developed Framework in terms of facilitating the informal collaboration concepts through a technological solution. Sarker and Sahay, (2003), Riemer and Frößler, (2007), Giakoumis *et al.* (2015), and Mei *et al.*, (2018), detail the

technologies available, the requirements of the technologies, and the way in which the technologies could address the informal communication and collaboration needs of virtual teams.

Through several case studies, (Sarker and Sahay, 2003; Williams *et al.*, 2006; Rutter *et al.*, 2009; Mei *et al.*, 2018), a generic list of suggested features has been developed in order to appropriately facilitate virtual collaboration and the infrastructure it requires. This list includes:

- "Guarantee of availability of recipients"
- "Translucence in the form of "glancing""
- "Message leaving abilities"
- "Presence settings"
- "Video"
- "Symmetrical design about interaction between users"
- "Ability to store conversations"
- "Object availability and processing"
- "Instant Messaging"
- "Conferencing facilities"
- "Wireless voice over IP"
- "IP enabled contact centres "
- "Recognition of public places (security controls)"

Sarker and Sahay (2003); Williams *et al.* (2006); Rutter *et al.* (2009)

In terms of infrastructure, it would be desirable for organisations to have a central collaboration area which is always available for users to create and share objects in (Sarker and Sahay, 2003; Mei *et al.*, 2018). This would also lead to a virtual system being able to generate some sort of shared context. This list includes:

- "High speed LAN connectivity"
- "Broadband internet connection"
- "Backup and recovery facilities"
- "Email and scheduling facilities"
- "High Definition web cameras and coupled sound devices such as microphones and speakers"

Jackson and Welch (2007); Schauer (2008); Baird, Mayer and Smyth (2013); Mei *et al.*, (2018).

To address the above requirements, unified communication technologies were suggested as they seemingly provide the simplest solution to the problem of seamlessly integrating several applications to achieve the complete range of virtual communication and collaboration functionality needed to conduct this research (Jackson and Welch, 2007; Schauer, 2008; Baird, Mayer and Smyth, 2013; Mei *et al.*, 2018). "Unified communication is commonly understood to consist of telephony, IM, video, multimedia conferencing and application sharing, combined with the powerful concept of presence" (Flores *et al.,* 2009; Mei *et al.*, 2018).

For the purposes of this study, a UCS was selected due to a number of reasons. Key amongst these reasons was the fact that corporate tools and environments provide a stable base in which to conduct a research experiment (Giakoumis, *et al.*, 2015). Corporate tools are also facilitated organisation wide and all users have access to the tools (Roberts *et al.,* 2006). A corporate tool was also chosen because of the support available to, not only, the users but also the researchers so as to provide a stable environment to conduct the research. Corporate tools are generally used holistically, and this should help to ensure that users do in fact make use of the tool so as not to skew the results of the research (Peterson, 2000).

9.6 Current Developed Framework

Table 9.8 provides a summary of issues raised in the literature and may be regarded as the current Developed Framework:

Table 9.8: Current Developed Framework Description

Factors identified in the literature review per sub problem with corresponding authors	Identified Factors	Grouping
Sub Problem 1: quantify what is meant by a virtual team and identify the communication challenges peculiar to virtual teams.		
Kratzer, Gemunden *et al.* **(2008) Fay and Kline (2008)**	• Scheduled • Intended • Opportunistic • Spontaneous	Communication Types
Kratzer, Gemunden *et al.* **(2008) Fay and Kline (2008)**	• Cross functional • Peer • External • Project	Communication Groups
Lawson, Peterson *et al.* **(2009) Ubell (2010) Bonvillain (2019)**	• Structural • Social • Technical • Legal	Communication Proximity
Otubanjo, Amujo *et al.* **(2010) Harris (2018)**	• Scheduled • Cross functional • Peer • External • Project	Organisational Team Types
Johnson, Donohue *et al.* **(1994) Crampton, Hodge** *et al.* **(1998) Lewis (2019)**	• Frequent, • Brief, • Unscheduled, • Dyadic • Supported by shared objects • Lacking in formal openings or closings • Dependant on physical proximity	Informal Communication
Johnson, Donohue *et al.* **(1994) Lewis (2019)**	• Tracking people, • Taking or leaving messages (covering) • Making meeting arrangements (commitment plans of others)	Informal Communication Functions

	• Delivering documents (check actions associated with the document) • Giving or getting help (spontaneous offers of help) • Reporting progress and news (updates about relevant information)	
Hurford, (2008) **Riemer and Frobler (2007)** **Rodriguez *et al*. (2018)**	• Operating environment • Virtual shared office • Opportunistic communication • User presence	Environment Conditions Effecting Communication
Hurford, (2008) **Rodriguez *et al*. (2018)**	• Low transmission lags • Integration	Shared Objects and Interactions in Communication
Sub problem 2: define what is meant by formal and informal collaboration and describe what the role that informal collaboration plays in the successful functioning of a team.		
Huxham (2015) **Mcloughlin *et al*. (2018)**	• stage one: discovery of collaborative opportunities • stage two: exploration of collaborative opportunities • stage three: crystallisation of collaborative relations	Network Formation
Das and Teng (1998	• Physical resources • Financial resources • technology resources • managerial resources	Participants Contribution Types
Lin Russel, Knutson, and Crowley (2013) **Mcloughlin *et al*. (2018)**	• Attain benefits of scale through effective global collaboration • Drive work force engagement and performance • Align collaboration with business partners and external stakeholders • Minimise network inefficiencies and costs	Effective Collaboration
Parung and Bititci (2008)	• A problem is decomposed into a multi-level hierarchical structure, which is comprised of value generators and their factors. • Prioritise the value generators and factors • Assess the individuals' contribution in each factor • Measure the individuals' contribution.	Measuring Informal Collaboration
Berardo (2009)	• Building Lateral Networks • Reducing Network Silos	Informal Collaboration Organisational Benefits
Sub problem 3: investigate what is meant by social capital and how this impacts on the successful functioning of a virtual team.		
Bostrom (2002)	• Embrained knowledge • Embodied knowledge • Encultured knowledge • Embedded knowledge • Encoded knowledge	Knowledge Types
Bullen and Onyx (1998) **Jokismovic *et al*. (2018)**	• Participation in the local community • Proactivity in a social context • Feelings of trust and safety • Neighbourhood connections • Connections to family and friends • Tolerance of diversity • Value of life • Work connections	Social Capital Components

Nahapiet and Ghoshal (1998)	• Trust • Organisational norms • Obligations and expectations • Race and culture • Developing shared meanings • Distance	Barriers to Social Capital Generation
Sub problem 4: investigate a commercial technology-mediated communication system to evaluate what attributes of such a system support informal communication and collaboration amongst virtual teams.		
Serce, Swigger, *et al.* (2011)	• ADSL • 3G • VOIP • Virtual collaboration software and workspaces	Technologies to Negate Distance as a Factor
Sarker and Sahay (2003) Williams *et al.* (2006) Rutter *et al.* (2009) Mei *et al.* (2018)	• High speed LAN connectivity • Broadband internet connection • Backup and recovery facilities • Email and scheduling facilities • High Definition web cameras and coupled sound devices	Virtual Collaboration Infrastructure Requirements
Schauer (2008) Glikson and Erez (2019) Mei *et al.* (2018)	• Guarantee of availability of recipients • Translucence in the form of "glancing" • Message leaving abilities • Presence settings • Video • Symmetrical design about interaction between users • Ability to store conversations Object availability and processing • Instant Messaging • Conferencing facilities • Wireless voice over IP • IP enabled contact centres • Recognition of public places (security controls)	Virtual Collaboration System Features

9.7 Conclusion

This chapter detailed each of the research sub problems and their associated factors. Following this, a current Developed Framework was proposed in order to evaluate the overall thesis of the research. Chapter 10 will now describe the methodology used to conduct the research and evaluate the current Developed Framework to determine the impact of whether a UCS intervention can be effective in supporting informal collaboration in virtual teams, in line with the thesis of this research. Chapter 11 and 12 will then follow with details of the survey instruments which will be executed to gather the required data to evaluate the thesis of this research.

Chapter 10 – Research Methodology

Chapter 9 presented the current Developed Framework in relation to this research. In order to validate this current Developed Framework, Chapter 10 will initially focus on a methodology to evaluate the Framework. Following this, a Mixed Method methodology will be used to evaluate the overall thesis of this research. Chapter 10 will thus detail the research design, methods and approaches used in collecting and analysing the data. Following Chapter 10, Chapters 11 and 12 will establish the data collection instruments that will be used to collect the respondent data for analysis and evaluation against the thesis of this research.

10.1 Introduction

Time has become an important commodity in modern business and as a result, the digital world now relies on virtual teams more than ever (Harris, 2018). Teams have evolved to the point where there is no longer a need for team members to be co-located, with a greater importance now being placed on the skills of individuals, rather than their location (Pridmore and Phillips-Wren, 2011: 284-285).

This research was conducted in two parts to ensure that a meaningful contribution of knowledge was established. Part 1 of the research focused on technically evaluating a UCS. Having explained the role and value of informal collaboration in virtual teams, during the current Developed Framework, several features were deemed necessary in a technology intervention for supporting virtual teams. Part 1 therefore, qualified a UCS for supporting virtual collaboration. Part 2 of this research investigated a different angle in the contribution(s) made by virtual teams and whether or not these contributions were beneficial to an organisation.

To consolidate the findings of both parts 1 and 2 of this research, a mixed method approach was used. This approach took the form of a case study where both qualitative and quantitative data collection and analysis was conducted. This hybrid approach facilitated the differing sets of data collected and created a holistic view and outcome to this research. This hybrid approach initially made use of a post-positive questionnaire that focused on determining whether the selected UCS met the informal communication and collaboration features identified in the literature and incorporated into the current Developed Framework. Following that, a mixed method comprising questionnaires and semi-structured interviews, coupled to content analysis was undertaken to evaluate the research thesis. Finally, a conclusion was drawn against the research thesis in the context of an overarching case study.

10.2 Part 1 – Evaluating the Unified Communications System

Part 1 of this research methodology represented the need to qualify a selected UCS for informal communication and collaboration. Based on the literature review, several key factors have been identified in this regard and are discussed in the following sections.

10.2.1 Research Methodology

A research methodology is a concept which addresses how a researcher discovers what they believe is known (Tennis, 2008). In a methodology, several techniques can be used to ensure that the required knowledge is available to ensure that trustworthy and reputable results are achieved. A research methodology will thus result in the generation of knowledge. For Part 1 of this research, a post-positivist methodology will be employed. This methodology typically employs the following techniques: surveys, and field and laboratory experiments (Tennis, 2008).

The evaluation of a UCS can be subjective, and in order to avoid any unnecessary confusion, a UCS tool has been pre-selected based on the preliminary results of this research's Literature Review. A survey, as discussed in Chapter 7, was used with a number of Likert scale questions to confirm that the selected tool is appropriate and supportive of this research. To ensure the output of the survey was definitive, the format of a typical Likert question response options was:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

The questions for this survey were targeted at establishing whether the selected UCS will adequately meet the needs, as highlighted in the Literature Review, to conduct Part 2 of this research. In this sense, the questions aimed to establish that:

- The tool will meet the required informal virtual communication and collaboration requirements of this research
- The tool will facilitate teaming
- The tool is available and implemented in the target organisation
- The outputs of the tool can, in some way, be measured

In order to proceed with Part 2 of the research, Part 1 was conducted and completed by the researcher. If the result of the survey was an aggregated response of "Agree" or stronger, it will be deemed successful and the research will continue. If the aggregated response of "Agree" or stronger was not achieved, the selected UCS will be deemed inappropriate for use in Part 2.

10.2.2 Research Technique

"The knowledge base provides the raw materials from and through which Information Systems (IS) research is accomplished ... methodologies provide guidelines used to confirm the results." (Hevner et al. 2004: 80). This principle was used in Part 1 where, knowledge was drawn upon from prior research and reference disciplines as is detailed in this research's Literature Review. This Literature Review then provided the necessary content to create and structure relevant and meaningful questions with which the survey for Part 1 was conducted. Questions were aimed at addressing highlighted requirements from the current Developed Framework ensuring they remain relevant within the overall thesis of this research.

The Literate Review identified that UCSs are a maturing sub-field of IS research. This field has witnessed a marked increase in research activity over the past ten years in both the academic and practical environments (Hurford (2008) Feller et al. (2001); Riemer and Frößler (2007); Lee and Mendelson (2008)). As a result, a decent amount of knowledge pertaining to technology, features and cost has accrued that can be drawn upon for this research. This knowledge base was summarised in the Literature Review and is assumed to present a holistic requirement for a UCS that could support the thesis of this research.

Two types of surveys as identified by Romm (2015) met the requirement for Part 1. These surveys are:

- Interviewer Administered
- Self-completion

Romm (2015)

10.2.3 Data Collection

Primary data for Part 1 of this research was collected by means of a purpose-built questionnaire. To ensure the consistency of the responses, the survey questions were conducted through the Likert Scale approach. "A Likert scale is a psychometric scale commonly involved in research that employs surveys. It is the most widely used approach to scaling responses in survey research" Reips and Funke, (2008:701).

For the purposes of Part 1, all questions used a five option Likert scale. This approach ensured that responses remained consistent and measurable. The approach also ensured that the relevance and quality of the selected UCS was validated before proceeding with Part 2. This validation ensured that the dataset collected in Part 2 is not unnecessarily skewed or tainted through the use of an unsuitable tool.

Extensive analysis and interpretation were also made based on the Likert item responses as they have clearly defined boundaries between responses options. Following the survey completion, each item was analysed separately, or in some cases item responses were summed to create a score for a group of items. Hence, "Likert scales are often called summative scales" Reips and Funke, (2008:702). This summative scale ultimately determined the suitability of the tool before moving on to Part 2 of this research.

10.2.4 Unit of Analysis

Primary data was collected from the current Developed Framework initially as the research did not have enough information on certain topics, which are crucial to the outcome of Part 1. This lack of information was due primarily to the lack of context around the scenario of which, where, and how the UCS was to be implemented. This primary data was thus extended via a researcher-completed survey which comprised of a secondary data source. Mouton (2001) shows how this secondary data can then be used in conjunction with the primary data to validate the technical suitability of the UCS chosen for this research.

For purposes of Part 1, the research also defined generalised questions and topics as per the Literature Review. These then resulted in the survey focusing on a UCS after which the research made a theoretical generalisation for the rest of the research conducted in Part 2. The unit of measure was the summative scale of the Likert scale question administered in the Part 1 survey.

10.2.5 Primary Data Collection Methods

In order to facilitate an effective questionnaire for Part 1, the use of internet-based survey was observed in order to achieve a higher response and distribution rate. This approach also ensured the maximum consistency in the responses received to the questions posed in the surveys (Mouton 2011). Thus, surveys were facilitated through an online third-party platform, Survey Monkey (https://www.surveymonkey.com/).

10.2.6 Criteria for Interpreting Data

Data interpretation for Part 1 of this research was conducted with the use of computer-aided tools. "These tools were used to store, retrieve and analyse data based on the functions offered by the solution package" Mouton, (2001:3). For Part 1, the tool used was Microsoft Excel for response tabulation and formula evaluation.

The same tool was used to conclude certain decisions and 'What If' scenarios as suggested by this research's current Developed Framework. Descriptive statistics allowed the researcher to summarise

a set of data and describe the degree of relationship between variables. The descriptive statistics were then modelled in Microsoft Excel, from the already collected dataset, and then displayed visually in the same tool via several graphs and data maps. This approach rendered raw data from the Proposed Framework and the completed survey from Part 1, in readable and understandable terms of consistency for evaluating the appropriateness of the selected UCS suggested for this research.

10.3 Part 2 – Degree of Support for Informal Teams and Virtual Communication and Collaboration

Part 2 leveraged a mixed method approach where a combination of surveys, semi-structured interviews and content analysis was used to ultimately create a case study to evaluate whether a UCS intervention was effective in supporting informal communication and collaboration in virtual teams.

10.3.1 Research Methodology

In order for Part 2 of this research to generate some knowledge, a case study technique was implemented. The case study technique helped to achieve an outcome where the result of the research focused on meaning, and multiple considerations were undertaken to reflect the different aspects of the research problem being addressed.

The case study technique involved an in-depth study where the researcher looked to gain an understanding regarding the research problem within a real-life context. Vital to the case study technique was the focus on understanding the phenomena within a single setting. Some of the key concepts in case studies identified were:

- "The study was set within a real context in which the researcher had no control"
- "The boundaries of the research were not clearly defined"
- The study addressed a contemporary phenomenon"

Cavaye, (1996).

Case study research is often associated with describing the phenomenon of interest, developing theory and testing theory (Cavaye, 1996). Theory development often occurs where it is used to give substantiation for hypothesis generation as well as examination of the research area in which existing knowledge is limited (Bonoma, 1985; Cavaye, 1996).

"Case study research can thus be classified into three types: explanatory, exploratory and descriptive, respectively" Yin, (1993:6). Explanatory case studies are used in causal investigations whereas, exploratory case studies are commonly known as a prelude to social research. Finally, descriptive case studies use a descriptive theory which is formed at the beginning of the research (Yin, 1993).

Benbasat *et al.* (1987) consider the case study to be viable for three reasons:

- "It is necessary to study the phenomenon in its natural setting"
- "The researcher can ask "how" and "why" questions, so as to understand the nature and complexity of the processes taking place"
- "Research is being conducted in an area where few, if any, previous studies have been undertaken"

Benbasat *et al.* (1987)

Therefore, for Part 2 of this research, a descriptive case study type was selected. This research leveraged this descriptive case study, based on the outcome of Part 1 of this research, to conclude the overall thesis of the research.

10.3.2 Research Technique

Having qualified the use of a UCS in Part 1 of this research, Part 2 looked at the concept of virtualisation of communication, collaboration, and teams. This is the part of the knowledge base that provided a new perspective or insight into the problem as defined initially by this research's thesis. The case study leaned heavily on the network survey and analysis approach, which allowed the researcher to gather a wide range of data from individuals about their collaborations and networks.

Network analysis provided the means to measure the contributions between virtual team members, irrespective of whether these contributions were in the form of virtual communication, collaboration, or social capital. The interactions and contributions were collected by means of a survey which was distributed to relevant teams and their members. Tabulating these responses lead to the identification of outlying responses where the researcher then engaged in semi-structured interview(s) with the respondent teams and performed some content analysis of the interview(s) to understand the reasons and context for the responses.

10.3.3 Technique Type

Part 2 of this research focused on the concepts that generated value for an informal communicative and collaborative network. Measuring an individual's contribution was a clearly defined problem and involved multiple, potentially conflicting, participant goals, and it is likely to involve a large number of factors which need to be considered. Thus, Parung and Bititci (2008:655) suggested "the process of measuring participants' contribution by use of a formal and systematic procedure in the decision-making process, using one of the multi-criteria decision aids. This formal systematic procedure took the form of a case study that encompassed the sample population".

This research then identified the need to measure contributions on the whole via a case study. Thus, in order to measure the results of a collaboration network, Parung and Bititci (2008), suggested the use

of the IDEF0 technique (Ross and Schoman, 1977; Maull, Childe, Bennett, Weaver and Smart, 1995). "IDEF0 is one of the IDEF families that is widely accepted as one of the process analysis tools used to analyse whole systems as a set of interrelated activities or functions" Ross and Schoman, (1977:8). Applied to this research, the IDEF0 technique helped to inform the structure of the surveys and questions that were distributed to teams and their members as well as the initial content of the semi-structured interviews. IDEF0 also made sure that certain business processes and outcomes were accurately mapped as processes through the interactions that this research was having with the sample population. The processes were then measured via Likert scale questions with definitive boundaries after which responses were quantified through semi-structured interviews and content analysis.

Ultimately the results informed an in-depth case study as to the validity of this research's thesis in the context of the chosen organisation.

10.3.4 Data Collection

Primary data collection for Part 2 was conducted with the use of surveys and semi-structured interviews as mentioned previously. Particularly relevant to this data collection and proposed by Foster *et al*. (2015:272) was that "virtuality is a significant contextual variable and a condition that helped researchers more fully understand and assess the contribution of individuals and teams". Context played an important role in these methodologies and can "have both subtle and powerful effects on research results" Johns, (2006: 9). Consideration of context helped:

- "Explain study-to-study variation"
- "Describe situations in which phenomena or relationships apply"
- "Reduce consideration of isolated, and thus potentially misleading, situational forces"
- "Facilitate aggregation and synthesis of information across studies (e.g., meta-analyses)"

Johns (2006)

In order to cater for virtuality, the responses to Part 2 surveys were analysed for content and context. The responding teams were included in semi-structured interviews to understand and incorporate the context associated with their responses which added into the overall conclusion of the case study.

The semi-structured interviews made use of both open and close ended questions so as to collect relevant and in-depth information about responses. The semi-structured interviews were Interviewer Administered. McBurney (2001: 13) defines an interviewer-administered survey as follows: "a structured interview is a quantitative research method commonly employed in survey research. The aim of this approach is to ensure that each interview is presented with exactly the same questions in the same order." The interview was thus led by an administrator asking a respondent a set of consistent

question to further establish context of an answer and additional detail where necessary. The key benefits of this type of survey were:

- "Queries about the meaning of a question were dealt with"
- "A misunderstood question was corrected"
- "Respondents were encouraged to provide deeper responses to open questions"

McBurney (2001)

An Interviewer Administered survey thus facilitated the researcher in being able to focus on certain phenomena in a natural setting. The Part 2 interviews were thus qualitative in nature and the content of the questions was informed primarily by the team responses and the associated primary data points identified from the Literature Review. These semi-structured interviews and following content analysis then formed the secondary data collection point to contribute towards the overall case study evaluation of the research thesis.

10.3.5 Suitability Profile

The suitability profile used for Part 2 will be a pre-selected group of individuals deemed to have represented the majority of the target Organisation. In confirmation of this: four teams were selected from the chosen Organisation based on the following factors: the team was virtual in nature, made use of the necessary Unified Communications Technology, were sufficiently complex in nature to be of value, and the virtual collaboration results were able to be included in an academic dissertation.

10.3.6 Participants and Data Analysis

Two types of sampling techniques have been defined by Polonsky and Waller (2011). These techniques are "non-probability sampling and probability sampling" Polonsky and Waller (2011:5). For this research, the non-probability sampling technique was used. This technique was selected because it relies on the personal judgement of the researcher to decide who will be included in the sample population. In particular, this research made use of the non-probability Convenience Sampling technique as the technique facilitated the attainment of a sample of convenient respondents. To this end, the participants forming the sample population of Part 2 of this research were all sourced from a single organisation. They were also selected across various roles and team memberships to obtain a representative sample of the organisation as a whole. A total of four teams were selected and the number of team members per team are detailed below:

Table 10.9: Part 2 Sample Population

Sample Population				
	Team 1	**Team 2**	**Team 3**	**Team 4**
Ideal number of members	8	5	10	4
Ideal Team Membership	1 x Manager	2 x Managers	1 x Manager	1 x Manager

	1 x Team Lead 6 x Members	3 x Team Leads	2 x Team Leads 7 x Members	3 x Members
Ideal Team Type	Operational	Strategic	Operational	Operational

These teams were also selected from three different business units within the organisation. Also selected was one management level team which focused on strategic engagements rather than operational engagements. Where possible, teams were selected where their members have virtual collaborative natures and are disbursed to some degree.

10.4 Hypotheses, Key Variables and Concepts

"When an organisation is able to harness and balance both formal and informal structures, they have the potential to create an organisation that is more efficient and innovative compared to the norm" Rethmeyer, (2005:120). However, "even though individual employees may be able to identify local patterns of collaboration, broader configurations of informal communication and collaboration tend to be far less visible to the organisation as a whole" Huxham, (2015:1039). With the above in mind, this research focused on understanding whether a UCS intervention was effective in supporting informal communication and collaboration in virtual teams. To this end, the following hypotheses were established and were included in the case study output of Part 2 of the research:

Table 10.10: Summary of Hypotheses

Summary of Hypotheses			
	Research Concept	**Methodology**	**Measure**
H1: - a unified collaboration tool will be able to effectively mimic physical interactions	Virtual collaboration technologies in support of virtual teams	Part 1: post-positive methodology	Likert Scale (Likert, 1932), based survey.
H2: - a unified collaboration tool will enable collaboration amongst virtual teams and their members	Virtual collaboration technologies in support of virtual teams	Part 1: post-positive methodology	Likert Scale (Likert, 1932), based survey.
H3: - networks will form in an organisation autonomously	Communication and Modern and Virtual Team Composition	Part 2: mixed methodology (surveys and semi-structured interviews)	Analytic Hierarchy Process (AHP) Pablos (2002) based survey with semi-structured interviews where necessary.
H4: - virtual teams will form due to the lack of available co-located resources	Modern and Virtual Team Composition	Part 2: mixed methodology (surveys and semi-structured interviews)	Analytic Hierarchy Process (AHP) Pablos (2002) based survey with semi-structured interviews where necessary.
H5: - informal collaboration will occur between team members with similar goals	Virtual communication and Informal Collaboration	Part 2: mixed methodology (surveys and semi-structured interviews)	Analytic Hierarchy Process (AHP) Pablos (2002) based survey with semi-structured interviews where necessary.
H6: - social capital will be generated through informal collaborations of virtual team members	Social Capital in the Communication Process	Part 2: mixed methodology (surveys and semi-structured interviews)	Analytic Hierarchy Process (AHP) Pablos (2002) based survey with semi-structured interviews where necessary.
H7: - knowledge will be more readily available and	Social Capital in the Communication Process	Part 2: mixed methodology (surveys	Analytic Hierarchy Process (AHP) Pablos (2002) based survey with

distributed through informal collaboration of virtual team members		and semi-structured interviews)	semi-structured interviews where necessary.
H8: - organisations will experience greater network formation and informal collaboration by providing technology interventions	Virtual collaboration technologies in support of virtual teams	Part 2: case study methodology	IDEF0 technique (Ross and Schoman, 1977; Maull, Childe, Bennett, Weaver and Smart, 1995) based case study.
H9: - organisations will experience gains through promoting informal collaboration in the organisation	Informal Collaboration	Part 2: case study methodology	IDEF0 technique (Ross and Schoman, 1977; Maull, Childe, Bennett, Weaver and Smart, 1995) based case study.

10.4.1 Detailed Hypotheses

Below are details of the hypotheses represented in the table above:

Hypothesis 1:

- **H0$_1$:** a unified collaboration tool will be able to effectively mimic physical interactions
- **H1$_1$:** a unified collaboration tool will **not** be able to effectively mimic physical interactions.

Hypothesis 2:

- **H0$_2$:** unified collaboration tool will enable collaboration amongst virtual teams and their members.
- **H1$_2$:** unified collaboration tool will **not** enable collaboration amongst virtual teams and their members.

Hypothesis 3:

- **H0$_3$:** networks will form in an organisation autonomously.
- **H1$_3$:** networks will **not** form in an organisation autonomously.

Hypothesis 4:

- **H0$_4$:** virtual teams will form due to the lack of available co-located resources.
- **H1$_4$:** virtual teams will **not** form due to the lack of available co-located resources.

Hypothesis 5:

- **H0$_5$:** informal collaboration will occur between team members with similar goals.
- **H1$_5$:** informal collaboration will **not** occur between team members with similar goals.

Hypothesis 6:

- **H0$_6$:** social capital will be generated through informal collaborations of virtual team members.
- **H1$_6$:** social capital will **not** be generated through informal collaborations of virtual team members.

Hypothesis 7:

- **H0$_7$:** knowledge will be more readily available and distributed through informal collaboration of virtual team members.
- **H1$_7$:** knowledge will **not** be more readily available and distributed through informal collaboration of virtual team members.

Hypothesis 8:

- **H0$_8$:** organisations will experience greater network formation and informal collaboration by providing technology interventions.
- **H1$_8$:** organisations will **not** experience greater network formation and informal collaboration by providing technology interventions.

Hypothesis 9:

- **H0$_9$:** organisations will experience gains through promoting informal collaboration in the organisation.
- **H1$_9$**: organisations will **not** experience gains through promoting informal collaboration in the organisation.

10.4.2 Criteria for Interpreting Data

Data interpretation for Part 2 of this research was conducted with the use of computer-aided tools. These tools were used to store, retrieve and analyse data based on the functions offered by the solution package. For Part 2, the tool used was Microsoft Excel and it facilitated response tabulation and formula evaluation. The same tool was used to conclude certain decisions and 'What If' scenarios as suggested by this research's current Developed Framework. Due to the requirement to analyse and interpret the content of the semi-structured interviews, the content analysis method was also implemented. This method was useful in allowing the systematic evaluation of semi-structured interview's content. The method also assisted in identifying previously unclear relationships and contributors to certain responses and variables. The content analysis also took responses and combined them with a team response from the semi-structured interview(s). The result was a contextual answer that was included in a focused case study that had an applied result from the content analysis of several semi-structured interview responses. To create the final verdict on the thesis of this research, Yin (2009) suggested four tests to validate the results of the case study methodology which were duly applied. These tests included: "Construct validity, Internal validity, External validity, Reliability" Yin, (2009:4).

10.5 Limitations of the Research

The aim of this research was to investigate informal communication and collaboration, amongst virtual teams, in the organisational context. A current Developed Framework was developed to identify the key success factors that enable and promote informal communication and collaboration. As part of the research, virtual teams were equipped with a technology intervention observed to be suitable in supporting informal collaboration to determine whether such an intervention supported effective informal communication and collaboration as discussed within the research. The research was geared at informal communication and collaboration, and as such, the research focused on certain situations which were outlined in the Literature Review. The case study output was used to evaluate the principles

identified in the Literature Review but certain limitations and areas for further research were identified as follows:

10.5.1 Limitations

When interpreting the research findings, the following limitations need to be taken into consideration:

- The research findings resulted from one in-depth case study conducted within a South African organisation that have adopted a UCS in support of virtual communication and collaboration for virtual teams. As such, the results may not be generalisable.
- The research findings are limited to virtual teams that are located within the country of South Africa and this could lead to the results not being reflective of global practices.
- The research findings were based on the responses by four disparate teams within the organisation. The number and scope of the teams could also be seen as a limiting factor in terms of the research output.
- The research was only conducted in a single organisation operating in a single industry in South Africa. As such, the research cannot be considered as a comprehensive indication for all industries within the South African context.
- The research was conducted against a relatively small population size that could result in skewed results and inaccurate representations being generated.
- The sampling design chosen in the Convenience Sampling technique can be seen as a limiting factor of this research.
- Informal hypothesis testing based on Likert items can result in decreased reliability of the survey instrument outputs due to higher standard errors of measurement occurring, less precise estimations being observed, and lower statistical power being available.
- The majority of the Likert scale questions have been phrased in the positive which can be seen as a limiting factor

10.5.2 Further research

While this research and its findings were aimed at being as comprehensive as possible, there were certain assumptions made during the research in order to facilitate a valid output. As such, the following aspects can be explored for further research based on the findings from the current study:

- The impact of UCSs on employee engagement has been left for future works and would be a good starting point for further research in the informal communication and collaboration field.
- A more in-depth study of the type and quality of the social capital outputs generated during formal and informal collaboration is also suggested as an area for additional research and investigation.
- Correct team composition and skills distribution forms a key part of most organisations, but this concept was not directly relevant to this research and as such has been left to future work.
- A quantitative study of this research's outputs would be the next recommended area of research where the outputs could be further validated in a broader context and with and extended scope in terms of number of organisations, teams, participants and business scenarios to be measured.

Ideally the results would be studied with a more focused aim on the evaluation of the direct impact for organisation with definitive imperial proof based on the constructs of this research.

10.6 Ethical Consideration

The research adhered to the requirements of the Rhodes University Ethics Committee. The ethical guidelines, as provided by the Ethics Committee, were followed in the creation and administration of the survey instruments used in the course of the research work. Senior management of the target organisation were approached to gain permission to conduct and distribute the required research methodologies and techniques. All respondents were informed of the purpose of the study and their optional participation in it. All information collected during the research was of an anonymous nature and kept confidential.

10.7 Conclusion

This chapter investigated the research methodologies and approaches that will be used to test the overarching thesis of this research. Several concepts were evaluated and ultimately selected to ensure that the exploratory nature of the current Developed Framework could be adequately tested. Various data collection methods were also implemented to ensure that the results were both relevant and accurate. Data analysis techniques were also highlighted, and their result will be presented in the following chapter.

Chapter 11 – Unified Communications Technology Questionnaire (Part 1)

Chapter 10 presented a research methodology to evaluate the current Developed Framework. The chapter identified that a Mixed Method methodology needs to be used to evaluate the overall thesis of this research. As such, Chapter 11 will introduce the first element of this Mixed Method methodology in the form of a Likert-based questionnaire. The questionnaire will be completed by the researcher in order to establish the suitability of the chosen UCS to conduct the research.

11.1 Introduction

In the literature review, several characteristics were identified as being necessary for the support of informal communication and collaboration in virtual teams. Chapter 11 outlines the construction of a survey instrument intended to explore the technical features incorporated within the chosen UCS. This survey instrument will help to determine to what extent these features support the aforementioned characteristics and their association with virtual team communication in general and informal communication in particular. The survey instrument has been divided into sections to group relevant questions together per the sub problems defined for this research. This survey instrument contains questions that have been defined from the Current Framework as constructed previously. Unless otherwise stated, the following answer options will be available for selection to each question: [Strongly Disagree; Disagree; Neutral; Agree; Strongly Agree].

11.2 Section 1: Sub Problem 1

a. Human communication comprises a system of symbols that collectively form a language (Conway, 1995: 327).

   1. Skype for Business facilitates an exchange of messages.
   2. Skype for Business facilitates multiple languages.

b. Communication in its simplest form is the flow of symbols, which represent information between communicants or groups of communicants (Röcker, 2012: 1-15).

   3. Skype for Business facilitates two-way synchronous communication.
   4. Skype for Business facilitates group communication.

c. Communication is found to occur both formally and informally (Conway, 1995: 327). As such, in chapter 2, Fay and Kline (2008) confirmed that formal communication on the whole can be divided into several groups.

   5. Skype for Business affords scheduled interactions.
   6. Skype for Business affords intended interactions.
   7. Skype for Business affords opportunistic interactions.
   8. Skype for Business affords spontaneous interactions.

d. Crampton, Hodge *et al*. (1998) and Lewis, (2019) argue that certain points are common to all informal communication models.

    9. Skype for Business facilitates supporting shared objects.
    10. Skype for Business facilitates the independence of physical proximity between communicants.

e. Function-wise, (Johnson, Donohue *et al*. 1994) explain how informal communication may perform several functions.

    11. Skype for Business provides facility for tracking people.
    12. Skype for Business provides facility for taking or leaving messages.
    13. Skype for Business provides facility for making meeting arrangements.
    14. Skype for Business provides facility for delivering documents.
    15. Skype for Business provides facility for giving or getting help.
    16. Skype for Business provides facility for reporting progress and news.

11.3 Section 2: Sub Problem 2

f. Functional requirements now dictate who forms part of the team regardless of the distance between members (Lea, 1997; Lewis, 2019).

    17. Skype for Business negates distance as a factor between communicants.

g. (Otubanjo, Amujo *et al*. 2010) suggest that several examples of teams are likely to be found in most organisations.

    18. Skype for Business facilitates scheduled communication between teams.
    19. Skype for Business facilitates cross functional communication between teams.
    20. Skype for Business facilitates peer communication between teams.
    21. Skype for Business facilitates external communication between teams.
    22. Skype for Business facilitates project communication between teams.

h. Virtual teams do not have to be co-located and can interact mainly though technological means (Williams et al., 2006; Ubell, 2010; Harris, 2018).

    23. Skype for Business supports collaboration in distributed teams.
    24. Skype for Business provides sufficient technological means for virtual team interaction.

i. Ubell (2010) states that virtual communication enables many individuals to virtually collaborate on several assignments and projects in both a synchronous and an asynchronous fashion.

    25. Skype for Business affords the ability to work on several engagements simultaneously.
    26. Skype for Business affords the ability to conduct synchronous interactions.
    27. Skype for Business affords the ability to conduct asynchronous interactions.

j. Informal Communication requires communication without the use of face-to-face interaction (Lamont, 2010; Bonvillain, 2019).

    28. Skype for Business facilitates non-face-to-face communication.

k. Virtual collaboration usually occurs when two or more non-co-located people work towards a common goal (Lamont, 2010).

    29. Skype for Business facilitates collaboration between two or more non-collocated people working on a common goal.

l. Lawson, *et al*. (2009) and Mcloughlin *et al*., (2018) indicates that the following concepts are both critical to virtual collaboration and its successful utilisation.

    30. Skype for Business facilitates sharing in the virtual collaboration sense.
    31. Skype for Business facilitates shared context for virtual collaboration.

m. Isaacs *et al*. (2008), Schauer, (2008), Flores *et al*. (2009), and Mei *et al*., (2018) suggested several key points in relation to a virtual system and its support of informal communication and collaboration.

    32. Skype for Business affords tracking the availability of recipients.
    33. Skype for Business affords "glancing".
    34. Skype for Business affords message leaving abilities.
    35. Skype for Business affords recognition of public places.
    36. Skype for Business affords video.
    37. Skype for Business affords symmetrical interactions.
    38. Skype for Business affords storing of conversations.
    39. Skype for Business affords document availability and processing.
    40. Skype for Business affords privacy and access controls.
    41. Skype for Business affords instant Messaging.
    42. Skype for Business affords conferencing facilities.
    43. Skype for Business affords wireless voice over IP.
    44. Skype for Business affords IP enabled contact centres.
    45. Skype for Business affords application sharing.

11.5 Section 3: Sub Problem 3

n. Social Capital has been listed as having eight generic elements (Bullen and Onyx 1998).

    46. Skype for Business facilitates participation in the local community, relevant to virtual collaboration amongst teams.
    47. Skype for Business facilitates proactivity in a social context, relevant to virtual collaboration amongst teams.
    48. Skype for Business facilitates feelings of trust between communicants.
    49. Skype for Business facilitates neighbourhood connections, relevant to virtual collaboration amongst teams.
    50. Skype for Business facilitates connections to family and friends, relevant to virtual collaboration amongst teams.
    51. Skype for Business facilitates work connections.

o. Social Capital generation is considered a large challenge in virtual teams. This generation is not always considered possible in organisations and as such, barriers to creation have been observed to exist (Nahapiet and Ghoshal, 1998).

52. Skype for Business eliminates barriers of trust by providing secured communication methods between communicants where trust can be established and maintained during interactions and collaborations.
53. Skype for Business eliminates barriers of organisational norms by providing facility for spontaneous and opportunistic interaction and engagements between communicants without prescribed conversational norms.
54. Skype for Business eliminates barriers of ambiguity by enabling communicants to develop shared meaning and context for their interactions and collaborations.

11.6 Section 4: Sub Problem 4

p. Through several case studies, Sarker and Sahay (2003); Williams et al. (2006); Rutter *et al.* (2009); Rodriguez *et al.,* (2018); Mei *et al,* (2018), suggest a generic list of features that should be deployed in order to appropriately facilitate informal virtual collaboration.

55. The available infrastructure to provide the Skype for Business services facilitates high speed LAN connectivity exceeding 100Mb\s per user.
56. The available infrastructure to provide the Skype for Business services facilitates broadband internet connection exceeding 4Mb\s per user.
57. The available infrastructure to provide the Skype for Business services facilitates backup and recovery facilities being available.
58. The available infrastructure to provide the Skype for Business services facilitates email and scheduling functions.
59. The available infrastructure to provide the Skype for Business services facilitates High Definition web cameras and sound devices per user.

11.7 Conclusion

The survey instrument described in this chapter, has been constructed in order to evaluate the use of technology in support of effective informal communication and collaboration amongst virtual teams. Chapter 12 follows which will detail the instrument used to evaluate the current Developed Framework of this research against the thesis of this research. Following that, Chapter 13 will provide the data and analysis of the survey responses in context of the survey instrument detailed during Chapter 11.

Chapter 12 – Virtual Collaboration Questionnaire for Team Members (Part 2)

Chapter 11 introduced Part 1 of the research. Part 2 will be focused on the survey and semi-structured interviews completed with the sample population. Chapter 12 will provide a brief summary of issues raised in the literature prior to constructing the relevant questions for Part 2 of this research.

12.1 Introduction

Virtual communication and collaboration are strategically important for an organisation because "it can address issues in new ways by delivering an integrated platform where a common environment allows applications to be used concurrently, creating multichannel sessions so employees can interact and communicate more effectively" Flores et al. (2009:263). Unified communication is commonly understood to consist of telephony, IM, video, multimedia conferencing and application sharing, combined with presence (Flores et al. 2009; Mei *et al*., 2018).

The second part of this research, Part 2, will therefore aim to measure and establish the level to which a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. To achieve this, employee contributions need to be measured and participants observed in terms of their contributions.

Furthermore, informal communication and collaboration is based on network formation which begins with the fact that networks are based on individuals that are loosely coupled and variable in number. Normally, the individual's interaction is free, driven more by informal opportunities than by precise intentions and organisational strategies (Parung and Bititci 2008). This too needs to be included as a measurement because both organisational and technological concepts shape the context in which informal collaboration occurs (Whitley 2000).

Parung and Bititci (2008) suggested four steps for measuring informal networks and their associated collaborations:

- "A problem is decomposed into a multi-level hierarchical structure, which is comprised of value generators and their factors"
- "The value generators and factors are prioritised"
- "Individuals' contributions in each factor are assessed"
- "Individuals' contributions are measured"

Parung and Bititci (2008)

"Interactions may be the consequence of formal interactions and/or cooperation, or they may occur in a more informal way" Mcloughlin *et al*., (2018:139). In both cases, these interactions usually entail

some form of knowledge and/or information exchange between the individuals involved. To this end, a collaborative network is a network which is made up of several individuals that have similar goals, operating environments and social capital (Huxham, 2015). These networks are formed through three stages:

- "Stage one: discovery of collaborative opportunities"
- "Stage two: exploration of collaborative opportunities"
- "Stage three: crystallisation of collaborative relations"

(Huxham, 2015)

Most organisations have several differing informal networks. These networks organise and reorganise themselves and extend their reach in several ways using several various commercial technologies (Huxham, 2015). As networks widen and deepen, they can mobilise talent and knowledge across the enterprise. These networks thus form the basis for informal communication and collaboration. The main assumption in the concept of informal communication and collaboration is that "individuals rarely have sufficient resources to pursue their activities and reach their goals" Lom and Sullenger, (2011:59).

Improving collaboration can be achieved in a number of ways as suggested by Lin Russel, Knutson, and Crowley (2013), below:

- "Attain benefits of scale through effective global collaboration"
- "Drive work force engagement and performance"
- "Align collaboration with business partners and external stakeholders"
- "Minimise network inefficiencies and costs"

Lin Russel, Knutson, and Crowley (2013)

Finally, Berardo (2009) demonstrated that the following two categories of organisational benefits may be experienced when informal collaboration occurs in an organisation:

- "Building Lateral Networks"
- "Reducing Network Silos"

Berardo (2009)

To evaluate this final scenario above, eight specific use cases will be used to further determine the result of the thesis of this research via the case study approach. "Measuring an individuals' contribution in a virtual team is a clearly defined problem and involves multiple, potentially conflicting, participants' goals, and it is likely to involve a large number of factors to be considered" Parung and Bititci (2008:656). Thus, Parung and Bititci (2008:656) suggest "the process of measuring participants' contribution by use of a formal and systematic procedure in the decision-making process, using one of the multi-criteria decision aids". According to Berardo (2009:529), "all problems and decisions are

multi-criteria in nature; multi-criteria analysis begins when an individual feels that the issue matters enough to explore the potential of formal modelling".

12.2 Use Case #1: Employee Productivity

This is where "virtual communication and collaboration should have the greatest impact, since all employees use some sort of communications applications" Lamont, (2010:57). "For internal communication, presence is the key catalyst, since it allows employees to see the status of co-workers in real time" Lawson, *et al*. (2009:160). "Not only does this technology cut down on wasted time, but by knowing which modes and team members are available, employees can choose the best form of communication for the task at hand" Huxham, (2015:1038).

"Virtual collaboration benefits employees by empowering them to work effectively from any broadband-accessible location - and today, that's a key driver for personal productivity. For most employees, the desk is just one of many locations where work gets done, and virtual collaboration is built around where the end user is, rather than where the desk phone is" Huxham, (2015:1038-1039).

In order to explore employee productivity, the following Likert scale questions will be asked. Unless otherwise stated, the following answer options will be available for selection to each question: [Strongly Disagree; Disagree; Neutral; Agree; Strongly Agree]:

1. The tool provided helped me perform my day-to-day business tasks.
2. The tool provided simpler ways to achieve common tasks.
3. The tool encouraged engaging with colleagues in different channels.
4. Productivity increased by having access to the tool.
5. I used the tool for functions other than those business related.
6. The presence capability helped in collaborating with colleagues.
7. Distance became immaterial when collaborating with colleagues distributed in other teams and regions.
8. I find myself collaborating more with colleagues.

12.3 Use Case #2: Team-Based Productivity

"Aside from personal productivity, employees also work in teams. These teams are both physical and virtual in nature. In team settings, the need for effective communication is even more important" Olaniran, (2008:122). "With today's disparate workforces and decentralised operations, teams rarely meet in-person all at once" Lamont, (2010:57). "This is where communications and collaborations technology play a major role" Olaniran, (2008:123). The ROI is often disappointing because of the high cost and poor user experiences Olaniran, (2008:123).

"Another way in which virtual collaboration benefits an organisation is the consistent end-user experience, where each employee is using the same applications and can easily engage and contribute in real time" Lamont, (2010:58). "Again, with presence, other employees can be added quickly to conversations when needed. Almost as a standard, UCS will have a strong video component, including high-definition video conferencing, and this can help reduce the need for travel to attend a meeting in person" Lawson *et al.,* (2009:161).

"Another key benefit is the persistent nature of UCSs – they are always available, so ad hoc meetings are never a problem" Crampton *et al*., (1998:763). "Conventional conferencing systems are reservation-based and not ideal for informal collaboration - a mode that many employees prefer given their busy schedules" Johnson *et al*., (1994:116). In this sense, the following Likert scale questions will be asked to evaluate team-based productivity:

9. I found myself reaching out of my usual set of colleagues to achieve a result.
10. The Unified Communications Technology facilitates me engaging with colleagues that I normally wouldn't engage with.
11. I found myself joining teams that are of interest.
12. I found myself forming teams to address specific business challenges.
13. I found that my team collaborates and communicates acceptably using the toolset.
14. I found myself collaborating more with my team members.

12.4 Use Case #3: Organisational Agility

This use case aims to reflect the strategic value of a UCS, as the results can have an additive impact on the organisation as a whole. To this point, "when both employees and teams are more productive, the organisation will increase in productivity" Lom and Sullenger, (2011:59). "To recognise how UCSs can benefit an organisation, communications should not only be considered to have a utilitarian value. When communications are shown to drive productivity and better business outcomes, the virtual collaboration value proposition of a UCS will resonate" Huxham, (2015:1040-1041).

"Organisations need agility to be competitive and enable their employees, and management will support initiatives that deliver on this strategy" Schauer, (2008:2). While the use case is strong, "there really aren't metrics to make a numbers-driven decision, so the rationale needs to be built around the assurance that the UCS can perform as advertised, particular with regard to virtual collaboration amongst teams" Schauer, (2008:2-3). In this sense, the following Likert scale questions will be asked to evaluate organisational agility:

15. I was more confident in addressing a complex business problem with the technology toolset provided.

16. I responded differently to problems when using the available Unified Communications Technologies to collaborate.
17. I included specialised colleagues in complex problem resolution as the technology affords wider collaboration.
18. I assisted in problems and engagements that traditionally would be out of my expertise.
19. The Unified Communication Tool gave me the ability individually to solve a complex problem.
20. The Unified Communications technology equips my team more readily to solve a complex problem.

12.5 Use Case #4: Usability

When considering usability with regard to virtual communication and collaboration, options such as an interface and functionality that "just works" intuitively, and is familiar to the user, should be considered (Flores *et al*. 2009). Furthermore, if a UCS is difficult to operate and complex to learn, users won't adopt or utilise it (Schauer, 2008). Ideally, a UCS should be able to lead users to new ways of collaborating and innovating, but also should make sure it supports a familiar and intuitive process so that it does not require too much training, if any (Flores *et al*. 2009). In this sense, the following Likert scale questions will be asked to evaluate usability:

21. The tools provided were already installed.
22. The tools provided were easy to use.
23. The toolset works as anticipated.
24. I required training to use the toolset.
25. It was easy to achieve the business functions I wanted to with the provided tools.
26. The toolset provided for all of my regular communication and collaboration needs? E.g. email, voice, IM, etc.
27. What aspects of the technology toolset did you find hindering?
   [Comments]
28. What aspects of the technology toolset did you find enabling?
   [Comments]

12.6 Use Case #5: Learning and Growth

The Social Capital concept has a major role in the communication process and collaboration environment, despite being largely external factors. "Social Capital can be seen as the concept of a relationship with others; a link among individuals within a community of sorts" Boström, (2002:511). Thus, Social Capital is the glue that creates the bonds between communicants, whether they be communicating and collaborating formally, informally, or in the virtual space (Boström, 2002).

Fishbach *et al*. (2009) illustrate that key to the concept of social capital are the factors of trust, communication and the network that it appears on. Bullen and Onyx (1998:101) illustrate how "formal

social capital requires planning and intentionality compared to informal social capital which has underlying motives and stresses the concept of sharing".

"Social capital is also referred to as an aggregate of actual or potential resources that arise from a durable network of institutional relationships of mutual acquaintances" Golnaz and Conida, (2012:22). This aggregation is a result of the sharing and shared context developed during the communication and collaboration processes of team members. In this sense, the following Likert scale questions will be asked to evaluate learning and growth:

29. The technology provided offered me the opportunity to learn from others.
30. The technology provided offered me a medium to share knowledge with others.
31. I was more willing to distribute knowledge with the toolset in place.
32. I was empowered to find the answers to complex problems through the tool.
33. I was adding to the overall knowledge of the organisation as a whole, using the toolset.

12.7 Use Case #6: Security and Trust

Modern teams depend hugely on trust between members (Golnaz and Conida, 2012). Therefore, this trust is both critical and necessary for teams and must be facilitated in UCSs. "With documents, customer sensitive information, and other important business information flowing through typical UCSs, organisations should ensure that their UCS provider has solid security practices in place. These security practices will lead to the development of trust between users of the tool" Nahapiet and Ghoshal, (1998:249). "This trust is developed when a UCS is able to provide strong identity management, independent security audits, adequate data retention and archival policies, and the ability to retrieve data should the business require it" Schauer, (2008:3).

Brown *et al*. (2004: 129) claim that "trust is the lubricant of commerce, essential to negotiations, and has been related to competitive advantage". From this, it is clear that modern day organisations would do well to develop trust between their members both physically co-located and non-physically co-located. Trust is largely gained by team members who are of the opinion that what they say in an interaction is observed, understood and taken seriously (Nahapiet and Ghoshal, 1998). Virtual interactions thus focus on trust because virtual communication and collaboration will only be effective if both users are willing to cooperate and interact openly in carrying out certain tasks, solving various problems and actively learning throughout the whole process (Serçe *et al*. 2011). In this sense, the following Likert scale questions will be asked to evaluate security and trust:

34. The engagements I had using the toolset were private.
35. The interactions I have using the toolset were secure.
36. I trust the information provided by colleagues I engaged with using the toolset.

12.8 Summary

While measuring collaboration may be difficult, organisations should still have the goal of improving communication and collaboration, particularly in the virtual sense (Berardo, 2009). Improved virtual communication and collaboration means faster decision making, ad-hoc collaboration and team formation, and multi-channel communications and interactions between employees (Lamont, 2010). Where possible, budgetary benefits should come second - that is, organisations shouldn't focus solely on cost savings, because it minimises the other values that a UCS can bring to an organisation (Lawson *et al*., 2009). To this end, the following Likert scale questions will be asked to evaluate virtual collaboration on a summary scale:

37. I would recommend this tool set to others.
38. I will continue to use the toolset once this research has finished.
39. Through the UC tool, my levels of collaboration increased with colleagues and team members.
40. Please indicate your gender.
    [Male; Female; Other (please specify)]
41. What is your age?
    [17 or younger; 18-20; 21-29; 30-39; 40-49; 50-59; 60 or older]
42. In what country do you currently reside?
    [South Africa; Other (please specify)]
43. What is the highest level of school you have completed or the highest degree you have received?
    [Less than high school degree; High school degree or equivalent; Some college but no degree; Associate Degree; Bachelor degree; Graduate degree]
44. Which of the following best describes your current occupation?
    [Management; Team Lead; Employee (Team Member); Other (please specify)]
45. Which Team do you belong to?
    [Strategic; Operational]

12.9 Thesis Evaluation

The overarching objective of this research is to determine whether a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. With that in mind, the value that this research will typically be measured against an organisational context. Most common amongst these organisation measures is that of ROI (Elkeles, Phillips, and Phillips, 2015).

Return on Investment is defined as "the gain from investment minus the cost of investment divided by the cost of investment" Elkeles, Phillips, and Phillips, (2015: 201). While this method is very popular in several types of organisations, there are two reasons that Elkeles, Phillips, and Phillips, (2015) point out as to why it can fall short of providing an accurate result:

- "The ROI calculation itself can very easily be manipulated and the results presented in numerous and extremely confusing ways"

- "ROI doesn't show you where or how Unified Communications Technologies align with and enable an organisation outside of strictly defined financial measurables"

Elkeles, Phillips, and Phillips (2015)

For the above two reasons, a balanced score card through a number of Likert based questions will be used to establish a research output (Krueger, 2013). However, to evaluate informal communication and collaboration in virtual teams, there is a need to combine this research output with that of the process methodologies described by Ross and Schoman (1977), Maull, *et al*. (1995), and Parung and Bititci (2008). These methodologies typically analyse a set of organisational processes and evaluate if there have been any increases in efficiency.

Finally, the results will be condensed into a case study via a similar set of Likert scale questions posed in a semi-structured interview process with each team involved in the research. The outputs of all of the above will produce a result with relation to the research thesis and be presented in a case study format.

12.9.1 Questions and Hypothesis and Use Case Matrix

To achieve the required research output, a number of base Likert scale questions were put to the research population. These questions were used to establish the first dimension of the research output by analysing the total response characteristics to the questions, irrespective of team. The second dimension of the research will then be achieved by aligning certain questions to predefined hypotheses to either confirm or reject the hypothesis. The hypotheses are:

- H1: a unified collaboration tool will be able to effectively mimic physical interactions
- H2: a unified collaboration tool will enable collaboration amongst virtual teams and their members
- H3: networks will form in an organisation autonomously
- H4: virtual teams will form due to the lack of available co-located resources
- H5: informal collaboration will occur between team members with similar goals
- H6: social capital will be generated through informal collaborations of virtual team members
- H7: knowledge will be more readily available and distributed through informal collaboration of virtual team members
- H8: organisations will experience greater network formation and informal collaboration by providing technology interventions
- H9: organisations will experience gains through promoting informal collaboration in the organisation

The third dimension of the research output will then be the alignment of certain base questions to predetermined use case scenarios with a process weighting as defined by Ross and Schoman (1977), Maull, *et al*. (1995), and Parung and Bititci (2008). This dimension will aim to evaluate the impact of

UCS across the teams participating in the research, as per the sub problems defined in this research. The use cases are:

- Employee productivity
- Team-based productivity
- Organisational agility
- Usability
- Learning and Growth
- Security and Trust
- Summary

12.9.2 Semi-structured Interview and Case Study Output

The previous section explored forty-six questions grouped via six use cases in order to explore the various topics raised in the Literature Review as experienced by virtual teams. The final exploratory work will be conducted as a single case study, as described in the research methodology.

This case study will afford the virtual teams the opportunity to answer business process related questions with a more qualitative output. The questions will also be aimed more specifically at measuring the results of a collaboration network and its impact on the organisation (Parung and Bititci, 2008). "With the use of process analysis tools, it is possible to analyse whole systems as a set of interrelated activities or functions" (Maull, *et al.*, 1995), (Parung and Bititci, 2008). Therefore, certain business processes and outcomes can be accurately mapped as processes through the team's interactions that this research is observing.

The same processes can then be measured via Likert scale questions with definitive boundaries. Responses can then be quantified through the semi-structured interviews held with the teams and qualitative factors and responses can be evaluated using content analysis. These outputs will then form the final result of this research in a case study format. The business processes to be examined are as follows. Unless otherwise stated, the following answer options will be available for selection to each question: [Strongly Disagree; Disagree; Neutral; Agree; Strongly Agree] [Comments]:

12.9.2.1 Employee Productivity
- We have found that we are able to attend local meetings, virtually and participate effectively, using the technology?
- We have found that we are able to attend regional\international meetings, virtually and effectively, using the technology?
- We have found that we are able to collaborate on documents simultaneously with other employees using the technology?

12.9.2.2 Team-Based Productivity

- We have found that we are able to share screens and content with our team\team members using the technology?
- We have found that we are able to engage acceptably over the video and voice channels using the technology?
- We have found that we are able to facilitate formal and informal interactions using the technology?

12.9.2.3 Organisational Agility

- We have found that we are able to rapidly respond to business problems using multiple programs of the Unified Communications technology?
- We have found that we are able to engage in new channels and techniques of communication and collaboration using the technology?
- We have found that we are able to join new teams and share a commitment easily using the technology?

12.9.2.4 Usability

- We have found that we are able to login without training or assistance and start using the technology?
- We have found that we are able to perform common meeting and document functions without training, using the technology?
- We have found that we are able to see previous interactions for context, where necessary, using the technology?

12.9.2.5 Learning and Growth

- We have found that we are able to distribute knowledge and content effectively and from several sources, as necessary, using the technology?
- We have found that we are able to solve a problem outside of the normal day to day business routine, using the technology?
- We have found that we are able to find relevant knowledge when required, using the technology?

12.9.2.6 Security and Trust

- We have found that the presence option enables us to know when to contact a fellow employee?
- We are confident that our messages and interactions were only received by the intended recipient?
- We have found that the Unified Communications Technology enables us to engage on multiple channels such as voice, IM, and email, in order to solve a business problem?

12.9.2.7 Summary

- We have found that we are able to engage with our team and team members more, using the technology?
- We have found that we are able to know when and over which channel to interact on, using the technology?
- We have found that we are able to be more productive individually, using the technology?
- We have found that we are able to be more productive in our team, using the technology?

12.10 Conclusion

Part 2 of this research is focused on the concepts that generate value for an informal communicative and collaborative network amongst virtual teams. "Measuring an individual's contribution is a clearly defined problem and involves multiple, potentially conflicting, participant goals, and it is likely to involve a large number of factors which need to be considered" Parung and Bititci (2008:656). Thus,

Parung and Bititci (2008:656) suggest "the process of measuring participants' contribution by use of a formal and systematic procedure in the decision-making process, using one of the multi-criteria decision aids". This formal systematic procedure will take the form of a case study that will encompass a sample population of teams of individuals. The research outputs will be combined into a case study which evaluates the sub problems of this research. Conclusions will be drawn against the analysis of the responses and the trends and outliers therein. The next two chapters will thus evaluate and investigate the statistical results of the research.

Chapter 13 – Part 1 Results

Chapter 11 introduced the survey instrument that would be used to conduct the initial qualification of the UCS used in this research. Chapter 13 will build on this instrument by analysing and inspecting the respondent data using statistical methods. The results and analysis of this initial instrument will look to validate the selected tool and enable the research to continue. The results of the survey data follow.

13.1 Introduction

Chapter 11 detailed the data collection process used for Part 1. This process in conjunction with analysis techniques and statistical methods will now be used to interpret the collected data. The survey for Part 1 has been used to analyse the response data quantitatively to ensure that the selected UCS would meet the technical requirements set forth by this research through the current Developed Framework. Graphs, charts, diagrams and visual aids are used to represent data analysed using Statistical Product and Service Solution (SPSS), Microsoft Excel, Microsoft PowerPoint and Microsoft Visio. Information gathered through the survey instrument allowed the researcher to formulate conclusions that offer an accurate and detailed interpretation of the collected data. These conclusions will then be implemented in Part 2 of the research after successfully validating the construct of the Part 1 survey instrument.

13.2 Part 1 Survey Analysis

The key aspects required in a UCS for informal communication and collaboration were identified and formed the structure of the survey instrument through the definition of the initial sub problems. While the results of a survey such as those of Part 1 could be subjective, the survey was structured with Likert scale questions to avoid just that. With that in mind, the ultimate goal of the Part 1 survey is to establish that:

- The UCS will meet the required informal virtual collaboration requirements of this research
- The UCS will facilitate teaming
- The UCS is available and implemented in the target organisation

The survey from Part 1 was conducted and completed by the researcher. This completion was possible as the instrument had been constructed via a comprehensive literature review and determined current Developed Framework. The current Developed Framework could be used to identify technologies that would be compatible with the research requirements for this thesis. Should the quantitative analysis of the survey results reveal an aggregated Likert response of "Agree" or stronger, the chosen UCS would be deemed successful and the research would continue. If the aggregated Likert response of "Agree"

or stronger is not achieved, the selected UCS would be deemed inappropriate for use in Part 2 and the Part 1 research would be repeated until an appropriate technology is found. The following sections contain the responses and results of the Part 1 survey instrument.

13.2.1 Section 1: Sub Problem 1

The Section 1 component of the Part 1 survey instrument uses sixteen indicators to measure the Communications and Virtual Team capabilities of the selected UCS, Skype for Business. These capabilities have been grouped based on their identification during the construct of the current Developed Framework in response to sub problem 1.

Table 13.11: Communication Statistics

Communication Statistics		
N	Valid	16
	Missing	0
Mean		4.1250
Sum		66.00

From the completed instrument, all sixteen responses were deemed valid. The sum of these sixteen responses was 66.00, resulting in a mean of 4.1250 on the Likert scale for Communications capabilities. Table 13.12 lists the Communication responses per indicator from Section 1 of the Part 1 survey instrument.

Table 13.12: Communication Responses

Chapter 2 - Communication		Score
1	Skype for Business facilitates an exchange of messages.	5
2	Skype for Business facilitates multiple languages.	4
3	Skype for Business facilitates two-way synchronous communication.	5
4	Skype for Business facilitates group communication.	5
5	Skype for Business affords scheduled interactions.	4
6	Skype for Business affords intended interactions.	4
7	Skype for Business affords opportunistic interactions.	5
8	Skype for Business affords spontaneous interactions.	4
9	Skype for Business facilitates supporting shared objects.	4
10	Skype for Business facilitates the independence of physical proximity between communicants.	5
11	Skype for Business provides facility for tracking people.	3
12	Skype for Business provides facility for taking or leaving messages.	2
13	Skype for Business provides facility for making meeting arrangements.	5
14	Skype for Business provides facility for delivering documents.	5
15	Skype for Business provides facility for giving or getting help.	3
16	Skype for Business provides facility for reporting progress and news.	3

Examination of indicators with Likert scores of 5 reveals that the respondent identified the selected UCS's primary communication strengths as:

- Facilitate an exchange of messages
- Facilitate two-way communication in this fashion
- Facilitate group communication
- Afford Opportunistic interactions
- Operating Independently of physical proximity
- Assisting in Making meeting arrangements
- Assisting in Delivering documents

Conversely, the respondent rated four communication indicators as 3 or below on the Likert scale. This indicates that the UCS does not adequately perform the following functions:

- Tracking people
- Taking or leaving messages
- Giving or getting help
- Reporting progress and news

Table 13.13 provides a distribution of the communication responses per Likert scale value from Section 1 of the Part 1 survey instrument.

Table 13.13: Distribution of Communication Responses

Communication Response Distribution					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strongly Disagree	0	0.0	0.0	0.0
	Disagree	1	6.3	6.3	6.3
	Neutral	3	18.8	18.8	25.0
	Agree	5	31.3	31.3	56.3
	Strongly Agree	7	43.8	43.8	100.0
	Total	16	100.0	100.0	

The survey from Part 1 shows responses indicating that 43.8% of the response 'Strongly Agree' with the selected UCS's communication capabilities. A further 31.3% of the response 'Agree', while 18.8% remain 'Neutral' on the matter. Just 6.3% 'Disagree' with the selected UCS's communication capabilities. Through the visualisation of the distribution of communication responses in Table 13.13, it can clearly be seen that the majority of communication responses fall within the 'Agree' and 'Strongly Agree' response range. The mean value of communication responses is 4.13, with a standard deviation of 0.957, exceeding the required mean value of 4. The respondent can therefore be seen to 'Agree' that the selected UCS meets the necessary communication requirements for effective virtual communication.

13.2.2 Section 2: Sub Problem

The Section 2 component of the Part 1 survey instrument uses twenty-nine indicators to measure the Formal and Informal Collaboration capabilities of the selected UCS, Skype for Business. These

capabilities have been grouped based on their identification during the construct of the current Developed Framework in response to sub problem 2.

Table 13.14: Team Statistics

Team Statistics		
N	Valid	29
	Missing	0
Mean		4.1379
Sum		120.00

Based on survey responses from Part 1, all twenty-nine team indicators were determined to be valid. The sum of these eleven responses was 120.00, resulting in a mean value of 4.1379 on the Likert scale for team capabilities. Table 13.15 lists the team responses per indicator from Section 2 of the Part 1 survey instrument.

Table 13.15: Teams Responses

Chapter 3 - Teams		Score
17	Skype for Business negates distance as a factor between communicants.	5
18	Skype for Business facilitates scheduled communication between teams.	5
19	Skype for Business facilitates cross functional communication between teams.	5
20	Skype for Business facilitates peer communication between teams.	4
21	Skype for Business facilitates external communication between teams.	3
22	Skype for Business facilitates project communication between teams.	4
23	Skype for Business supports collaboration in distributed teams.	5
24	Skype for Business provides sufficient technological means for virtual team interaction.	4
25	Skype for Business affords the ability to work on several engagements simultaneously.	4
26	Skype for Business affords the ability to conduct synchronous interactions.	5
27	Skype for Business affords the ability to conduct asynchronous interactions.	4
28	Skype for Business facilitates non-face-to-face communication.	4
29	Skype for Business facilitates collaboration between two or more non-collocated people working on a common goal.	2
30	Skype for Business facilitates sharing in the virtual collaboration sense.	4
31	Skype for Business facilitates shared context for virtual collaboration.	4
32	Skype for Business affords tracking the availability of recipients.	4
33	Skype for Business affords "glancing".	4
34	Skype for Business affords message leaving abilities.	4
35	Skype for Business affords recognition of public places.	3
36	Skype for Business affords video.	5
37	Skype for Business affords symmetrical interactions.	5
38	Skype for Business affords storing of conversations.	5
39	Skype for Business affords document availability and processing.	3
40	Skype for Business affords privacy and access controls.	3
41	Skype for Business affords instant Messaging.	5
42	Skype for Business affords conferencing facilities.	5
43	Skype for Business affords wireless voice over IP.	5
44	Skype for Business affords IP enabled contact centres.	3
45	Skype for Business affords application sharing.	4

Indicators with Likert scores of 5 indicate that the selected UCS is able to effectively:

- Negate distance as a factor between members
- Facilitate Scheduled teams
- Facilitate Cross functional teams
- Facilitate Teams that are not co-located
- Afford the ability to conduct Synchronous interactions
- Facilitate video
- Facilitate symmetrical interactions
- Storing of conversations
- Facilitate IM
- Facilitate conferencing facilities
- Facilitate wireless voice over IP

The respondent was seen to 'Disagree' with the selected UCS's ability to facilitate common goals, with a Likert score of 2. The respondent displayed indifference regarding the selected UCS's ability to provide four other informal communication and virtual collaboration tools, namely:

- Recognition of public places
- Document availability and processing
- Privacy and access controls
- IP enabled contact centres
- Facilitate external teams

Table 13.16 provides a distribution of the teams' responses per Likert scale value from Section 2 of the Part 1 survey instrument.

Table 13.16: Distribution of Teams Responses

Teams Response Distribution					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	0	0.0	0.0	0.0
	Disagree	1	3.4	3.4	3.4
	Neutral	5	17.2	17.2	20.6
	Agree	12	41.4	41.4	62.0
	Strongly Agree	11	38.0	38.0	100.0
	Total	29	100.0	100.0	100.0

Responses from the survey in Part 1 shows that 38% of response 'Strongly Agree' with the selected UCS's informal communication and virtual collaboration capabilities. A further 41.4% 'Agree', while 17.2% remain 'Neutral'. 3.4% 'Disagree' with the selected UCS's informal communication and virtual collaboration capabilities. The distribution of informal communication and virtual collaboration responses in Table 13.16, show that the majority of responses fall within the 'Agree' and 'Strongly Agree' range. The mean value of informal communication and virtual collaboration responses is 4.14, with a standard deviation of 0.907, exceeding the required mean value of 4. The respondent therefore

can be seen to 'Agree' that the selected UCS meets the necessary informal communication and virtual collaboration requirements for effective informal virtual collaboration.

13.2.4 Section 3: Sub Problem 3

The Section 3 component of the Part 1 survey instrument uses nine indicators to measure the Social Capital capabilities of the selected UCS, Skype for Business. These capabilities have been grouped based on their identification during the construct of the current Developed Framework in response to sub problem 3.

Table 13.17: Social Capital Statistics

Social Capital Statistics		
N	Valid	9
	Missing	0
Mean		3.6667
Sum		33.00

Based on survey responses from Part 1, all nine social capital indicators were determined to be valid. The sum of these nine responses was 33.00, resulting in a mean value of 3.6667 on the Likert scale for social capital capabilities. Table 13.18 lists the social capital responses per indicator from Section 3 of the Part 1 survey instrument.

Table 13.18: Social Capital Responses

	Chapter 6 - Social Capital	Score
46	Skype for Business facilitates participation in the local community, relevant to virtual collaboration amongst teams.	2
47	Skype for Business facilitates proactivity in a social context, relevant to virtual collaboration amongst teams.	3
48	Skype for Business facilitates feelings of trust between communicants.	4
49	Skype for Business facilitates neighbourhood connections, relevant to virtual collaboration amongst teams.	4
50	Skype for Business facilitates connections to family and friends, relevant to virtual collaboration amongst teams.	3
51	Skype for Business facilitates work connections.	5
52	Skype for Business eliminates barriers of trust by providing secured communication methods between communicants where trust can be established and maintained during interactions and collaborations.	4
53	Skype for Business eliminates barriers of organisational norms by providing facility for spontaneous and opportunistic interaction and engagements between communicants without prescribed conversational norms.	3
54	Skype for Business eliminates barriers of ambiguity by enabling communicants to develop shared meaning and context for their interactions and collaborations.	5

Indicators with Likert scores of 5 indicate that the selected UCS facilitates users' work connections, and helps users overcome barriers of developing shared meanings. Conversely, the respondent does not believe that the UCS affords participation in the local community, assigning this measure a Likert

score of 2. The UCS was given a Likert score of 4 for five social capital indicators, indicating that the respondent is observed to 'Agree' that the tool is able to:

- Afford proactivity in a social context
- Afford connections to family and friends
- Eliminate barriers of organisational norms (cooperation) by providing facility for spontaneous and opportunistic interaction and engagements between communicants without prescribed conversational norms

Table 13.19 provides a distribution of the social capital responses per Likert scale value from Section 3 of the Part 1 survey instrument.

Table 13.19: Distribution of Social Capital Responses

Social Capital Response Distribution					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	0	0.0	0.0	0.0
	Disagree	1	11.1	11.1	11.1
	Neutral	3	33.3	33.3	44.4
	Agree	3	33.3	33.3	77.8
	Strongly Agree	2	22.2	22.2	100.0
	Total	9	100.0	100.0	

Survey responses from Part 1 shows that 22.2% of responses 'Strongly Agree' and 33.3% 'Agree' with the selected UCS's social capital capabilities. A further 33.3% remain 'Neutral' while the remaining 11.1% 'Disagree'. The majority of social capital responses were 'Neutral' to 'Agree' on the Likert scale. The mean value of these responses is 3.67, with a standard deviation of 1.00. Respondents therefore 'Agree' to the selected UCS's ability to meet social capital needs.

13.2.5 Section 4: Sub Problem 4

The Section 4 component of the Part 1 survey instrument uses five indicators to measure the availability of virtual collaboration technologies required for the selected UCS, Skype for Business. These capabilities have been grouped based on their identification during the construct of the current Developed Framework in response to sub problem 4.

Table 13.20: Virtual Collaboration Technologies Statistics

Virtual Collaboration Technologies Statistics		
N	Valid	5
	Missing	0
Mean		4.8000
Sum		24.00

All five virtual collaboration technologies survey responses were deemed valid. The sum of these five responses was 24.00, resulting in a mean of 4.8000 on the Likert scale for virtual collaboration technologies availability. Table 13.21 lists the virtual collaboration technologies responses per indicator from Section 4 of the Part 1 survey instrument.

Table 13.21: Virtual Collaboration Technologies Responses

Chapter 8 - Virtual Collaboration Technologies		Score
16a	High speed LAN connectivity exceeding 100Mb\s per user is readily available?	5
16b	Broadband internet connection exceeding 4Mb\s per user is readily available?	5
16c	Backup and recovery facilities are readily available?	5
16d	Email and scheduling facilities are readily available?	5
16e	High Definition web cameras and sound devices per user are readily available?	4

Based on the listed responses, the following virtual collaboration technologies are readily available to survey respondents:

- High speed LAN connectivity exceeding 100Mb\s per user
- Broadband internet connection exceeding 4Mb\s per user
- Backup and recovery facilities
- Email and scheduling facilities.

The majority of the respondent's responses indicate that they also have access to High Definition (HD) web cameras and sound devices. Table 13.22 provides a distribution of the virtual collaboration technologies responses from Section 4 of the Part 1 survey instrument.

Table 13.22: Distribution of Virtual Collaboration Technologies Responses

Virtual Collaboration Technologies Response Distribution					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strongly Disagree	0	0.0	0.0	0.0
	Disagree	0	0.0	0.0	0.0
	Neutral	0	0.0	0.0	0.0
	Agree	1	20.0	20.0	20.0
	Strongly Agree	4	80.0	80.0	100.0
	Total	5	100.0	100.0	

Survey responses from Part 1 shows that 80.0% of respondents 'Strongly Agree' and a further 20.0% 'Agree' with the availability of virtual collaboration technologies required for the selected UCS. The distribution of virtual collaboration technologies responses in Table 13.22, show that all responses fall within the 'Agree' and 'Strongly Agree' range. The mean value of virtual collaboration technologies responses is 4.80, with a standard deviation of 0.447, exceeding the required mean value of 4. The respondents therefore can be observed to 'Strongly Agree' that the virtual collaboration technologies required for the selected UCS are readily available and implemented in the target organisation.

13.3 Part 1 Survey Outcome

Based on the survey instrumented completed by the researcher in Part 1 of this research, a summary Likert score of above 4.12 was reached through measuring currently available UCS solutions as comparted against the current Developed Framework of this research. This shows that the respondent is observed to 'Agree' with the statement that the selected UCS is an effective platform for:

- Sub problem 1 – Likert score 4.13
- Sub problem 2 – Likert score 4.14
- Sub problem 3 – Likert score 3.67
- Sub problem 4 – Likert score 4.80

Figure 13.4: Part 1 Summary
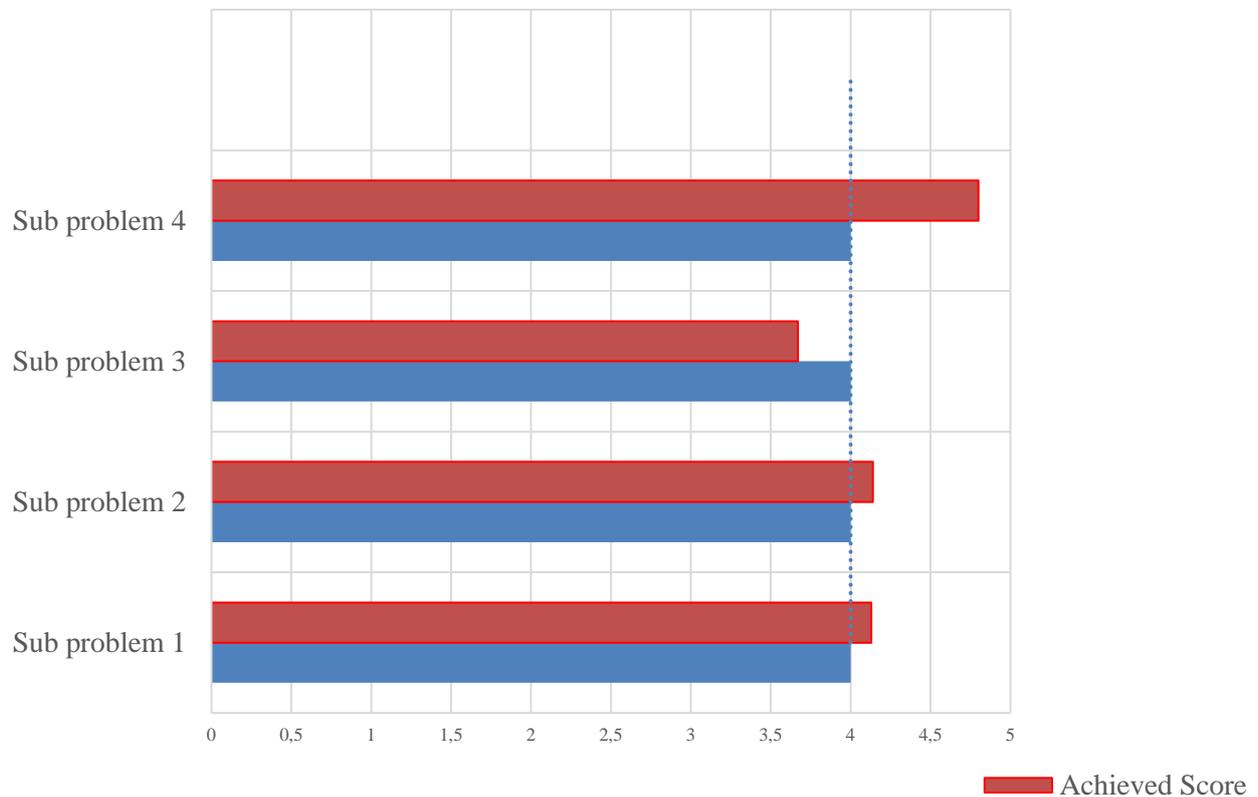
This summary score is also indicated via the bar graph above where the majority of responses are above the mean response required of 4.

13.4 Conclusion

Quantitative analysis of Part 1 survey resulted in a summary Likert score exceeding 4 for all measured constructs, thus establishing that:

- The UCS will meet the required informal virtual collaboration requirements of this research
- The UCS will facilitate teaming
- The UCS is available and implemented in the target organisation

The selected UCS therefore meets the technical requirements set forth by this research through the current Developed Framework and is deemed to be appropriate for use in Part 2 of this research.

Chapter 14 – Part 2 Results

Chapter 13 analysed the results of the survey conducted as Part 1 of the research, proving that the selected UCS was appropriate for use in Part 2 of the research. In Chapter 14, the results and analysis of the hypothesis testing in Part 2 of the research will be provided based on the data sets collected. The consequent semi-structured interview results will also be analysed and presented through content analysis.

14.1 Demographic Results

Analysis of the demographic profiles of Part 2 survey respondents provides insight as to their gender, age, country of residence, level of education, employment status and occupation.

Table 14.23: Gender Analysis

Respondent Gender			
	Frequency	**Percent**	**Cumulative Percent**
Male	16	59.3	59.3
Female	11	40.7	100.0
Other	**0**	**0.0**	**100.0**
Total	**27**	**100.0**	

The majority of survey respondents are male, representing 59.3% of the sample population. The remaining 40.7% of respondents are female, with no respondents identifying themselves as 'Other'.

Table 14.24: Age Analysis

Respondent Age			
	Frequency	**Percent**	**Cumulative Percent**
17 or younger	0	0.0	0.0
18-20	0	0.0	0.0
21-29	8	29.6	29.6
30-39	14	51.9	81.5
40-49	3	11.1	92.6
50-59	2	7.4	100.0
60 or older	0	0.0	100.0
Total	**27**	**100.0**	

The majority of respondents are between the ages of 30-39, representing 51.9% of the sample population. The second largest age grouping is 21-29, reflecting 29.6% of respondents. Therefore, 81.5% of all Part 2 survey respondents are between the ages of 21-39. The remaining 18.5% of Part 2 survey respondents are between the ages of 40-59, comprised of 11.1% between 40-49 and 7.4% between 50-59. There were no survey respondents under the age of 20 or over the age of 60.

Table 14.25: Country of Residence Analysis

Respondent Country of Residence			
	Frequency	**Percent**	**Cumulative Percent**
South Africa	25	92.6	92.6
Other	2	7.4	100.0
Total	**27**	**100.0**	

The vast majority of survey respondents reside in South Africa, representing 92.6% of the total sample. One of the remaining two respondents resides in Swaziland, while the other resides in Zimbabwe.

Table 14.26: Level of Education Analysis

Respondent Highest Level of Education			
	Frequency	**Percent**	**Cumulative Percent**
Less than high school degree	1	3.7	3.7
High school degree or equivalent	18	66.7	70.4
Some college but no degree	0	0.0	70.4
Associate degree	0	0.0	70.4
Bachelor degree	7	25.9	96.3
Graduate degree	1	3.7	100.0
Total	**27**	**100.0**	

Part 2 survey respondents were predominantly High School educated, with 66.7% of respondents holding a high school degree or equivalent. Just 3.7% of respondents have less than a high school degree. The remaining 29.6% of respondents have achieved a higher qualification than a high school degree, with 25.9% holding Bachelor degrees and 3.7% holding Graduate degrees.

Table 14.27: Current Occupation Analysis

Respondent Current Occupation			
	Frequency	**Percent**	**Cumulative Percent**
Management	6	22.2	22.2
Team Lead	5	18.5	40.7
Employee (Team Member)	16	59.3	100.0
Other (please specify)	0	0.0	100.0
Total	**27**	**100.0**	

The current occupation of the majority of Part 2 survey respondents is Employee (Team Member), representing 59.3% of respondents. 18.5% of respondents are employed as Team Leads, and the remaining 22.2% are employed as Management.

Table 14.28: Team Analysis

Respondent Team			
	Frequency	**Percent**	**Cumulative Percent**
Strategic	5	18.5	18.5
Operational	22	81.5	100.0
Total	**27**	**100.0**	

The vast majority of survey respondents are currently members of operational teams, representing 81.5% of the sample population. The remaining 18.5% of the sample population are members of strategic teams.

14.2 Survey Question Results

The results of the Part 2 questions will now be discussed in more detail. Annexures 5 and 6 will display a complete illustration of the descriptive statics and frequency distributions mentioned for each question's result set. Focus will be placed on outlying responses and significant factors that have been identified where the Part 2 responses vary from the current Developed Framework and the responses collected through the Part 1 survey instrument.

Where most responses were observed to align to the Likert scale option of 'Agree', Question 6 of Part 2 had an outlying response were respondents were observed to 'Strongly Agree' when posed the question of whether the tools provided to them were already installed. Examination of the frequency distribution of Question 6 responses reveals that 59.3% of respondents 'Strongly Agree' with this statement, while 37% 'Agree'. Just 3.7% of responses were 'Neutral'. This is not unexpected due to the nature of the sample population and organisation being corporate in nature, where technology solutions are approved and rolled out enterprise wide.

Question 8 of Part 2 was a negatively worded question where respondents were asked whether the toolset was complicated to use and whether they required training to utilise the toolset. There were twenty-seven valid survey responses for Question 8. These responses had a mean value of 2.7037, with a standard deviation of 0.91209, skewed at -0.332. This indicates that respondents are 'Neutral' as to whether the toolset was complicated to use and whether they required training. Examination of the frequency distribution of Question 8 responses, reveals that 44.4% of responses were 'Neutral', while 25.9% 'Disagree' and a further 11.1% 'Strongly Disagree'. The remaining 18.5% of respondents 'Agree'. This result is somewhat unexpected as the UCS had similar interfaces and operating patterns to existing software that the respondents already made use of and that was highlighted by the current Developed Framework as being a positive item in terms of user adoption and familiarity.

Both Question 22 and 24 from Part 2 had considerably lower mean values when compared to the rest of the survey responses and the indications of the Part 1 survey instrument. Both questions had twenty-seven valid survey responses. Question 22 observed that respondents are 'Neutral' as to whether they found themselves assisting in problems and engagements that traditionally would be out of their expertise, and Question 24 observed that respondents are also 'Neutral' as to whether they feel more willing to distribute knowledge with the toolset in place. This result is considered in the context of the

teams that responded to the survey instrument as being expected. The composition of the sample population and participating teams suggest that the majority of the functions that they perform will not promote engagements outside of their expertise, nor the willing sharing of knowledge through a toolset. To confirm this, the frequency distribution of the Question looks as follows:

- Question 22 responses show that 51.9% of responses were 'Neutral'. 11.1% of respondents 'Agree', and 37% 'Disagree'.

- Question 24 responses show that 55.6% of responses were 'Neutral'. 22.2% of respondents 'Disagree', and a further 11.1% 'Strongly Disagree'. The remaining 11.1% 'Agree'.

In the same vein as Question 22 and 24, Question 10 dealt with the respondents branching out of their assigned functions. Question 10 dealt with the question of whether respondents found themselves joining teams that were of interest to them. Again, because of the sample population composition, the strict focus of the teams would suggest that this behaviour was unlikely to occur. As observed, the respondents 'Disagree' with the statement and they did not find themselves joining teams that were of interest to them. The strength to which participants disagreed with the statement and further varied from the current Developed Framework and the Survey 1 suggested outcome response of 'Agree', was unexpected. Analysis of the data shows that responses had a mean value of 2.4444, with a standard deviation of 0.64051, skewed at 0.222. Examination of the frequency distribution of Question 10 responses reveals that 51.9% of respondents 'Disagree' with the statement, and a further 3.7% 'Strongly Disagree'. 40.7% of respondents remain 'Neutral', while just 3.7% 'Agree'.

Finally, with questions 35 and 36 of Part 2, the response option was optional and in a free-text format. As a result, a significantly lower response rate was observed, due mainly to the question not being mandatory. For Question 35 of Part 2, which asked respondents what aspects of the technology toolset they found hindering, there were six valid and twenty-one missing survey responses. Similarly, from Question 36, which asked respondents what aspects of the technology toolset they found enabling, there were thirteen valid and fourteen missing survey responses. While the lack of responses was unexpected, the quality of the captured responses was found to be of a high validity as follows:

Question 35:
- The video connection was not always stable and would sometimes become blurry
- Colleagues would sometimes interrupt me if I didn't turn the technology off (x2)
- There was an echo when I made calls using the software (x2)
- The solution makes my computer slow to start up

Question 36:
- The tools enabled me to easily get in touch with my colleagues (x5)
- I no longer needed a physical phone to call and chat to a work colleague (x2)

- It works with my existing Microsoft Office products and was very helpful in enabling me to send things back and forth with my team
- The instant messaging functionality was great to get an instant reply and decision from my team and/or colleagues (x3)
- I could connect easily with colleagues in different offices and locations (x2)

From the data collected and analyses conducted, several hypotheses will now be tested as determined by the current Developed Framework. These responses will be aligned to the thesis of this research and observing its validity.

14.3 Hypothesis Results

Nine hypotheses were tested in order to establish whether the selected UCS effectively supports informal communication and collaboration in virtual teams. These hypotheses results were determined from a combination of predetermined questions from Part 2 and the factors of the current Developed Framework. Their results are as follows:

14.3.1 Hypothesis 1

- **$H0_1$:** a unified collaboration tool will be able to effectively mimic physical interactions
- **$H1_1$:** a unified collaboration tool will **not** be able to effectively mimic physical interactions.

The survey responses indicated that the teams are more strongly distributed towards the 'Agree' statement for Hypothesis 1. The responses indicate that the teams 'Agree' that a UCS will be able to effectively mimic physical interactions. As such, the following is true for Hypothesis 1: **$H0_1$:** a unified collaboration tool will be able to effectively mimic physical interactions

14.3.2 Hypothesis 2

- **$H0_2$:** a unified collaboration tool will enable collaboration amongst virtual teams and their members.
- **$H1_2$:** a unified collaboration tool will **not** enable collaboration amongst virtual teams and their members.

The survey responses indicated that the teams are more strongly distributed, but above the mean of 3, towards the 'Neutral' statement for Hypothesis 2. The responses indicate that the teams are 'Neutral' in their responses that a UCS will enable collaboration amongst virtual teams and their members. As such, the following is true for Hypothesis 2: **$H0_2$:** a unified collaboration tool will enable collaboration amongst virtual teams and their members.

14.3.3 Hypothesis 3

- **$H0_3$:** networks will form in an organisation autonomously.
- **$H1_3$:** networks will **not** form in an organisation autonomously.

The survey responses indicated that the teams are more strongly distributed, but above the mean of 3, towards the 'Neutral' statement for Hypothesis 3. The responses indicate that the teams are 'Neutral' in their responses that networks will form in an organisation autonomously. As such, the following is true for Hypothesis 3: **H0₃:** networks will form in an organisation autonomously.

14.3.4 Hypothesis 4

- **H0₄:** virtual teams will form due to the lack of available co-located resources.
- **H1₄:** virtual teams will **not** form due to the lack of available co-located resources.

The survey responses indicated that the teams are more strongly distributed, but above the mean of 3, towards the 'Neutral' statement for Hypothesis 4. The responses indicate that the teams are 'Neutral' in their responses that virtual teams will form due to the lack of available co-located resources. As such, the following is true for Hypothesis 4: **H0₄:** virtual teams will form due to the lack of available co-located resources.

14.3.5 Hypothesis 5

- **H0₅:** informal collaboration will occur between team members with similar goals.
- **H1₅:** informal collaboration will **not** occur between team members with similar goals.

The survey responses indicated that the teams are more strongly distributed, but above the mean of 3, towards the 'Neutral' statement for Hypothesis 5. The responses indicate that the teams are 'Neutral' in their responses that informal collaboration will occur between team members with similar goals. As such, the following is true for Hypothesis 5: **H0₅:** informal collaboration will occur between team members with similar goals.

14.3.6 Hypothesis 6

- **H0₆:** social capital will be generated through informal collaborations of virtual team members.
- **H1₆:** social capital will **not** be generated through informal collaborations of virtual team members.

The survey responses indicated that the teams are more strongly distributed, but above the mean of 3, towards the 'Neutral' statement for Hypothesis 6. The responses indicate that the teams are 'Neutral' in their responses that social capital will be generated through informal collaborations of virtual team members. As such, the following is true for Hypothesis 6: **H0₆:** social capital will be generated through informal collaborations of virtual team members.

14.3.7 Hypothesis 7

- **H0₇:** knowledge will be more readily available and distributed through informal collaboration of virtual team members.
- **H1₇:** knowledge will **not** be more readily available and distributed through informal collaboration of virtual team members.

The survey responses indicated that the teams are more strongly distributed towards the 'Agree' statement for Hypothesis 7. The responses indicate that the teams 'Agree' in their responses that knowledge will be more readily available and distributed through informal collaboration of virtual team members. As such, the following is true for Hypothesis 7: **H0$_7$:** knowledge will be more readily available and distributed through informal collaboration of virtual team members.

14.3.8 Hypothesis 8

- **H0$_8$:** organisations will experience greater network formation and informal collaboration by providing technology interventions.
- **H1$_8$:** organisations will **not** experience greater network formation and informal collaboration by providing technology interventions.

The survey responses indicated that the teams are more strongly distributed towards the 'Agree' statement for Hypothesis 8. The responses indicate that the teams 'Agree' in their responses that organisations will experience greater network formation and informal collaboration by providing technology interventions. As such, the following is true for Hypothesis 8: **H0$_8$:** organisations will experience greater network formation and informal collaboration by providing technology interventions.

14.3.9 Hypothesis 9

- **H0$_9$:** organisations will experience gains through promoting informal collaboration in the organisation.
- **H1$_9$:** organisations will **not** experience gains through promoting informal collaboration in the organisation.

The survey responses indicated that the teams are more strongly distributed towards the 'Agree' statement for Hypothesis 9. The responses indicate that the teams 'Agree' in their responses that organisations will experience gains through promoting informal collaboration in the organisation. As such, the following is true for Hypothesis 9: **H0$_9$:** organisations will experience gains through promoting informal collaboration in the organisation.

14.3.10 Hypotheses Summary

The below is a consolidated table of the hypotheses results:

Table 14.29: Summarised Hypotheses Mean Results

Hypothesis Mean Summary					
	All respondents	Team 1	Team 2	Team 3	Team 4
H1 Mean	3.97	4.15	3.73	4.23	3.75
H2 Mean	3.2	3.06	3.77	2.88	3.3
H3 Mean	3.22	3.27	3.5	3.02	3.08
H4 Mean	3.2	3.06	3.1	3.77	2.88
H5 Mean	3.45	3.06	3.1	3.77	2.88
H6 Mean	3.08	3.28	3.6	2.5	2.95
H7 Mean	3.86	4.25	4.2	3	4
H8 Mean	3.68	4	3.87	3.83	3
H9 Mean	3.68	4	3.87	3.83	3

Table 14.30: Summarised Hypotheses Results

Hypotheses Summary		
	Score	**Result**
Hypothesis 1	3.97	**H01:** a unified collaboration tool will be able to effectively mimic physical interactions
Hypothesis 2	3.20	**H02:** a unified collaboration tool will enable collaboration amongst virtual teams and their members.
Hypothesis 3	3.22	**H03:** networks will form in an organisation autonomously.
Hypothesis 4	3.02	**H04:** virtual teams will form due to the lack of available co-located resources.
Hypothesis 5	3.45	**H05:** informal collaboration will occur between team members with similar goals.
Hypothesis 6	3.08	**H06:** social capital will be generated through informal collaborations of virtual team members.
Hypothesis 7	3.86	**H07:** knowledge will be more readily available and distributed through informal collaboration of virtual team members.
Hypothesis 8	3.68	**H08:** organisations will experience greater network formation and informal collaboration by providing technology interventions.
Hypothesis 9	3.68	**H09:** organisations will experience gains through promoting informal collaboration in the organisation.

With the hypothesis testing now completed, the results of the Part 2 semi-structured interviews will be analysed. These interview results will be used to quantify the outlying responses from the Part 2 survey as well as to capture responses from teams on a team basis rather than individually. These semi-structured interviews and following content analysis will also then form a secondary data collection point to contribute towards the overall case study evaluation of the research thesis.

14.4 Semi-Structured Interview Results

In order to cater for virtuality, the responses to Part 2 semi-structured surveys were analysed for content and context. The responding teams were included in semi-structured interviews to understand and incorporate the context associated with their responses which added to the overall conclusion of the case study output for this research. The semi-structured interviews made use of both open and close ended questions to collect relevant and in-depth information about responses. The semi-structured interviews presented several use cases before the teams which were then evaluated, by the teams, in a consolidated manner with one answer per team, per question being recorded. The semi-structured interviews were Interviewer Administered, which facilitated the researcher in being able to focus on certain phenomena in a natural setting. Thus, the semi-structured interviews enabled responses to be related back to relevant components of the Developed Framework as well as understood and contextualised within the organisational context. Annexures 5 and 6 will display a complete illustration of the descriptive statics and frequency distributions mentioned for each of the results that follow.

14.4.1 Semi-Structured Interview Questions Results Summary

The below is a consolidated table of the semi-structured interview questions results by use case:

Table 14.31: Semi-Structured Interview Questions Results by Use Case

Semi-Structured Interview Results Summary					
	All respondents	Team 1	Team 2	Team 3	Team 4
Employee productivity	3.58	3.67	4.33	3.00	3.33
Team-based productivity	3.75	3.67	4.33	3.67	3.33
Organisational agility	2.92	2.33	3.67	2.33	3.33
Usability	3.33	3.67	3.33	3.00	3.33
Learning and Growth	3.75	3.33	4.33	3.33	4.00
Security and trust	3.50	4.00	4.00	2.67	3.33
Summary	3.44	3.75	4.25	2.75	3.00

From the results above, Team 2, which is strategic in business function, were consistently observed to score their responses higher than the other 3 operational teams. During their responses there was also indication of their willingness to engage with the tool and the features it had to offer. What was also observed was the fact that the teams regarded individual employee productivity as increased but far less so than that of the team-based productivity for all members. This was echoed in several responses across the teams where they felt that doing functions with and through their team members was much more efficient when compared to not having the UCS in place.

Unexpectedly, the results for organisational agility were lower than expected based on the Part 2 Survey responses and the current Developed Framework would suggest. This outlying response was quantified during the semi-structured interviews and was mostly the result of the teams being very focused on their sets of functions without being afforded much room to innovate on them, or to assist in other functions outside of their job role. While this observation was noted, the teams also indicated that the abilities of the UCS to support learning and growth were a major factor in helping them to start overcoming this. The learning and growth questions received the joint highest response in line with what the current Developed Framework and the responses from the Part 2 Survey would anticipate.

In summary, the majority of the responses were of the 'Neutral' Likert scale option, including Questions 3, 7, 8, 9, 10, 12, 16, 17, and 20. While the mean of the responses confirmed the observations around the 'Neutral' Likert scale option, several factors and contextualisations were provided that further clarified the responses. Now that these secondary data points have been captured, the results of this research, with the associated context, will be discussed in a Findings and Recommendations chapter. This chapter will provide a case study output which combines all this research's observations and couples them with some recommendations that are suggested based on the current Developed Framework in order to validate this research's thesis.

Chapter 15 – Findings and Recommendations

Chapters 13 and 14 analysed the results of the research conducted through the Part 1 and 2 survey instruments of this research, leveraging a mixed method approach of surveys and semi-structured interviews. In Chapter 15, the analysis of the hypothesis testing and analysis of Part 1 and Part 2 will be provided based on the data sets collected. The results will form a set of findings and recommendations aimed at validating the thesis of this research, in a case study format.

15.1 Introduction

At the outset of this research, the aim of investigating informal communication and collaboration amongst virtual teams, in the organisational context, was established. This aim was separated into two parts where Part 1 represents a current framework developed by the study of several literature sources. These literature sources helped to solidify the key success factors that enable and promote informal communication and collaboration.

This current Developed Framework was then tested by a self-administered survey to determine if contextual relevance, within an organisation, could be established. This relevance would also include the availability of the required teams and team structures, as dictated by the current Developed Framework. The survey would be administered against a predetermined UCS before confirming it as appropriate for this research. Following this, an organisation would be identified that had a deployment of the technology and where the research could be conducted with several teams.

At this stage, Part 2 of the research, a survey instrument, was delivered to the members of four disparate teams and their members. The findings of the surveys were then consolidated and considered before semi-structured interviews were held with each team. The following sections represent the outputs of the two parts of the research.

15.2 Part 1 Findings

The Part 1 survey comprised of fifty-nine questions that would explore the technical features incorporated within the chosen UCS. The survey instrument would then determine to what extent these features support the aforementioned characteristics and their association with virtual team communication in formal and informal collaboration in particular. The survey was divided into sixteen topics each with several questions. These groups would be later utilised in developing use cases that could be further evaluated by the teams in Part 2 of the research.

From a summary point of view, the combined score was averaged at a Likert score of 4.12 out of 5. This represented an 'Agree' rating from the available Likert scale responses. In terms of identifying whether the survey's sub problems were addressed, the following was observed:

- Sub problem 1 – Likert score 4.13
- Sub problem 2 – Likert score 4.14
- Sub problem 3 – Likert score 3.67
- Sub problem 4 – Likert score 4.80

These scores indicate that the chosen UCS meets the technical requirements set for this research by the current Developed Framework. The UCS is therefore deemed to be appropriate for use in Part 2 of this research. The scores also indicate that there are four sections that can be constructed in Part 2, based on the sub problems of this research. These sub problems can then be easily evaluated and related back to the current Developed Framework, the use cases associated to the current Developed Framework, and the questions defined in the Part 1 survey. This continuity will also help to ensure that the results remain accurate, valid within the current Developed Framework, and importantly, contextual to the organisational context in which they were conducted. From a technology point of view, the chosen UCS was confirmed to:

- meet the required informal virtual collaboration requirements of this research
- facilitate teaming
- be available and implemented in the target organisation

With these results formalised, Part 2 of the research could proceed, and the findings of the Part 2 results are below.

15.3 Part 2 Findings

Part 2 of this research focused on measuring and establishing the level to which a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. This was primarily facilitated through measuring employee responses to predetermined questions and sub problems. These results were further explained and contextualised through the summary results recorded in the semi-structured survey conducted in Part 2. The semi-structured survey results were also evaluated in terms of the individual team results that were previously summarised. The sub problems from Part 1 were combined with the hypothesis established in Part 2 and the result was a set of use cases that formed the basis of the case study output of this research.

The use cases were used to observe the results of the research hypothesis and sub-problems established at the beginning of this research. The use cases are of importance because the current Developed

Framework identified informal communication and collaboration as being based on network formation which suggests that networks are based on individuals that are loosely coupled and variable in number.

As a result, the case study output of this research was enhanced with results from the four steps suggested by Parung and Bititci (2008) for measuring informal networks and their associated collaborations:

- "A problem is decomposed into a multi-level hierarchical structure, which is comprised of value generators and their factors".
- "The value generators and factors are prioritised".
- "Individuals' contributions in each factor are assessed".
- "Individuals' contributions are measured".

Parung and Bititci (2008)

From these four suggestions, the thirty-nine survey questions, and the twenty-two semi-structured interview questions were tested against the use cases. As the use cases were aligned to the four identified sub problems of this research, and were continually evaluated throughout the case studies, their result would indicate a final outcome for this research thesis, in case study format.

15.3.1 Demographic Findings of the Sample Population

The sample population was primarily high school educated, South African residents between the age of thirty and thirty-nine. This metric is relevant as it indicates that the respondents were mostly matriculants and working professionals who were technically empowered. The age of the respondents also suggests that the majority of the sample population will have enough experience in the working world to be able to provide informed and educated responses to the questions being put before them. There is also a sixty to forty percent split between male and female respondents to get a representative sample across the organisation.

15.3.2 Team Findings and Function Bias

The sample population also had a majority percentage of respondents who were in a 'team member' role in an operational team. The sample population however was representative of the organisation where there were also management type respondents and strategic teams involved. This was relevant as the responses to each use case were evaluated and the differences between job roles and team purposes could be quantified against the Unified Communications Tool.

15.3.3 Use Case Structure

For Part 2 of the survey, thirty-nine questions were administered on an individual basis. Each respondent remained anonymous and the results were then evaluated on a team basis, against a set of

sub problems and associated hypotheses, where a combination of the individual results were averaged over the number of responses received. This grouping was used to try and establish reasons for the differing of values between the Part 1 score and the considerably lower Part 2 scores highlighted in each sub problem. The use cases were also used to align the data collection with more business process and outcome focused scenarios that respondents would typically be involved in performing during their day-to-day roles.

The semi-structured interviews enabled specific topics, that the researcher wanted to explore during the interview, to be further clarified. The themes for the questions were established by the sub problems of the research and the individual questions aim to clarify and contextualise individual responses versus those of combined teams. By systematically evaluating responses, qualitative voice data was converted into quantitative data. As applied to this research, response analysis enabled coding categories and responses as derived directly from the participant responses. The semi-structed interviews that were conducted on a team basis facilitated a single result per question. This result was collected per team and several observations and annotations were made by the researcher to place the results in context. This context is vitally important when evaluating the outputs of this research as it will help to explain the variances between what the technology is capable of and what was observed based on a single quantified answer per team. The results of the semi-structured interviews with any annotations and context were added through analysis of the sessions that were performed during the interviews by the researcher and included in the sub problem findings and recommendations.

The results for each sub problem follow below in the context of this research:

15.3.3.1 Sub Problem 1

Sub problem 1 of this research explored what is meant by a virtual team and identified the communication challenges peculiar to virtual teams. Statistically, the sub problem was evaluated through two hypotheses as follows:

Hypothesis 1: a unified collaboration tool will be able to effectively mimic physical interactions. From the analysis it is clear that the strategic team is the one in which the lowest combined score was recorded. This is due to the fact that the nature of these types of teams is historically based on face-to-face interactions and the team members are generally of a generation that is more technology resistant (Huxham, 2015). Overall the hypothesis scored a 3.82 which indicates a Likert scale response of 'neither agree nor disagree' with a leaning towards 'Agree'. In conclusion for Hypothesis 1, it was observed that the following is true: **H0$_1$:** a unified collaboration tool will be able to effectively mimic physical interactions.

Hypothesis 3: networks will form in an organisation autonomously. The largest team was the team with highest score for this hypothesis and this is indicative of the fact that the team that is the largest by number, is that which affords networks to form more readily (Lom and Sullenger, 2011). Interestingly, networks were observed to form in all of the teams including the strategic team. Overall the hypothesis scored a 3.63 which indicates a Likert scale response of 'neither agree nor disagree' with a leaning towards 'Agree'. In conclusion for Hypothesis 3, it is observed that the following is true: **H0₃:** networks will form in an organisation autonomously.

Following the outcomes of these two Hypotheses a use case was also established to validate this sub problem. The employee productivity use case was formed, and the use case received an overall score of 3.45 which indicates a Likert scale response of 'neither agree nor disagree'. This use case thus indicates that employee productivity seems to remain neutral which would agree with the results observed by hypotheses H1, and H3. This result should also be considered in the context it was taken as the aim of the research and UCS is to facilitate team-based interaction and productivity. This context helps to explain why the score is somewhat lower than expected and lower than the Part 1 score.

From a findings and recommendations standpoint, this initial use case comprised three questions aimed at ascertaining whether common day-to-day business functions could be easily completed through the UCS. Based on the Developed Framework, this use case would be able to evaluate the virtual communication and collaboration between users in the context of employee productivity and enabling interactions to occur irrespective of the user's location or distance from the team. These questions were presented to the teams and they were asked to discuss this with the following being observed:

> The average response once qualified from each of the teams was a Likert scale score of 'Neutral' leaning towards 'Agree'. The strategic team seemed to derive the most value out of this use case as they found in particular that the presence indicator that the system afforded them enabled them to interact with colleagues at times where they knew they could be productive and achieve more. The instant nature of the communication and responses in an unstructured fashion also helped to get to the point quickly, enabling the users to make a decision, and move forward with the task at hand. The strategic team also noted that the solution worked well in the office as well as when they were out on the road which helped to

ensure they were connected and productive more often than they had been before the use of the UCS.

All three of the operational teams found that the UCS did help them with day-to-day tasks but noted that colleagues would interrupt them with non-work-related items which would lead to negative productivity scenarios. The teams were also conscious that the UCS could be used to monitor each user's actions, but most users did not see this as something that would be implemented. The operational teams also noted that being able to collaborate on the same screen with their colleagues was the one feature that really enabled them to solve and perform business functions more readily without having to engage in a separate interaction with their colleagues.

Both sets of teams did agree that attending meetings was very easy using the tool but that connection issues did sometimes create a less than optimal experience. Collaboration, particularly on documents, was also easily achieved but on several occasions, was observed to be slow. Also noted was that the technology seemed to work well for the users rather than the users having to adapt to the technology. The UCS also helped to eliminate wasted time in terms of determining where a user was based on their presence and status features.

The summary semi-structured interview score for all four teams was 3.58 and this varies slightly from the 3.45 of the individual responses. This indicates that once validated and clarified, responses tend to be slightly higher than what was observed on an individual basis. This is expected as qualifying the context for answers will provide the correct context with which teams can evaluate the question put before them.

Based on the statistical results as well as the results from the semi-structured interviews, it was observed and further recommended that:

- a UCS will effectively mimic physical interactions such as communication and collaboration
- Networks and virtual teams will form in an organisation autonomously through the use of a UCS
- The instant nature of the UCS will enable instant decision making and efficient task completion
- The presence feature can be used to gauge the most appropriate time to interact with colleagues
- Appropriate hardware and network/internet connectivity are required to facilitate the full benefit of the virtual communication, collaboration and team formation

15.3.3.2 Sub Problem 2

Sub problem 2 of this research explored what is meant by formal and informal collaboration and described the role that informal collaboration plays in the successful functioning of a team. Statistically, the sub problem was evaluated through three hypotheses as follows:

Hypothesis 2: - a unified collaboration tool will enable collaboration amongst virtual teams and their members. All teams seemed to observe a fairly neutral score in this hypothesis which is typically a good indication that the tool may not be widely utilised to its full potential by the respondents (Schauer, 2008). Overall the hypothesis scored a 3.31 which indicates a Likert scale response of 'neither agree nor disagree'. In conclusion for Hypothesis 2, it is observed that the following is true: **H02:** unified collaboration tool will enable collaboration amongst virtual teams and their members.

Hypothesis 4: - virtual teams will form due to the lack of available co-located resources. The highest scoring team, here again, was the team that was strategic in nature. While all teams scored relatively in favour of the hypothesis, the strategic team were highest due to the typically lower number of strategic resources found within an organisational (Lom and Sullenger, 2011). Overall the hypothesis scored a 3.76 which indicates a Likert scale response of 'neither agree nor disagree' with a lean towards 'Agree'. In conclusion for Hypothesis 4, it is observed that the following is true: **H04:** virtual teams will form due to the lack of available co-located resources.

Hypothesis 5: - informal collaboration will occur between team members with similar goals. Apart from the largest team, the other teams all scored this hypothesis towards the negative. It was observed that the size of the team with the highest score was the main contributing factor to the high score but overall the results suggest that the teams are more focused on induvial tasks rather than team collaboration. This metric was observed to change when enough team members were available for informal collaboration to occur as indicated by the results from team three. Overall the hypothesis scored a 3.15 which indicates a Likert scale response of 'neither agree nor disagree'. In conclusion for Hypothesis 5, it is observed that the following is true: **H05:** informal collaboration will occur between team members with similar goals.

Following the results of these three hypotheses two use cases were also established to validate this sub problem. The team-based productivity use case was formed and produced an overall score of 3.20 which indicates a Likert scale response of 'neither agree nor disagree'. This use case then indicates that team-based productivity only becomes apparent when the team is of significant size,

typically eight members or more. Smaller teams thus do no experience the same productivity increase due mainly to their size. This is supported by hypothesis H2, H4 and H5 but it is important to note that H2 is not strongly supported in this use case because of the team size, irrespective of the team function.

From a findings and recommendations standpoint, this team-focused use case comprised three questions aimed at ascertaining whether common intra-team functions and tasks completed through the UCS resulted in a perceived increase in team-based productivity. Based on the current Developed Framework, this use case would be able to evaluate the interactions between physical and virtual teams. These interactions would include video and ad-hoc interactions based on available channels that the UCS facilitates. These questions were presented to the teams and they were asked to discuss them with the following being observed:

> The average response once qualified from each of the teams was a Likert scale score of 'Neutral' with a lean towards 'Agree'. All of the teams consistently agreed that they were able to engage over voice and video channels in an effective manner with few performance issues being observed. The teams also observed that they often used the screen sharing abilities of the Tool to co-author and collaborate on several types of functions and tasks. The only negative observation here was that the security of some of the older systems wouldn't allow the screen sharing to work as expected.

> Surprisingly, informal interactions were only extensively used by one operationally focused team. The other teams would only use the functionality to interact formally when they were engaged in a business-related task or function. The other teams made greater use of formal meetings facilitated through the tool which enabled them to more accurately plan their schedules and commitments.

With the above in mind, it is evident that collaboration is markedly increasing in many organisations. "As businesses become increasingly global and cross-functional, silos are breaking down, connectivity is increasing, and teamwork is seen as a key to organisational success" Bonvillain, (2019:6). According to data collected by Cross *et al.* (2016:6) "over the past two decades, the time spent by managers and employees in collaborative activities has increased by fifty percent or more".

"However, when consumption of a valuable resource spikes that dramatically, it should also be considered how much time people spend in communication and collaboration interactions" Bonvillain, (2019:7). "In many companies, the proportion hovers around eighty per cent, leaving

employees little time for all the critical work they must complete on their own. Performance suffers as they are buried under an avalanche of requests for input or advice, access to resources, or attendance at a meeting" Bonvillain, (2019:6-7). "Employees take assignments home, and soon, according to a large body of evidence on stress" as mentioned by Cross *et al.* (2016:6), burnout and turnover become real risks. All of this is pronounced through the use of technologies such as UCS which leads many organisations to evaluate the thesis of this research: determining whether a unified communication technology intervention can be effective in supporting informal communication collaboration in virtual teams.

The teams studied by Cross *et al.* (2016:6) "had members spread among multiple locations, and in as many as thirteen sites around the world". "Consistently the study showed that as the size of teams increased, usually due to new technologies like UCSs, collaboration effectiveness per member tended to drop" Cross *et al.*, (2016:7). This result was also observed through the results of this research. Furthermore, "large teams often formed to ensure the involvement of a wide stakeholder group and assumed outcomes but the coordination of a diverse set of activities, and the harnessing of multiple skills inevitably led to the level of natural communication and collaboration among members of the team decreasing" Gratton and Erickson, (2007:44).

While building on and improving collaboration and informal networks is the aim for most organisations, this should not come at the cost of employee's day-to-day business functions, capacity, and the wellbeing of the overall team (Gratton and Erickson, 2007). Correctly formed virtual teams are most often observed to be the answer in this scenario and these teams are generally formed on the heritage of previous relationships (Cross *et al.*, 2016).

It is therefore important to evaluate networks and their importance across the organisation. These evaluations will identify performing employees as well as business functions that are generating value outside of their prescribed context (Cross *et al.*, 2016). Huxham (2015:1041) observed that "most organisations have several differing informal networks. These networks organise and reorganise themselves and extend their reach in several ways using several various commercial technologies". "As networks widen and deepen, they can mobilise talent and knowledge across the enterprise" Cross *et al.*, (2016:7). These networks thus form the basis for informal collaboration.

Improving collaboration can be achieved in a number of ways as suggested by Lin Russel, Knutson, and Crowley (2013), below:

- "Attain benefits of scale through effective global collaboration"

- "Drive work force engagement and performance"
- "Align collaboration with business partners and external stakeholders"
- "Minimise network inefficiencies and costs"

Lin Russel, Knutson, And Crowley (2013)

"A key concept in relation to virtual collaboration is trust. Given how important trust is to successful collaboration, forming teams that capitalise on pre-existing, or heritage, relationships, increases the chances of a virtual team's success" Bonvillain, (2019:5). Research by Cross *et al.* (2016:6-7) shows that "new teams, particularly those with a high proportion of members who were strangers at the time of formation, find it more difficult to collaborate than those with established relationships".

The second use case established was also used to validate the above sub problem. The security and trust use case was formed and the use case received an overall score of 3.86 which indicates a Likert scale response of 'neither agree nor disagree' with a leaning towards 'Agree'. This use case then indicates that respondents believed that the technology was secure, and they were able to trust the technology to maintain their privacy and anonymity where required. This is in line with the H2, H4, and H5 hypothesis and the outputs from Part 1 of this research.

The security and trust use case comprised three questions aimed at determining whether the UCS was considered by respondents to be a trusted system with the correct and secure transmission of their messages, whilst maintaining the ability to share content and detail as their business functions required. Based on the current Developed Framework, this use case would give an indication on whether the UCS effectively implements a presence feature, allows users to trust the security of their interactions on the system and provides confidence that interactions are delivered to only the intended recipients.

The average response once qualified from each of the teams was a Likert scale score of 'Neutral' with a leaning towards 'Agree'. All the responding teams found that their ability to share details, context and their screen during their day-to-day business functions was one of the key strengths of the UCS. They also noted that they were happy that their messages were only being transmitted to the intended recipients. The unique logins for each user also helped to ensure that user's trust towards the system was enhanced and the users felt confident that no one could interact with other users as though it was them.

The operational teams did note that there were some worries about the presence function being used to track their working hours as well as system administrators being able to view the contents of their messages. The strategic team was of the opinion that while this 'oversight' may occur, their interactions were business focused and were thus governed by the organisation's internal security policies. The teams did conclude that they were happy with conducting their day-to-day business processes through the UCS.

The summary semi-structured interview score for all four teams was 3.50 and this varies slightly from the 3.86 of the individual responses. This indicates that once validated and clarified, responses tend to be slightly lower than what was observed on an individual basis. This is unexpected as qualifying the context for answers should provide the correct context which would lead to a slightly higher score being observed. In this scenario, the variance was observed to be the result of operational users being concerned that the UCS could provide administrators with unwelcome oversight of their daily working habits.

"Newly formed teams are forced to invest significant time and effort in building trusting relationships" Cross *et al.*, (2016:7). This was particularly evident from the Part 2 team-based results where the operational teams were conscious of the following: interacting with colleagues on the correct channels, and system administrators monitoring their every action. If, as the Cross *et al.* (2016:8) study shows, "some team members already know and trust one another, they can become nodes, which over time evolve into networks". The study by Cross *et al.* (2016:8) and the Part 2 results confirmed that "when team members were already well connected to one another, like in the strategic team's case, the team displayed strong collaboration right from the start".

This trust can be extended through ensuring that a team has a compelling direction (Gratton and Erickson, 2007). "There is no one right way to set a direction and as such the responsibility can fall to the team leader or to an employee in the organisation outside the team or even to the team itself in the case of more strategic teams" Cross *et al.*, (2016:8). "Leaders who are emotionally mature, willing, and able to move their team toward anxiety-inspiring situations are able to establish a clear team direction" Cross *et al.*, (2016:8). This move can be more easily facilitated through solutions like UCSs but simultaneously, a leader will usually encounter resistance to the team direction, the UCS, or sometimes both.

The summary semi-structured interview score for all four teams was 3.75 and this varies largely from the 3.20 of the individual responses. This indicates that once validated and clarified, responses tend

to be slightly higher than what was observed on an individual basis. This result is expected as the qualifying context for the answers will provide the correct context with which the teams can evaluate the question put before them.

Based on the statistical results as well as the results from the semi-structured interviews, it was observed that:

- A UCS will enable collaboration amongst virtual teams and their members especially when there is a lack of available co-located resources.
- Informal collaboration will occur between team members with similar goals, but informal interaction only occurs extensively in operationally focused teams.
- A UCS enables users to engage over voice and video channels in an effective manner.
- Organisations need to consider how much time employees spend in communication and collaboration interactions as it may overtake productive outputs of their defined job roles.
- Large teams are often formed to ensure the involvement of a wide stakeholder group. These large teams are counterproductive and should be avoided.
- Virtual teams should not include too many experts as this will dilute the purpose of the team and result in reduced output.
- Teams found that the ability to share details, context and their screen was one of the key strengths facilitated by the UCS.
- Newly formed teams are forced to invest significant time and effort in building trusting relationships which can be reduced when some team members already know and trust one another. This trust can transform into nodes, which over time evolve into networks, if promoted in the organisation.
- Trust can be extended through ensuring that a team has a compelling direction which is most often facilitated through organisational promotion of a collaboration and sharing culture.

15.3.3.3 Sub Problem 3

Sub problem 3 of this research investigated what is meant by Social Capital and how this impacts on the successful functioning of a virtual team and ultimately, the organisation. Statistically, the sub problem was evaluated through two hypotheses as follows:

Hypothesis 6: - social capital will be generated through informal collaborations of virtual team members. Most of the scores were in favour of a positive outcome for the hypothesis which indicates that teams which are smaller in nature tend to generate more social capital. Overall the hypothesis scored a 3.24 which indicates a Likert scale response of 'neither agree nor disagree'. In conclusion for Hypothesis 6, it is observed that the following is true: $H0_6$: social capital will be generated through informal collaborations of virtual team members.

Hypothesis 7: - knowledge will be more readily available and distributed through informal collaboration of virtual team members. Of all the teams observed, the strategic team is of the opinion that knowledge will be more readily available through informal collaboration. This is likely due to the team function and the nature of strategic teams in requiring and generating lots of additional knowledge which can now be facilitated through tools such as UCS (Golnaz and Conida, 2012). Overall the hypothesis scored a 3.26 which indicates a Likert scale response of 'neither agree nor disagree'. In conclusion for Hypothesis 7, it is observed that the following is true: **H0₇:** knowledge will be more readily available and distributed through informal collaboration of virtual team members.

Following the outcomes of these two Hypotheses, a use case was also established to validate this sub problem. The learning and growth use case was formed and received an overall score of 3.08 which indicates a Likert scale response of 'neither agree nor disagree. This use case then indicates that learning and growth are not seamlessly facilitated by the UCS. This in turn agrees with the following hypotheses: H6 and H7. It is clear from these use case results that even though the technology is capable of facilitating the learning and growth scenarios, this is not being observed by the respondents. This was due to the majority of the respondents being operationally focused which highlighted a focus on interaction and outcome rather than social capital and formal knowledge creation.

From a findings and recommendations standpoint, this use case comprised three questions aimed at determining whether the UCS was capable of enabling learning and growth scenarios though day-to-day business functions. Based on the Developed Framework, this use case would give an indication on whether the UCS promotes the concepts of Social Capital. This was observed through enhanced relationships with other users and team members, and trust building up between teams when business functions needed to be executed. This use case also highlighted sharing and shared context between users if and where it occurs. These questions were presented to the teams and they were asked to discuss with the following being observed:

> The average response once qualified from each of the teams was a Likert scale score of 'Neutral' with a lean towards 'Agree'. The teams all agreed that the UCS was able to assist them in solving problems outside of their usual day-to-day functions. Primarily they found that the ability to connect with other individual's and share opinions and insight was the main strength. While the teams agreed that the dissemination of information and knowledge was

supported by the technology, they found that they used the technology more for interactions than knowledge sharing.

While none of the teams directly identified social capital as being generated from their activities, they did agree that they could connect with users who had the knowledge and information they required. Previously, they confirmed that they would have had difficulty in connecting to these individuals and getting access to the knowledge. The teams also agreed that they found themselves assisting in additional business functions outside of their normal job role as it was easy to do so and the technology enabled them to operate on several channels which helped to facilitate the extra interactions with their colleagues.

Immediately apparent in most organisations is that it's important to distinguish among three types of collaborative resources that individual employees invest in others to create value for themselves and potentially their organisation: informational, social, and personal.

- **"Informational** resources are knowledge and skills - expertise that can be recorded and passed on".
- **"Social** resources involve one's awareness, access, and position in a network, which can be used to help colleagues better collaborate with one another".
- **"Personal** resources include one's own time and energy".

Gratton and Erickson (2007)

These three resource types are not equally efficient. "Informational and social resources can be shared - often in a single exchange, where shared context has been established" Gratton and Erickson, (2007:45) - without depleting the collaborator's supply. That is, "when an employee offers another knowledge or network awareness, they still retain it for personal use. However, an individual employee's time and energy are finite, so each request to participate in or approve decisions for additional business functions leaves less available for that employee's own business functions" Gratton and Erickson, (2007:45-46).

"Unfortunately, personal resources are often the default demand when people want to collaborate. Instead of asking for specific informational or social resources - or better yet, searching in existing repositories such as reports, or knowledge bases facilitated by tools such as UCS - employees ask for hands-on assistance they may not even need" Gratton and Erickson, (2007:46). An interaction that might have taken five minutes or less turns into a thirty-minute calendar invite that strains personal resources on both sides of the request (Huxham, 2015).

Huxham (2015:1039) makes it clear that "interactions may be the consequence of formal interactions and/or cooperation or they may occur in a more informal way. In both cases, these interactions usually entail some form of collaborative network where a network is made up of several individuals that have similar goals, operating environments and social capital". These networks are formed through three stages:

- "stage one: discovery of collaborative opportunities"
- "stage two: exploration of collaborative opportunities"
- "stage three: crystallisation of collaborative relations"

Huxham (2015)

These stages are important as they vary in terms of the impact and efficiency of employees as the execute their day-to-day business functions. These three stages and the impact on employees became abundantly clear when the results of Part 2 were analysed between the individual responses and the team-based responses. On a summary level, the induvial responses score summary for all respondents was 3.75. The team-based summary score for the same respondents but on a team level was 3.46 or a Likert scale response of 'Neutral'.

This variance is also observed by Gratton and Erickson (2007:46) where "a study on teams working together virtually highlighted the fact that as teams became more virtual, collaboration declined, unless the organisation had taken measures to establish a collaborative culture".

It was noted in the same study by Cross *et al.* (2016:8) "that complex collaborative teams often generate huge value by drawing on a variety of deeply specialised skills and knowledge to devise new solutions". The research shows that this scenario only occurs when there is a minority of the virtual team consisting of highly educated specialists, else it was observed that the team is more likely to disintegrate into unproductive conflicts. Statistically, it was observed that twenty to thirty-five per cent of value-added collaborations come from only three to five per cent of employees (Cross *et al.*, 2016). As employees become known for their Social Capital, they are drawn into business functions and roles of growing importance (Gratton and Erickson, 2007). A single Social Capital contributing employee who frequently contributes beyond the scope of his or her role was observed to be capable of driving team performance more than all the other employees combined (Gratton and Erickson, 2007).

The summary semi-structured interview score for all four teams was 3.75 and this varies largely from the 3.46 of the individual responses. This indicates that once validated and clarified, responses tend

to be slightly higher than what was observed on an individual basis. This result is expected as qualifying the context for the answers will provide the correct context with which the teams can evaluate the question put before them.

Based on the statistical results as well as the results from the semi-structured interviews, it was observed that:

- A UCS will facilitate social capital generation through the informal collaborations of virtual team members
- Knowledge will be more readily available and distributed through informal collaboration of virtual team members
- Social capital wasn't explicitly observed as being generated but the UCS did connect users with other users who had knowledge and information they required
- Requests were too often made for personnel resources as a lack of a collaborative culture was observed in the organisation
- Complex teams can generate high value outputs but only when the minority of the team consists of experts

15.3.3.4 Sub Problem 4

Sub problem 4 of this research investigated and described a commercial technology mediated communication system in an attempt to highlight what attributes of such a system support informal communication and collaboration amongst virtual teams. Statistically, the sub problem was evaluated through a hypothesis as follows:

Hypothesis 8: - organisations will experience greater network formation and informal collaboration by providing technology interventions. Responses for Hypothesis 8 were analysed through content analysis before determining a positive or negative outcome, based on the suggestions of the Developed Framework. In conclusion for Hypothesis 8, the number of responses leaning towards a positive of the hypothesis lead to an observation that the following is true: **$H0_8$:** organisations will experience greater network formation and informal collaboration by providing technology interventions.

Following the results of this hypothesis a use case was also established to validate this sub problem. The usability use case was formed and produced an overall score of 3.97 which indicates a Likert scale response of 'neither agree nor disagree' with a lean towards 'Agree'. For this use case, the teams agreed that they were able to perform common document functions using the UCS, but they stated this was due mainly to their previous familiarity with associated Microsoft technologies. All four of the teams were concerned with a lack of training that they usually receive on solutions of this type. This lack of training left them feeling unsure of the technology and the functions it could

perform. While the users said they could often figure it out, they lacked the confidence to explore the technology and all that it had to offer which is reflected in the relatively low Likert scale responses scored consistently by each team.

From a findings and recommendations standpoint, the usability use case comprised six questions aimed at determining whether the UCS was easily adopted by users without a significant amount of training or a steep learning curve. Based on the current Developed Framework, this use case would give an indication on whether the UCS can lead users to new ways of collaborating and innovating, while simultaneously supporting a familiar and intuitive process so minimal training, if any is required. These questions were presented to the teams and they were asked to discuss with the following being observed:

> All of the teams confirmed that they were able to perform common day-to-day functions like IM, voice and video calls, email and calendaring, as well as document collaboration and screen sharing. While the operational teams highlighted the fact that the video and audio capabilities were not always perfect, the observation was quantified to the fact that the teams believed their device hardware was insufficient rather than the UCS being insufficient. The use of the presence was particularly useful for the strategic team as they found it enabled them to connect seamlessly with their colleagues whenever they needed to.

This use case then indicates that the UCS was relatively simple for the respondents to use and interact with. This adoption piece is a valid construct because if respondents don't engage correctly with the provided technology, the result of this thesis may be skewed. While supported by hypothesis H8, it is interesting to note that even though the technology was seen to be adopted and easy to use, the full benefit of the UCS as reported in Part 1, was not being realised by the respondents and the teams overall.

This summary semi-structured interview score for all four teams was 3.33 and this varies largely from the 3.97 of the individual responses. This indicates that once validated and clarified, responses tend to be slightly lower than what was observed on an individual basis. This is unexpected as qualifying the context for answers should provide the correct context which would lead to a slightly higher score being observed. In this scenario, the variance was observed to be the result of users not feeling confident with the technology in a team setting. The higher individual scores suggest that users are willing to engage with the technology further but lack the confidence to do so during business-critical day-to-day functions.

Based on the statistical results as well as the results from the semi-structured interviews, it was observed that:

- Appropriate infrastructure and hardware should be made available for users to experience the full benefit of a UCS.
- Training and familiarisation are an important part of user's adoption of the system, as is being made aware of the capabilities the UCS affords.
- Familiarity with a supplier of solutions like Microsoft does not always translate into familiarity of a new solution provided by the same provider, but it does provide basic levels of understanding and of adoption.
- IM, voice, video, email, calendaring, presence, document collaboration and screen sharing were all used by and expected to be available as part of a UCS from the user's perspective

15.3.3.5 Problem Statement (Thesis Evaluation)

The Problem Statement of this research explored what determines whether a unified communication technology can support informal communication processes in a virtual team. Statistically, the problem was evaluated through the following hypothesis:

Hypothesis 9: - organisations will experience gains through promoting informal collaboration in the organisation. Overall this summary hypothesis received positive responses from the teams other than the smallest operational team which recorded a more neutral response. This is likely due to team size and function combining to result in lower scores compared to the other teams (Serçe et al. 2011). Overall the hypothesis scored a 3.77 which indicates a Likert scale response of 'neither agree nor disagree' with a lean towards 'Agree'. In conclusion for Hypothesis 9, it is observed that the following is true: **H0$_9$:** organisations will experience gains through promoting informal collaboration in the organisation.

Following the results of this hypotheses, two use cases were established to validate this sub problem. The organisational agility use case was formed, and the use case received an overall score of 3.22 which indicates a Likert scale response of 'neither agree nor disagree'. This use case then indicates that even though the score was expected to be higher, based on Part 1 results, the neutral response indicates that the respondents do believe the organisation is able to change rapidly if required. This is backed up by hypotheses H2, H3, H4, H5 and H8 which indicate that teams using the technology do react more quickly and innovatively to scenarios, but this only starts to become apparent when teams are of a larger size. From the findings and recommendations standpoint, this use case comprised six questions aimed at determining whether organisational agility was possible, through the UCS, and if so, to what level. Based on the current Developed Framework, this use case should give an indication on whether the UCS can afford benefits outside of a pure utilitarian value. This was observed through potential changes in productivity, better business outcomes, and virtual collaboration

between users and teams. Organisations need tools that support agility in order to be competitive and enable their employees to achieve predetermined outcomes (Serçe et al. 2011).

The average response once qualified from each of the teams was a Likert scale score of 'Disagree' with a lean towards 'Neutral'. There was a sharp difference between the strategic and operational teams for this use case. Operational teams were more inclined to believe that while the technology was an enabler for them, it did not help them engage more rapidly to solve business problems or to engage with new channels that they weren't already engaged in. Operational teams also agreed with the fact that joining teams and sharing commitments was not easily achievable using the UCS because of the rigid corporate structures that exist in the organisation.

Conversely, the strategic team were more aligned to agreeing that the UCS was able to facilitate joining a new team and sharing in the responsibilities thereof. The strategic team also agreed that they could engage in more channels than before and these channels were most often observed to be screen sharing and collaboration.

The main observation from this use case is that while the technology is able to facilitate multiple scenarios, it ultimately comes down to the way users engage with the technology. This became very apparent when conversations would often highlight several different options and examples of functions that individuals and teams performed that the other teams didn't know existed or were available.

This is reflected in the summary semi-structured interview score for all four teams at 2.92 and this varies slightly from the 3.22 of the individual responses. This indicates that once validated and clarified, responses tend to be slightly lower than what was observed on an individual basis. This is unexpected as qualifying the context for answers should provide the correct context which would lead to a slightly higher score being observed. In this scenario, the variance was observed to be the result of the interpretation of the UCS and the ways in which it can function and be utilised.

With this seemingly negative set of outcomes becoming apparent, what benefits could an organisation derive from this environment? Berardo (2009) demonstrated that the following two categories of organisational benefits may be experienced when an organisation is able to exercise agility in their operations: Building Lateral Networks; Reducing Network Silos.

One of the simplest ways to realise these benefits is through the encouragement of behavioural change and particularly, informal collaboration (Gratton and Erickson, 2007). "It also helps if the organisational leadership has taken other measures to cultivate networks that cross boundaries and

promote a culture of collaboration" Gratton and Erickson, (2007:45). This is usually a long-term process, and Gratton and Erickson (2007) observed that the following will accelerate the process toward benefit recognition:

- Enable the most active and overburdened employees to filter and prioritise requests;
- Provide employees and teams the authority to say no or to reallocate tasks as required;
- Encourage employees to make an introduction to additional users when the request doesn't draw on their own unique contributions.

Gratton and Erickson (2007)

UCSs also enable employees to use their presence settings and notification "snoozing" that encourages them to set stronger boundaries around their incoming information flow. By controlling this information flow, employees will find themselves in environments where when they do invest personal resources, and these include value-added activities that they find energising rather than exhausting (Gratton and Erickson, 2007).

"To stem the tide of incoming requests, information seekers must change their behaviour too" Gratton and Erickson, (2007:46). Resetting norms regarding when and how to initiate interactions can free up a great deal of wasted time. These interactions will become more prioritised and of a higher value by default which leads to a strong sense of community developing (Gratton and Erickson, 2007). "When employees feel a sense of community, they are more comfortable reaching out to others and more likely to share knowledge" Gratton and Erickson, (2007:46). In addition, requests for time-sapping reviews and approvals can be reduced in many risk-averse cultures by encouraging employees to take courageous action on decisions they should be making themselves, rather than constantly checking with leaders or additional team members (Gratton and Erickson, 2007).

A second simple way to encourage these benefits is through executive support. "At the most basic level, a team's success or failure at collaborating reflects the philosophy of top executives in the organisation" Gratton and Erickson, (2007:46). "Teams do well when executives invest in supporting social relationships, demonstrate collaborative behaviour themselves, and create trusting and meaningful relationships in which employee interactions with leaders and colleagues are value-generating and generously offered" Cross et al., (2016:7-8).

"In companies with many thousands of employees and several hundred teams, relatively few employees have the opportunity to observe the behaviour of the senior teams on a day-to-day basis" Gratton and Erickson (2007:46). Nonetheless, Gratton and Erickson (2007) found that the perceived

behaviour of senior executives plays a significant role in determining how collaborative teams are prepared to be. "While the behaviour of the executive team is crucial to supporting a culture of collaboration, the challenge is to make executives' behaviour visible" Gratton and Erickson (2007:47). To facilitate this visibility, internal communication should be frequent and open, and throughout the organisation, collaboration is promoted through knowledge being made available both formally and informally. These situations can be aided by solutions such as UCSs by always having the underlining theme of employees and teams working together.

"The senior team's collaborative nature trickles down throughout the organisation. Employees quickly learn that the best way to get things done is through informal networks" Cross et al. (2016:8). Cross et al. (2016:8) provide an example "where a major program was launched to introduce a new customer-facing technology. The team responsible had an uncanny ability to understand who the key stakeholders at each bank branch was, and where and how best to approach them. The team members' first-name acquaintance and relationship with people across the company brought a sense of dynamism and trust to their interactions".

With these dynamic interactions being deemed as value generating for the organisation, the case study provides clear evidence of a blueprint for where a UCS intervention can be effective in supporting informal collaboration in virtual teams. This blueprint will be confirmed below through the second use case established which was also used to validate the sub problem. The summary use case was formed and produced the following overall score of 3.68 which indicates a Likert scale response of 'neither agree nor disagree' with a lean towards 'Agree'. This use case was derived from three summary statements aimed at representing the entire outcome for the business in line with the thesis of this research. These questions were:

- Would you recommend this tool set to others?
- Will you continue to use the toolset once this experiment has finished?
- Do you believe that your levels of collaboration increased with colleagues and team members?

This use case then indicates that respondents are leaning towards 'Agree' in the sense that they believe the tool is capable and promotes communication and collaboration between teams and they are looking to continue using it after the research concludes. This is in slight contradiction to the previous use cases which did not all 'Agree' so strongly with this sentiment. This result however is to be expected because the nature of the research requires a mixed method approach where data results are collected and then analysed before being quantified through a process like semi-structured interviews and analysis.

From a findings and recommendations perspective, while measuring collaboration may be difficult, organisations should still have the goal of improving collaboration, particularly in the virtual sense (Berardo, 2009). Improved virtual collaboration means faster decision making, ad-hoc collaboration and team formation, and multi-channel communications and interactions between employees (Lamont, 2010). Where possible, budgetary benefits should come second - that is, organisations shouldn't focus solely on cost savings, because it minimises the other values that a UCS can bring to an organisation (Lawson et al., 2009).

With this in mind, the summary use case comprised three questions aimed at determining whether the UCS was considered by the responding teams to facilitate their virtual communication and collaboration needs. These needs were established across the team's business functions both individually and in a team setting. Based on the current Developed Framework, this use case should give an indication on whether the UCS effectively facilitates users in their interactions with the technology across a spectrum of channels. The use case should also indicate a perception of whether the respondents individually and in a team-setting, believed they were more productive.

The average response from each of the teams was a Likert scale score of 'Neutral'. The strategic team again scored highest here with observations that the number of channels available to the team enabled them to perform functions that were difficulty to do so before previously. The strategic team also noted that the UCS was able to help them facilitate effective interactions both in the individual and team sense. There was a confirmation from the strategic team that they agree that they are more productive both individually and as a team with the use of the UCS.

The operational teams were slightly lower scoring with a more neutral response to the UCS. Particularly frustrating for the operational teams was not knowing which of the several available channels were the best to use for engaging with their colleague. Based on this, the operational teams often felt that they were not as productive as they could be because of the delays in interacting on the channels they had initially chosen. The teams did agree that training on the tool was likely to help them resolve these issues.

The summary semi-structured interview score for all four teams was 3.41 and this varies slightly from the 3.86 of the individual responses. This indicates that once validated and clarified, responses tend to be slightly lower than what was observed on an individual basis. This is unexpected as qualifying the context for answers should provide the correct context which would lead to a slightly

higher score being observed. In this scenario, the variance was observed to be the result of operational users being unable to connected over the correct channel with their colleagues at the first time of asking.

Interestingly, each team scored lower than the output of the Part 1 survey instrument which scored 4.12. To evaluate the discrepancies, it is clear that the same results need be evaluated in terms of several use cases where the score might be more accurately mapped back to business factors and capabilities of the UCS. This use case output can then be used to provide context over the current Developed Framework that was evaluated and selected in Part 1 and provide a set of findings and recommendations for its implementation.

15.5 Conclusion

When evaluating the hypotheses on a summary level it can be seen that all nine were observed to be true. What is more interesting is that when the hypotheses were compared together, it became apparent that while the UCS was capable of performing the processes and functions required, the individuals and teams engaging with the technology did not always make use of the full scope of the technology provided. Chapter 16 will conclude this study with insights and outputs related to the findings of Chapter 15 and in relation to the sub problems and the current Developed Framework of this research.

Chapter 16 – Conclusion

When evaluating the hypotheses on a summary level it can be seen that all nine were observed to be true. What is more interesting is that when the hypotheses are compared together, they provide some interesting insight as follows:

- There is a marked difference between strategic and operationally focused teams and their responses:
  - Strategic teams:
    - prefer face-to-face collaboration
    - are technology resistant
    - despite the two points above, easily form virtual teams through non- co-located resources
    - distribute social capital more readily over informal channels when they are available
  - Operational Teams:
    - Informally collaborate more often
    - Form networks more easily
- Both types of team didn't use the UCS to its full potential as was indicated in the Part 1 survey
- Team size has a direct impact on the formation of networks with larger teams forming networks more easily
- Team size also has an impact on informal collaboration where larger sized teams tend to have more informal collaboration occurring
- Smaller teams do however tend to generate more social capital

From the above, it is clear that the larger the team making use of the UCS, more collaboration and informal collaboration will occur. However, the converse is true for generating social capital which leads to the observation that there are a smaller number of interactions happening in the smaller teams, but these are of higher value when compared to the larger teams of this study. It is also clear that the larger a team becomes, the more the trend is to focus on adopting new technologies to make their roles more efficient. This adoption is not however translated into outputs such as social capital but is translated into stronger networks and formation of new networks. From the free text responses, it is also clear that most negative factors around the technology are related to the respondent's hardware rather than the solution itself. Positive free text responses indicated that the UCS:

- Enabled communication and collaboration between respondents
- Integrated with other technologies well
- Enabled real-time decision making
- Enabled connecting with remote colleagues and negated distance as a factor

This agrees with the summary hypothesis results which were positive and confirmed the hypothesis but also determined a major theme: the bigger the team, generally, the bigger the number of team

interactions, outputs, network formations and network strengthening, but at a reduced value of output when compared to smaller teams.

In conclusion, the aim of this research should be remembered as follows: to determine whether a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. Throughout this research, this thesis has been evaluated through an investigation of informal communication and collaboration amongst virtual teams, in the organisational context.

Four additional sub problems were also defined and the first three of these were answered during a comprehensive literature review. These sub problems included:

- **Sub problem 1**: described what is meant by a virtual team and identify the communication challenges peculiar to virtual teams.
- **Sub problem 2**: delved into what is meant by formal and informal collaboration and describe what the role that informal collaboration plays in the successful functioning of a team.
- **Sub problem 3**: aimed to investigate what is meant by social capital and how this impacts on the successful functioning of a virtual team and ultimately the organisation.

Following the literature review, a Developed Framework was established to identify the key success factors that enable and promote informal communication and collaboration between virtual teams in an organisation. This Developed Framework was constructed in order to enable the evaluation of the effects that virtual teams experience based on informal communication that is technologically based. This was in answer to the fourth sub problem, defined as follows:

- **Sub problem 4**: investigated and described a commercial technology mediated communication system in an attempt to highlight what attributes of such a system support informal communication and collaboration amongst virtual teams.

Sub problem 4 was also supported by the Part A survey which was conducted by the researcher in order to confirm the applicability and suitability of the technology selected. Following this, virtual teams were equipped with the technology intervention believed to be suitable in supporting informal collaboration in an attempt to determine whether such an intervention can support effective informal collaboration as discussed within the research. This led onto the Problem Statement which was defined as follows:

- **Problem Statement**: determined whether a unified communication technology can support informal communication processes in a virtual team.

The problem Statement also made use of the Part B survey and subsequent semi-structured interviews to observe the virtual and physical environments, in which the interactions occurred to provide qualitative results to illustrate the informal interactions based against the current Developed

Framework and subsequent use cases. The use cases were geared towards informal communication and collaboration, and as such, the results will focus on certain situations which are outlined in the literature review.

The results were then tabulated and evaluated in a case study to identify the shortcomings of the UCS and the impact that the informal communication and collaboration had on the target organisation and its virtual teams as defined by the case study.

In summary the case study identified the following outcomes in relation to the overarching thesis of: determining whether a unified communication technology intervention can be effective in supporting informal collaboration in virtual teams:

- Microsoft Skype for Business is a suitable UCS to evaluate this research thesis with
- From a hypothesis point of view, all of the hypotheses were observed to be true and the following was noted:
    - **Hypothesis 1** - Strategic teams prefer face-to-face interactions and are relatively technology resistant, especially without prior training.
    - **Hypothesis 2** – The teams indicated that they believe they don't use the UCS to its full potential.
    - **Hypothesis 3** - Team size has an impact on the formation of networks both formal and informal with strategic teams tending to already have well-formed networks.
    - **Hypothesis 4** - Strategic teams more often form virtually due to the lack of available and skilled co-located resources.
    - **Hypothesis 5** - Informal collaboration tends to happen in teams of a larger size.
    - **Hypothesis 6** - Smaller teams tend to generate more social capital.
    - **Hypothesis 7** - Strategic teams distribute social capital more readily over informal channels when they have these channels available.
    - **Hypothesis 8** – Most issues observed with the UCS were related to hardware issues and lack of user training.
    - **Hypothesis 9** – Small operational teams were the worst perceived performers with regard to collaboration due to their team size and function. Bigger teams lead to better output particularly when the team was strategic in function.
- From a use case point of view, the following was observed:
    - **Use Case 1** – Teams confirmed a consistent and frequent use of the presence function. The teams also noted that the UCS enabled them to work outside of the office and to be always connected. The immediate nature of the UCS afforded teams the ability to execute quick decision-making processes where necessary. The teams did also observe some connection issues primarily related to the hardware of their machines. The overall use case score (3.58) was slightly higher than the overall individual score (3.45).
    - **Use Case 2** – The teams responded that voice and video channels were good quality and easy to use. The teams also favoured the screen sharing capabilities but found that certain security measures prevented them for utilising the full functionality of the

function. The teams also noted a lack of informal interactions with more focus being placed on formal interactions, particularly to plan their calendars and commitments. The overall use case score (3.75) was much higher than the overall individual score (3.20) and an observation was made that all of the teams lacked the awareness as to the full extent of what the UCS can do.

- o **Use Case 3** – Operational teams found that the UCS did not speed up interactions or processes. They also noted that they did not engage on new channels that they had not already being doing so on. The strategic team observed the opposite to the operational teams. The overall use case score (2.92) was slightly lower than the overall individual score (3.22) and an observation was made that while the UCS can facilitate several use cases and functions, there are clear issues with the way in which users adopt the technology and make use of it.
- o **Use Case 4** – All of the responding teams noted that a lack of training was a problem. Primarily this led to a lack of confidence in the technology and a lack of awareness of what the technology was capable of. Furthermore, this led to the team observing a lack of confidence in solution in team settings and while executing certain business functions. The teams did state that they are willing to engage with solution but not during business-critical scenarios until they feel more confident with all of the functions and capabilities. The overall use case score (3.33) was much lower than the overall individual score (3.97).
- o **Use Case 5** – The responding teams found the UCS was able to assist in several diverse business problems, processes and functions. The teams also observed that they could connect well with others both as part of their team, and external to their team. It was also noted that the teams used the UCS more for interaction than knowledge dissemination. While social capital was not specifically called out but by the teams, there was an acknowledgement that being able to connect to the correct people and experts timeously was able to create additional value and benefit for the organisation. The overall use case score (3.75) was much higher than the overall individual score (3.08).
- o **Use Case 6** – The teams were in agreement that messages were delivered only to the intended recipients. The teams also trusted the platform and were of the opinion that it was secure. Operational teams raised a concern that oversight of their daily working habits may be facilitated by the UCS. The overall use case score (3.50) was slightly lower than the overall individual score (3.86).
- o **Use Case 7** – The strategic team engaged on their traditional channels as well as the new channels available to them and confirmed that this promoted individual and team-based productivity. Operational teams found it difficult to get hold of colleagues on the correct channel leading them to believe that they are less productive due to having to switch channels repeatedly. The overall use case score (3.41) was slightly lower than the overall individual score (3.86).

It is clear that as the research progressed, the scores that were observed varied between a pure induvial recorded score from Part A, to a pure team-based score in Part B, to a use-case-based score in the semi-

structured interviews. This variance is clear evidence that while the UCS is capable of executing against the requirements of the current Developed Framework, in practice, the results are not always realised. As such, it is more accurate and correct to contextualise the results. Therefore, to wrap this all up in the research thesis, it is best to consider the results in the context of Return on Investment (ROI) for an organisation. "It is difficult to imagine a world without technology, and investment in technology continues to grow at astonishing rates" Cross et al., (2016:8). "Its growth is inevitable, and its use is growing exponentially. However, these investments attract attention from executives who often want to know if the investments are paying off and generating a return. Most executives would agree that any large expenditure in an organisation should in some way be connected to business success" Cross *et al.,* (2016:8-10). "Even in non-business settings, large investments should connect to organisational measures of output, quality, cost, and time—classic measurement categories of hard data that exist in any type of organisation" Cross *et al.,* (2016:10).

What has become apparent during this research is that the classic measurement categories do not always apply to measuring informal collaboration and its outputs within an organisation. As such, it is essential for an organisation to determine what value looks like for them before they try and measure outputs against a technology. For this research, an appropriate technology was selected based on the following perceived value generating factors:

- a UCS will be able to effectively mimic physical interactions
- a UCS will enable collaboration amongst virtual teams and their members
- networks will form in an organisation autonomously
- virtual teams will form due to the lack of available co-located resources
- informal collaboration will occur between team members with similar goals
- social capital will be generated through informal collaborations of virtual team members
- knowledge will be more readily available and distributed through informal collaboration of virtual team members
- organisations will experience greater network formation and informal collaboration by providing technology interventions
- organisations will experience gains through promoting informal collaboration in the organisation

The factors were also formalised into hypotheses which were later all observed to be true. However, the aim of this research was to determine whether a UCS intervention can be effective in supporting informal communication and collaboration in virtual teams. Therefore, these hypotheses need to be resolved into some use cases, aimed at mimicking business functions and processes, with accompanying context to answer the thesis. What became apparent was that while the UCS was

capable of performing the processes and functions, the individuals and teams engaging with the technology did not always make use of the full scope of the technology provided. So, while the final hypothesis (H_9) was observed to be true in relation to proving the thesis of this research, the value and success of the UCS needed more context to ensure that the value generating outcomes defined by the additional hypotheses ($H_1 - H_8$) were observed to be true continually and could be measured against a business outcome to provide a ROI measure. The current Developed Framework provided the starting point for proving this ROI measure and the following must also be observed to ensure that H_9 is also observed to be true and the organisation is able to quantify and observe actual business benefit from a UCS intervention by supporting informal communication and collaboration in virtual teams:

- Promoting a collaboration culture in the organisation
    - Create visibility of senior management using the same technologies and tools
- Enabling employees to collaborate
    - Ensuring that the appropriate technologies are available
    - Ensuring that the appropriate hardware and connections are available
    - Ensuring that teams are of the correct size, so they can generate valuable outputs both formally and informally
- Appointing collaboration leaders
    - Enabling leaders to prioritise requests
    - Enabling leaders to provide direction for their teams
    - Promote trust building activities with the systems and fellow users and team members
    - Promote network formation
- Formalise social capital creation processes
- Facilitate appropriate training and user education to effectively manage user behavioural change

While measuring the direct financial benefits, including ROI of a UCS, is beyond the scope of this research, the literature, as discussed, would suggest that improved collaboration, enhanced social capital, and increased organisational agility are predictions of a successful and sustainable organisation. For these reasons, it is believed that a UCS will indeed provide direct benefits to an organisation in increasing communication and collaboration in the organisation. These increases can be observed in both the physical and virtual sense. The benefits will also include negation of distance as a factor and particularly, the formation of highly functioning teams that have consistent and value-generating outputs for an organisation. Cost reductions because of virtuality will also be observed and using the current Developed Framework as a blueprint with the above success enablers, an organisation should be able to effectively implement a UCS like Skype for Business. Subsequently, it should be able to observe direct benefits for an organisation by being able to confirm the thesis of this research in, that having a UCS intervention is effective in supporting informal communication and collaboration in virtual teams.

References

ADLER, P., and KWON, S., 2002. Social Capital: Prospects for a New Concept. *Academy of Management,* 27(1), 17:40.

AHMED, A.E., 2009. Virtual Teams: A Literature Review. *Australian Journal of Basic and Applied Sciences*, 3(3): 2653-2669.

ALLEN, M., 2000. Media bias in presidential elections: a meta-analysis. *Journal of Communication*, 50(4): 133-156.

ALTSCHULLER, S., and BENBUNAN-FICH, R., 2010. Trust, performance, and the communication process in ad hoc decision making virtual teams. *Journal of Computer-Mediated Communication*, 16: 27-47.

AMBROZEK, J., AXELROD, V.G., CARBONARO, J., KELLEY, L.M. and RUSSELL, W.G. 2008. Sustainable Enterprise Field book. London, UK: Greenleaf Publishing Limited.

ANDRESSEN, P., KONRADT, U., and NECK, C. P., 2012. The relation between self-leadership and transformational leadership: Competing models and the moderating role of virtuality. *Journal of Leadership & Organizational Studies,* 19: 68-82.

ARGOTE, L., and INGRAM, P., 2000. Knowledge transfer: A basis for competitive advantage in firms. O*rganizational Behaviour and Human Decision Processes,* 82, 150–169.

BAILEY, K., and LELAND, K., 2006. Watercooler wisdom: How smart people prosper in the face of conflict, pressure, & change. Oakland, CA: New Harbinger.

BANDURA, A., 1997. Self-efficacy: The exercise of control. New York: Freeman.

BAIRD, R., MAYER, J., and SMYTH, J., 2013. Support for virtualized unified communications clients when host server connectivity is lost. *USPTO Patent Grants*.

BASSANINO, M., LAWSON, B., WORTHINGTON, J., PHIRI, M., BLYTH, A., and HADDON, C., 2001. Final report: Learning from experience – applying systematic feedback to improve the briefing process in construction. The University of Sheffield, Sheffield.

BEAUDOUIN-LAFON, M., 1990. Collaborative development of software in multi-user interfaces and applications. *Proceedings of IFIP WG8.4 Conference on Multi-User Interfaces and Applications*, Crete.

BEINLICH, J., NIXON, C. and BURMOOD, J., 2002. Deploying collaboration systems: project level collaboration and KM. *KM & Intranets World 2002: Collected Presentations, 8*, pp. 69-77.

BELTON, V., and GEAR, T., 1985. The legitimacy of rank reversal: a comment. *Omega.* 13(3), 143:144.

BENBASAT, I., GOLDSTEIN, D., & MEAD, M., 1987. The Case Research Strategy in Studies of Information Systems. MIS Quarterly, 11(3): 369-386.

BERARDO, R., 2009. Processing Complexity in Networks: A Study of Informal Collaboration and its Effect on Organizational Successes. *The Policy Studies Journal*. 37(3), 521:539.

BHARADWAJ, S.S. and SAXENA, K.B.C., 2006. Impacting the Processes of Global Software Teams: a Communication Technology Perspective. *Vision (09722629),* 10(4), pp. 63-75.

BJØRN, P. and NGWENYAMA, O., 2009. Virtual team collaboration: building shared meaning, resolving breakdowns and creating translucence. *Information Systems Journal,* 19(3), pp. 227-253.

BONOMA, T., 1985. Case research in marketing: opportunities, problems, and a process. *Journal of Marketing Research*, 22 (2), 199-208.

BONVILLAIN, N., 2019. *Language, Culture, and Communication - The Meaning of Messages*. Maryland: Rowman & Littlefield.

BOROS, S., MESLEC, N., CURSEU, P. L., and EMONS, W., 2010. Struggles for cooperation: Conflict resolution strategies in multicultural groups. *Journal of Managerial Psychology*, 25: 539-554.

BOSTRÖM, A., 2002. Informal learning in a formal context: problematizing the concept of social capital in a contemporary Swedish context. *International Journal of Lifelong Education*, 21(6), 510-524.

BOYACI, C., ASKU, A., TARCAN, E., and ATILGAN, E., 2009. The Importance of Communication within Organisations. *Information Systems Engineering,* 3(2), 672:692.

BRAHM, T., and KUNZE, F., 2012. The role of trust climate in virtual teams. *Journal of Managerial Psychology*, 27:595-614.

BRANDT, V., ENGLAND, W. and WARD, S., 2011. Virtual Teams. *Research Technology Management,* 54(6), pp. 62-63.

BROWN, H.G., POOLE, M.S., and RODGERS, T.L., 2004. Interpersonal Traits, Complementarity, and Trust in Virtual Collaboration. *Journal of Management Information Systems*, 20:(4), 115-138.

BULLEN, P. and ONYX, J., 1998. Measuring Social Capital in Five Communities in NSW – A Practitioner's Guide, *Management Alternatives*, 5(2), 99:108.

BURT, R.S., 1992. Structural holes: The social structure of competition. Cambridge, MA: Harvard University Press.

BURT, R.S., 2000. The Network Structure of Social Capital, R*esearch in Organizational Behaviour,* 22(1), 339:365.

CANGELOSI, A., 2001. Evolution of Communication and Language Using Signals, Symbols and Words. *IEEE Transaction in Evolution Computation.* 5, 93:101.

CARR, C., and ZUBE, P., 2014. Network Autocorrelation of Task Performance via Informal Communication within a Virtual World. *Journal of Media Psychology. 27(1): 33-44.*

CAVAYE, A.L.M., 1996. Case study research: a multi-face-ted research approach for IS. *Information Systems Journal*, 6 (3): 227-242.

CHOI, S., LEE, H., and YOO, Y., 2010. The Impact of Information Technology and Transactive Memory Systems on Knowledge Sharing, Application, and Team Performance: A Field Study. MIS Quarterly, 34(4): 855-870.

CISCO SYSTEMS, 2008. Unified Communications: Use Virtual Collaboration to Improve Environmental Sustainability.

CLARK, A.M., 1998. The qualitative-quantitative debate: moving from positivism and confrontation to post-positivism and reconciliation. *Journal of Advanced Nursing*. 27(6): 1242-1249.

CLARK, H. H., and BRENNAN, S. E., 1991. Grounding in communication*. Perspectives on socially shared cognition*. Washington, DC: American Psychological Association.

COLEMAN, J. S., 1988. Social capital in the creation of human capital. *American Journal of Sociology*, 94(1): 95-120.

COLEMAN, J. S., 1990. *Foundations of Social Theory,* Harvard University Press, Boston.

CONWAY, S., 1995. Informal Boundary-spanning Communication in the Innovation Process: An Empirical Study. *Technology Analysis & Strategic Management,* 7(3): 327.

COPPOLA, N. W., HILTZ, S. R., and ROTTER, N. G., 2004. Building trust in virtual teams. *IEEE Transactions on Professional Communication*, 47: 95-104.

CRAMPTON, S.M., HODGE, J.W. and MISHRA, J.M., 1998. The Informal Communication Network: Factors Influencing Grapevine Activity. *Public Personnel Management,* 27(4): 569.

CRAMTON, C. D., and WEBBER, S. S., 2005. Relationships among geographic dispersion, team processes, and effectiveness in software development work teams. *Journal of Business Research*, 58: 758-765.

CROSS, R., and PARKER, A., 2004. The Hidden Power of Social Networks. Understanding How Work Really Gets Done In Organizations. Harvard Business School Press, Boston.

CROSS, R., REBELE, R., GRANT, A., 2016. Collaborative Overload. Harvard Business Review, 1(1), 6 - 8.

CUMMINGS, J. N., and HAAS, M. R., 2012. So many teams, so little time: Time allocation matters in geographically dispersed teams. *Journal of Organizational Behavior*, 33: 316-341.

DAEL, N., MORTILLARO, M., and SCHERER, K.R., 2012. The body action and posture coding system (BAP): Development and reliability. *Journal of Nonverbal Behavior,* 36(1): 97:121.

DAFT, R. L., and LENGEL, R. H., 1986. Organizational information requirements, media richness and structural design. *Management Science*, *32(1)*: 554-571.

DAS, T.K., and TENG, B.S., 1998. Resource and risk management in strategic alliance making process. *Journal of Management*. 24(1): 21-42.

DAVENPORT, T., and PEARLSON, K., 1998. Two cheers for the virtual office. *Sloane Management Review*. 3, 51-64.

DEETER-SCHMELTZ, D. R., and RAMSEY, R. P., 2003. An investigation of team information processing in service teams: Exploring the link between teams and customers. *Journal of the Academy of Marketing Science*, 31(4): 409–424.

DENNIS, A. R., FULLER, R. M., & VALACICH, J. S., 2008. Media, tasks, and communication processes: A theory of media synchronicity. *MIS Quarterly*, *32(1):* 575-600.

DIMITROV, S., 2015. Comparing Data Envelopment Analysis and Human Decision Making Unit Rankings: A Survey Approach. Economics Quality Control, 29(2): 129-141.

DITTMAN, D.R., HAWKES, M., DEOKAR, A.V. and SARNIKAR, S., 2010. Improving Virtual Team Collaboration Outcomes through Collaboration Process Structuring. *Quarterly Review of Distance Education,* 11(4): 195-210.

DOLOREUX, D., SHEARMUR, R., and VAN ASSCHE, A., 2019. *Combined innovation and export strategies of KIBS in different regional settings. Industry & Innovation*, 26(6):715-740.

DOWNS, C., and HAZEN, M. D. 1977. A factor analytic study of communication satisfaction.

Journal of Business Communication, *14*(3): 63-73.

DULAL, H., FOA, R., and KNOWLES, S., 2011. Social capital and Cross Country Environmental Performance. *The Journal of Environment Development,* 4(2): 121-142.

DYER, J.S., 1990a. A clarification of remarks on the analytic hierarchy process. *Management Science.* 36(3): 274-275.

DYER, J.S., 1990b. Remarks on the analytic hierarchy process*. Management Science*. 36(3): 249-58.

EDVINSSON, L., 1997. Developing intellectual capital at Skandia. *Long Range Planning*. 30(3): 366-73.

EDVINSSON, L., and MALONE, M.S., 1997. Intellectual Capital. Judy Piatkus Limited, London.

EISENHARDT, K.M., 1989. Building theories from case study research. *Academy of Management Review*, 14(1): 532-550.

ELKELES, T., PHILLIPS, P., and PHILLIPS, J., 2015. ROI Calculations for Technology-Based Learning. *Association for Talent Development*. 1(1): 181-215.

FAY, M.J., and KLINE, S.L., 2008. The Influence of Informal Communication on Organizational Identification and Commitment in the Context of High-Intensity Telecommuting. *Southern Communication Journal,* 77(1): 61-76.

FELLER, J., B. FITZGERALD, AND E. RAYMOND., 2001. *Understanding Open Source Software Development*. Addison-Wesley Publishing Company, London.

FERRAZZI, K., 2014. Managing Yourself: Getting Virtual Teams Right. *Harvard Business Review*, 1(1): 120-123.

FISCHBACH, K., GLOOR, P.A., and SCHODER, D., 2009. Analysis of Informal Communication Networks – A Case Study. *Business and Information Systems Engineering*. 1(1): 40-149.

FISCHBACHER-SMITH, D., and FISCHBACHER-SMITH, M., 2014. What Lies Beneath? The Role of Informal and Hidden Networks in the Management of Crises. *Financial Accountability & Management*, 30(3), 114-126.

FLEMING, K., THORSON, E., and PENG, Z., 2005. Associational membership as a source of social capital: Its links to use of local newspaper, interpersonal communication, entertainment media, and volunteering. *Mass Communication & Society*, 8(3): 219-240.

FLORES, F., RIVERA-VASQUEZ, J., and ORTIZ-FOURNIER, J., 2009. Overcoming cultural barriers for innovation and knowledge sharing. Journal of Knowledge Management, 13(5): 257-270.

FOSTER, M. K., ABBEY, A., CALLOW, M. A., ZU1, X., and WILBON A. D., 2015. Rethinking Virtuality and Its Impact on Teams. *Small Group Research*, 46(3): 267– 299.

FRANK, A., ZHAO, Y., and BORMAN, K., 2004. Social Capital and the Diffusion of Innovations within Organisations. *Sociology of Education, 77(1): 148-171.*

FUKUYAMA, F., 2000. The Great Disruption, Human Nature and the Reconstitution of Social Order. *Touchstone,* New York.

FULK, J., and BOYD, B., 1991. Emerging theories of communication in organizations. *Journal of Management*, *17(1)*: 407-446.

FURST, S., BLACKBURN, R., and ROSEN, B., 1999. Virtual team effectiveness: A proposed research agenda. *Information Systems Journal*, 9(1): 249-269.

GANESH, M. P., and GUPTA, M., 2010. Impact of virtualness and task interdependence on extra-role performance in software development teams. *Team Performance Management*, 16(1): 169-186.

GAUTIER, G., KUBASKI, S., BASSANINO, M., & FERNANDO, T., 2009. Solving the human problem: investigation of a collaboration culture. *Proceedings of the IESA 2009, International Conference on Interoperability for Enterprise Software and Applications*, Beijing.

GEISTER, S., KONRADT, U., and HERTEL, G., 2006. Effects of Process Feedback on Motivation, Satisfaction and Performance. *Small Group Research*. 37(5): 459-489.

GIAKOUMIS, D., MAVRIDOU, E., VOTIS, K., GIANNOUTAKIS, K., TZOVARAS, D., and HASSAPIS, G., 2015. A Semantic Framework to Support the Management of Cloud-Based Service Provision Within a Global Public Inclusive Infrastructure. *International Journal Of Electronic Commerce*. 1(1): 142-173.

GIDDENS, A., 2009. Social Theory and Modern Sociology. Cambridge: Polity Press.

GLIEM, J.A. and GLIEM, R.R., 2003. Calculating, interpreting, and reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education.

GLIKSON, E., and EREZ, M., 2019. The emergence of a communication climate in global virtual teams. *Journal of World Business*, 54(4): 231-420.

GREBOW, D., 2002. At the water cooler of learning. *Transforming culture: An executive briefing on the power of learning*. Charlottesville, VA: The University of Virginia.

GOLDHABER, G. M., 1999. Organizational communication in 1976: Present domain and future directions. *Organizational communication and change*, Cresskill, NJ: Hampton Press.

GOLDHABER, G., and KRIVONOS, P., 1977. The ICA communication audit: Process, status, and critique. *Journal of Business Communication, 15(1)*: 41-64.

GOLDIN-MEADOW, S., and ALIBALI, M.W., 2013. Gesture's role in speaking, learning, and creating language. *Annual Review Psychology*, 64(1): 257-283.

GOLNAZ, S., and CONDIA, J., 2012. Managing the Virtual World. *Industrial Management.* 2(1): 21-24.

GRATTON, L., and ERICKSON, T. J., 2007. Eight Ways to Build Collaborative Teams. Harvard Business Review, 1(1): 43-49.

GULATI, R., and SINGH, H., 1998. The architecture of cooperation: managing coordination and appropriation concerns in strategic alliances. *Administrative Science Quarterly.* 43(4): 781-814.

HAN, J., and KAMBER, M., 2006. Data mining: Concepts and techniques. San Francisco, CA: Morgan Kauffman.

HANSEN, M., 1999: The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organizational Subunits. *Administrative Science Quarterly*. 44(1): 82:111.

HANSEN, M., 2002. Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization Science.* 13(1): 232–248.

HATAMI-MARBINI, A., ROSTAMY-MALKHALIFEH, M., AGRELL, P., J., TAVANA, M., MOHAMMADI, F., 2015. Extended symmetric and asymmetric weight assignment methods in data envelopment analysis. Computers & Industrial Engineering, 87(1): 621-631.

HARKER, P.T., and VARGAS, L.G., 1987. The theory of ratio scale estimation: Saaty's analytic hierarchy process. *Management Science.* 33(11): 1383-1403.

HARKER, P.T., and VARGAS, L.G., 1990. Reply to 'remarks on the analytic hierarchy process' by J.S. Dyer. *Management Science*. 36(3): 269-273.

HARRIS, W.J., 2018. Technology Adoption by Global Virtual Teams: Developing a Cohesive Approach. *SAM Advanced Management Journal*, 83(1).

HEER, J., and AGRAWALA, M., 2009. Design considerations for collaborative visual analytics. *Information Visualization*, 1(1): 263–274.

HEVNER, A.R., MARCH, S.T., PARK, J., and RAM, S., 2004. Design Science in Information Systems Research. *MIS Quarterly,* 28(1), 75:105.

HINSZ, V. B., TINDALE, R. S., and VOLLRATH, D. A., 1997. The emerging conceptualization of groups as information processors. *Psychological Bulletin*, 121(1), 43–64.

HOCH, J. E., and KOZLOWSKI, S. W. J., 2012. Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership. *Journal of Applied Psychology*, 99: 390-403.

HOLLENBECK, J. R., BEERSMA, B., and SCHOUTEN, M. E., 2012. Beyond team types and taxonomies: A dimensional scaling conceptualization for team description. Academy of Management Review.

HOLLER, J., TURNER, K., and VARCIANNA, T., 2013. It's on the tip of my fingers: Co-speech gestures during lexical retrieval in different social contexts. *Language Cognitive Process*, 28(1): 1509-1518.

HOLLER, J., SCHUBOTZ, L., KELLY, S., HAGOORT, P., SCHUETZE, M., and OZYBUREK, A., 2014. Social eye gaze modulates processing of speech and cospeech gesture. *Cognition*, 133(1): 692-697.

HORWITZ, F. M., BRAVINGTON, D., and SILVIS, U., 2006. The promise of virtual teams: Identifying key factors in effectiveness and failure. *Journal of European Industrial Training*, 30(1): 472-494.

HUNT, N. and TYRRELL, S., 2004. Cluster Sampling. [online]. Available at: http://www.coventry.ac.uk/ec/~nhunt/meths/cluster.html. Coventry: Coventry University. [Accessed 17 February 2012].

HURFORD, J., 2008. The Evolution of Human Communication and Language. *Socio-biology of Communication.* 14(1): 249-261.

HURST, S., ARULOGUN, O., OWOLABI, M., AKINYEMI, R., UVERE, E., WARTH, S., and OVBIAGELE, B., 2015, Pretesting Qualitative Data Collection Procedures to Facilitate Methodological Adherence and Team Building in Nigeria. *International Journal of Qualitative Methods.* 14(1): 53-64.

HUVILA, I., HOLMBERG, K., EK, S., and WIDÉN-WULFF, G., 2010. Social capital in Second Life. *Online Information Review*, 34(2): 295-316.

HUXHAM, C., 2015. Facilitating Collaboration: Issues in Multi-Organizational Group Decision Support in Voluntary, Informal Collaborative Settings. *The Journal of the Operational Research Society*. 42(12): 1037-1045.

INCE, M., and GUL, H., 2011. The Role of the Organizational Communication on Employees' Perception of Justice: A Sample of Public Institution from Turkey. *European Journal of Social Sciences*. 21(1): 106-120.

INKPEN, A., and TSANG, E., 2005. Social Capital, Networks, and Knowledge Transfer. *Academy of Management Review*. 30(1): 146-165.

ISAACS, E., A., WHITTAKER, S., FROHLICH, D., and O'Conaill, B., 1997. Informal Communication re-examined: New functions in supporting opportunistic encounters. *European Journal of Social Sciences*. 12(1): 15-22.

ISHAM, J., KELLY, T., and RAMASWAMY, S., 2002. Social capital and well-being in developing countries: An introduction. *Social capital and economic development: Well-being in developing countries*. Edward Elgar, Cheltenham, UK.

JACKSON, P., and WELCH, M., 2007. Rethinking internal communication: a stakeholder approach. *Corporate Communications: An International Journal*, 12(2): 177-198.

JEFFREY, E., FERRIS, M., and MARTINSON, V., 2003. Does it matter where you work? A comparison of how three work venues (traditional office, virtual office, and home office) influence aspects of work and personal/family life. *Journal of Vocational Behaviour*. 63(1): 220-241.

JOHNS, G., 2006. The essential impact of context on organizational behavior. Academy of Management Review.

JOHNSON, J.D., DONOHUE, W.A., ATKIN, C.K. and JOHNSON, S., 1994. Differences between Formal and Informal Communication Channels. *Journal of Business Communication,* 31(2): 111-122.

JOKISMOVIC, S., DOWELL, N., POQUET, O., KOVANOVIC, V., GASEVIC, D., DAWSON, S., and GRAESSER, A., 2018. Exploring development of social capital in a CMOOC through language and discourse. The Internet and Higher Education, 36(1): 54-64.

KIKUCHI, M. and COLEMAN, C., 2012. Explicating and Measuring Social Relationships in Social Capital Research. *Communication Theory,* 22(1): 187-201.

KIESLER, S., and SPROULL, L., 1992. Group decision making and communication technology. *Organizational Behavior and Human Decision Processes*, 52(1): 96–123.

KIRKMAN, B. L., ROSEN, B., TESLUK, P. E., and GIBSON, C. B., 2004. The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, 47(1): 175-192.

KOCK, N., and LYNN, G. S., 2012. Electronic media variety and virtual team performance: The mediating role of task complexity coping mechanisms. *IEEE Transactions on Professional Communication*, 55(1): 325-344.

KRACKHARDT, D., & HANSON, J. R. 1993. Informal networks: The Company behind the chart. Harvard Business Review, 71(4): 104-111.

KRATZER, J., GEMÜNDEN, H.G. and LETTL, C., 2008. Balancing creativity and time efficiency in multi-team R&D projects: the alignment of formal and informal networks. *R&D Management,* 38(5): 538-549.

KRAUT, R., E., FUSSELL, S., R., BRENNAN, S., E., SIEGEL, J., 1990. Understanding Effects of Proximity on Collaboration: Implications for Technologies to Support Remote Collaborative Work. *Academy of Management Review*. 18(1): 83-90.

KRUEGER, K.R., 2013. Forget ROI, the Future of Technology Investment Is All About Value. *T H E Journal,* 6(1): 25-28.

LAMONT, S., BRUNERO, S., LYONS, S., FOSTER, K., and PERRY, L., 2010. Collaboration amongst clinical nursing leadership teams: a mixed-methods sequential explanatory study. *Journal of Nursing Management*, 11(1): 56-89.

LANKHORST, M. 2005. *Enterprise architecture at work: modelling, communication, and analysis*. Berlin; New York: Springer.

LAWSON, B., PETERSEN, K., COUSINS, P., and HANDFIELD, R., 2009. Knowledge sharing in Inter-organizational Product Development Teams: The Effect of Formal and Informal Socialization Mechanisms. *Product Development and Management Association. 26(1), 156:172.*

LEA, R., HONDA, Y. and MATSUDA, K., 1997. Virtual Society: Collaboration in 3D Spaces on the Internet. *Computer Supported Cooperative Work: The Journal of Collaborative Computing,* 6(2): 227-250.

LEE, A. AND MENDELSON, J. 2008. *Divide and Conquer: Competing with Free Technology Under Network Effects.* Production and Operations Management. 17(1): 12-28.

LEINONEN, L., LINNANKOSKI, I., VIHLA, M., and LAASKO, M., 2005. Conveyance of emotional connotations by a single word in English. Speech Communication, 45(1): 27-39.

LEWIS, L., 2019. Organizational Change - Creating Change Through Strategic Communication. Boston: Wiley.

LIKERT, R., 1932. A Technique for the Measurement of Attitudes. *Archives of Psychology.* 140(1): 1–55.

LINDLOF, T. R., and TAYLOR, B. C., 2010. Qualitative communication research methods (3rd ed.). Thousand Oaks, CA: Sage Publications.

LIPNACK, J., 2000. Virtual Teams: People Working Across Boundaries with Technology. John Wiley & Sons.

LIPNACK, J. and STAMPS, J., 1997. *Virtual Teams: Reaching Across Space, Time, and Organizations with Technology.* New York, NY: John Wiley & Sons, Inc. PODOLNY, J.M and BARON, J. N., 1997. Resources and Relationships: Social Networks and Mobility in the Workplace. *American Sociological Review.* 62 (5): 673-693.

LIN RUSSEL, J., KNUTSON, K., and CROWLEY, K., 2013. Informal learning organizations as part of an educational ecology: Lessons from collaboration across the formal-informal divide. *Journal of Educational Change.* 14(1): 259-281.

LOM, E., and SULLENGER, K., 2011.Informal spaces in collaborations: exploring the edges/boundaries of professional development. *Professional Development in Education.* 37(1), 55:74.

MAJ, P. C. S., and ISSA, R. R. A., 2007. Evaluating the Impact of Building Information Modelling (BIM) on Construction. *Proceedings of the 7th International Conference on Construction Applications of Virtual Reality*, Pennsylvania.

MARIN, A., and WELLMAN, B., 2010. Social network analysis: An introduction. *Handbook of social network analysis.* London, England: Sage.

MARTINS, L. L., GILSON, L. L., and MAYNARD, M. T., 2004. Virtual teams: What do we know and where do we go from here? *Journal of Management*, 30(1): 805-835.

MAULL, R., CHILDE, S., BENNETT, J., WEAVER, A., and SMART, A., 1995, Different types of manufacturing processes and IDEF0 models describing standard business processes. Working Paper WP/GR/J95010-6. *School of Computing.* University of Plymouth, Plymouth.

MAYNARD, M. T., MATHIEU, J. E., RAPP, T. L., and GILSON, L. L., 2012. Something(s) old and something(s) new: Modeling drivers of global virtual team effectiveness. *Journal of Organizational Behavior*, 33(1): 342-365.

MCBURNEY, H. D., 2001. *Research methods.* 5th edition. Belmont: Wadsworth Thomson learning.

MCLOUGHLIN, C., PATEL, K.D., O'CALLAGHAN, T., and REEVES, S., 2018. The use of virtual communities of practice to improve interprofessional collaboration and education: findings from an integrated review. *Journal of Interprofessional Care*, 32(2); 136-142.

MCROBERTS, M., 2014. Software Licensing in the Cloud Age. *International Journal of Soft Computing and Software Engineering.* 3(3): 395-402.

MEADORS, J.D., and MURRAY, C.B., 2014. Measuring Nonverbal Bias Through Body Language Responses to Stereotypes. *Journal of Nonverbal Behavior*, 38(1): 209-229.

MEARS, J., 2004. Open source products grab corporate attention. *Network World.* 1. 8:9.

MEHDILOOZADA, M., MIRDEHGHANA, S., M., SAHOOB, B., K., ROSHDIC, I., 2015. On the identification of the global reference set in data envelopment analysis. European Journal of Operational Research, 245(1): 779-788.

MEI, L., YAN, Z., and SHAO, J., 2018. Special issue on multimodal information learning and analytics on cross-media big data. *Concurrency and Computation: Practice and Experience*, 31(9): 1-34.

MESSMER, E., 2004. Companies mull commercial vs. freeware SSH. *Network World.* 3. 49-50.

MINTON-EVERSOLE, T., 2012. Virtual teams used most by global organizations, survey says. Alexandria, VA: Society for Human Resource Management.

MJOEN, H., and TALLMAN, S., 1997. Control and Performance in International Joint Ventures, 8(3): 1-18.

MOURITSEN, J., LARSEN, H.T., and BUKH, P.N., 2001. Valuing the future: intellectual capital supplements at Skandia. *Accounting, Auditing & Accountability Journal.* 14(4): 399-422.

MOUTON, J., 2001. *How to succeed in your Master's and Doctoral Studies, A South African Guide and Resource Book.* Pretoria: Van Schaik Publishers.

NAHAPIET, J., and GHOSHAL, S., 1998. Social capital, intellectual capital, and the organisational advantage. *Academy of Management.* 23(1): 242-266.

NEBUS, J. 1998. International teams: Their social capital and its effects on MNE knowledge creation and knowledge transfer. Working paper, University of South Carolina, Columbia.

NEELY, A., 1999. The performance measurement revolution: why now and what next*?. International Journal of Operations & Production Management*. 19(2): 205-228.

NISHIMOTO, K., and MATSUDA, K., 2007. Informal Communication Support Media for Encouraging Knowledge-Sharing and Creation in a Community. *International Journal of Information Technology & Decision Making*, 6(3): 411-426.

NORAN O., ROMERO D., ZDRAVKOVIC M., 2014. The Sensing Enterprise: Towards the Next Generation Dynamic Virtual Organisations. Advances in Information and Communication Technology, 434(1). Springer, Berlin, Heidelberg

OLGUÍN, D. O., WABER, B. N., KIM, T., MOHAN, A., ARA, K., & PENTLAND, A., 2009. Sensible organizations: Technology and methodology for automatically measuring organizational behavior. *IEEE Transactions on Cybernetics*, *39*(1): 43-55.

OLANIRAN, B. A., and EDGELL, D. A., 2008. Cultural Implications of Collaborative Information Technologies (CITs) in International Online Collaborations and Global Virtual Teams. Handbook of Research on Virtual Workplaces and the New Nature of Business Practices. Hershey, PA: 120-136.

OTUBANJO, O.B., and MELEWAR, T.C., 2010. Nation branding - Concepts, Issues, Practice. London: Routledge.

ORBACH, M., DEMKO, M., DOYLE, J., WABER, B., and PENTLAND, A, 2015. Sensing Informal Networks in Organisations. American Behavioural Scientist. 59(4): 508-524.

OUCHI, W. G. 1980. Markets, bureaucracies, and clans. *Administrative Science Quarterly*, 25(1): 129-141.

PABLOS, P.O.D., 2002. Evidence of intellectual capital measurement from Asia, Europe and the Middle East. *Journal of Intellectual Capital.* 3(3), 287:302.

PANDYA, R., 1995. Emerging mobile and personal communication systems. IEEE Communications Magazine,

33(1): 44–52.

PARUNG J., and BITITCI, U.M., 2008. A metric for collaborative networks. *Business Process Management Journal.* 14(5): 654-674.

PATEL, H., PETTITT, M., and WILSON, J. R., 2012. Factors of collaborative working: A framework for a collaboration model. *Applied Ergonomics*, 43(1): 1–26.

PEFFERS, K., TUUNANEN, T., ROTHENBERGER, M.A., and CHATTERJEE, S., 2007. A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems.* 24(3): 45-77.

PETERSON, S., 2000.What's behind the ERP blues?. *eWeek.* 1, 51.

POLONSKY, M. J. and WALLER, D. S., 2011. *Designing and Managing a Research Project, a business student's guide.* New Delhi: Sage Publications, Inc.

PORTES, A., 1998. Social Capital: Its Origins and Applications in Modern Sociology, *Annual Review of Sociology* 24(3): 1–24.

POWELL, W. W., 1991. 'Neither Market nor Hierarchy: Networks Forms of Organization *Markets, Hierarchies & Networks: The Coordination of Social Life,* London: SAGE Publications.

POWELL, A., PICCOLI, G., and IVES, B., 2004. Virtual teams: A review of current literature and directions for future research. *Database for Advances in Information Systems*, 35(1): 6-36.

PREECE, J., and SHNEIDERMAN, B., 2009. The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation. *AIS Transactions on Human-Computer Interaction, 1(*1): 13-32.

PRIDMORE, J., and PHILLIPS-WREN, G., 2011. Assessing decision making quality in face-to-face teams versus virtual teams in a virtual world. *Journal of Decision Systems*, 20(1): 283-308.

PRISS, U., 2010. Descriptive Statistics. [online]. Available at: http://www.upriss.org.uk/maths/mlec8.pdf. Napier: Edinburgh Napier University. [Accessed 17 February 2012].

PUTMAN, R., 1993. The prosperous community: social capital and community life. *Am Prospect* 2(1): 5-42.

PUTNAM, R., 1995. Bowling alone: America's declining social capital. *Journal of Democracy*, 6(1): 65-78.

PUTNAM, L. L., PHILLIPS, N., and CHAPMAN, P., 1999. Metaphors of communication and organization. *Managing organizations: 45(2):* 125-158. London, England: Sage.

RAGUSA, J.M., and BOCHENEK, G.M., 2004. Improving Integrated Project Team Interaction Through Virtual (3D) Collaboration. *Engineering Management Journal*, 16(2): 3-12.

RAINIE, L., and WELLMAN, B., 2012. *Networked: The new social operating system*. Cambridge: MIT Press.

RAPP, A., AHEARNE, M., MATHIEU, J., and RAPP, T., 2010. Managing sales teams in a virtual environment. *International Journal of Research in Marketing*, 27(1): 213-224.

REICHER, S. D., 1984. Social influence in the crowd: Attitudinal and behavioural effects of de-individuation in conditions of high and low group salience. *British Journal of Social Psychology*, 23(1): 341–350.

REIPS, U., AND FUNKE, F. 2008. Interval level measurement with visual analogue scales in Internet-based research: VAS Generator. *Behavior Research Methods.* 40(3): 699-704.

REMENYI, D., 2013. Case study research. 2nd ed. London: Academic Publishing International.

RESNICK, P., 2001. Beyond bowling together: SocioTechnical capital. *HCI in the New Millenium,* 25(1): 647–672.

RETHMEYER, K., 2005. Conceptualizing and Measuring Collaborative Networks. *Public Administration Review*. 65(1): 117-121.

RICE, D. J., DAVIDSON, B. D., DANNENHOFFER, J. F., and GAY, G. K. 2007., Improving the effectiveness of virtual teams by adapting team processes. *Computer Supported Cooperative Work*, 16(1): 567-594.

RICO, R., and COHEN, S. G., 2005. Effects of task interdependence and type of communication on performance in virtual teams. *Journal of Managerial Psychology,* 20(1): 261-274.

RIEMER, K. and FRÖßLER, F., 2007. Introducing Real-Time Collaboration Systems: Development of a Conceptual Scheme and Research Directions. *Communications of AIS,* 2007(20), 204:225.

ROBERTS, J. A., HANN, I. H., AND SLAUGHTER, S. A. 2006. Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the Apache projects. *Management Science*. 52(7): 984-999.

ROBERTS, K., and O`REILLY, C. A., 1974. Measuring organizational communication. *Journal of Applied Psychology*, *59*(3): 321-326.

RÖCKER, C., 2012. Informal Communication and Awareness in Virtual Teams: Why We Need Smart Technologies to Support Distributed Teamwork. *Communications in Information Science and Management Engineering*. 2(5): 1-15.

RÖCKER, C., O'DONOGHUE, J., ZIEFLE, M., MACIASZEK, L., MOLLOY, W., 2012. *Information and Communication Technologies for Ageing Well and e-Health*. Boston: Springer.

RODRIGUEZ, A., NIETO, M.J., and SANTAMARIA, L., 2018. International collaboration and innovation in professional and technological knowledge-intensive services. Industry and Innovation, 25(4): 408-431.

ROMM, N.,A., 2015. Conducting Focus Groups in Terms of an Appreciation of Indigenous Ways of Knowing: Some Examples from South Africa. *Qualitative Social Research*. 16(1): 32-54.

ROSENBERG, D. 2000. *Open Source: The Unauthorized White Papers*. John Wiley & Sons, Toronto.

ROSS, D.T., and SCHOMAN, K.E., 1977. Structured analysis for requirements definition. *IEEE Transactions on Software Engineering*. 3(1): 6-15.

ROTH, W., 2015. Analyzing the Qualitative Data Analyst: A Naturalistic Investigation of Data Interpretation. Forum Qualitative Social Research. 16(3): 1-44.

RUTTER, C.M., SIMON, G.E., and LUDMAN, E.J., 2009. Incremental Benefit and Cost of Telephone Care Management and Telephone Psychotherapy for Depression in Primary Care. Arch Gen Psychiatry, 66(10): 1081–1089.

SAAD, M., and MAHER, M. L., 1996. Shared understanding in computer-support collaborative design. *Computer Aided Design*, 28(1): 183–192.

SAATY, T.L., 1980. The Analitic Hierarchy Process: Planning, Priority Setting, Resource Allocation. McGraw-Hill, New York, NY.

SAATY, T.L., 1990. An exposition of the AHP in reply to the paper 'remarks on the analytic hierarchy process'. *Management Science*. 36(3): 259-268.

SAATY, T.L., and VARGAS, L.G., 1984. The legitimacy of rank reversal. *Omega*. 12(5): 513-516.

SARIN, S., and GREIF, I., 1985. Computer-based real-time conferencing systems. *Computer Aided Design*, 18(1): 33–45.

SARKER, S., and SAHAY, S., 2003. Understanding Virtual Team Development: An Interpretive Study. *Journal of the Association for Information Systems,* 4(1): 1-33.

SAUNIER, J., BALBO, F., and PINSON, S., 2014. A formal model of communication and context awareness in multiagent systems. *Springer Sciences + Business media,* Dordrecht.

SCHAUER, B., 2008. Reviewing the E-Collaboration marketplace: A survey of electronic collaboration systems. International Conference on e-Business (ICE-B), Athens.

SCHMIDT, K., and RODDEN, T., 1996. Putting it all together: Requirements for a CSCW platform. The design of computer-supported cooperative work and groupware systems. Amsterdam: North-Holland Elsevier.

SCHWANDT, T.A., 1997. *Qualitative Inquiry*. Thousand Oaks: Sage.

SCHWEITZER, L., and DUXBURY, L., 2010. Conceptualizing and measuring the virtuality of teams. *Information Systems Journal*, 20(1): 267-295.

SEAGATE TECHNOLOGY LLC, 2014a. Managing Software Operations Based Upon User Status in A Unified Communications Environment. *USPTO Patent Applications*.

SEAGATE TECHNOLOGY LLC, 2014b. Unified message-based communications. *USPTO Patent Grants*.

SEIDL, D., 2007. 'The Dark Side of Knowledge,' *Emergence: Complexity and Organization*, 24(9): 16–29.

SERÇE, F.C., KNUTAS, A., IKONEN, J., PORRAS, J. 2011. *Collaborative behavior patterns and factors affecting globally distributed team performance. Computers in Human Behavior*. 27(1): 490–503.

SHAH BHARADWAJ, S., BHUSHAN, K., and SAXENA, C., 2006. Impacting the processes of global Software teams: a communication Technology perspective. *The Journal of Business Perspective*. 10(1): 63-75.

SHANNON, C. E., and WEAVER, W., 1949. The Mathematical Theory of Communication. University of Illinois Press, Illinois.

SHYAMSUNDAR, N., and GADH, R., 2002. Collaborative virtual prototyping of product assemblies over the internet. *Computer Aided Design*, 34(1): 755–768.

SMITH, D., 2005. Business (not) as Usual – Crisis Management, Service Interruption and the

Vulnerability of Organisations. *Journal of Services Marketing*, 19(1): 309–20.

STEFIK, M., FOSTER, G., BOBROW, D. G., KAHN, K., LANNING, S., and SUCHMAN, L., 1987. Beyond the chalkboard: Computer support for collaboration and problem solving in meetings. *Communications of the ACM*, 30(1): 32–47.

SUH, A., and SHIN, K. S., 2010. Exploring the effects of online social ties on knowledge sharing: A comparative analysis of collocated vs dispersed teams. *Journal of Information Science*, 36(1): 443-463.

TENNIS, J.T., 2008. Epistemology, Theory, and Methodology in Knowledge Organization: Toward a Classification, Metatheory, and Research Framework. *Knowledge Organization*, 35(1): 102-112.

TEXAS STATE AUDITOR'S OFFICE (1995). Methodology Manual. [online]. Available at: http://www.sao.state.tx.us/Resources/Manuals/Method/data/7QUESTID.PDF. United States of America

TROUT, P., 2011. The Dawning of the virtual age. *Commercial Law League of America*. 1(1): 1-3.

UBELL, R., 2010. Virtual team learning. *Association for Talent Development*, 1(1): 52-57.

UZZI, B. 1999. Embeddedness in the making of financial capital: How social relations and networks benefit firms seeking financing. *American Sociological Review*, 64(1): 481-505.

VAN GINKEL, W. P., and VAN KNIPPENBERG, D., 2008. Group information elaboration and group decision making: The role of shared task representations. *Organizational Behavior and Human Decision Processes*, 105(1): 82–97.

WATSON, S.R., and FREELING, A.N.S., 1982. Assessing attribute weights. *Omega*. 10(6).

WEBSTER, J., and STAPLES, D. S., 2006. Comparing virtual teams to traditional teams: An identification of new research opportunities. In J. J. Martocchio (Ed.), Research in personnel and human resources management 25(1): 181-215). New York, NY: Elsevier.

WEICK, K. E., 1979. The social psychology of organizing. Cambridge, MA: Addison-Wesley.

WHITLEY, R., 2000. The intellectual and social organization of the sciences. Oxford: Oxford University Press.

WIIO, O. A., 1975. *Systems of information, communication, and organization*. Helsinki: Helsinki Research Institute for Business Economics.

WILLIAMS, E. A., DURAY, R., and REDDY, V., 2006. Teamwork Orientation, Group Cohesiveness, and Student Learning: A Study of the Use of Teams in Online Distance Education. *Journal of Management Education*, 30(4): 592–616.

WOO, S., LEE, E., and SASADA, T., 2001. The multiuser workspace as the medium for communication in collaborative design. *Automation in Construction*, 10(1): 303–308.

WU, M., X., 2013. Temporal variation of residential pesticide use and comparison of two survey platforms: a longitudinal study among households with young children in Northern California. *Environmental Health.* 12(1): 1-11.

YIN, R.K., 1984. *Case Study Research, Design and Methods*. California: Sage Publications.

YIN, R.K., 1993. *Applications of case study research*. Newbury Park: Sage Publishing.

YIN, R.K., 1994. *Case Study Research: Design and Methods*. 2nd ed. California: Sage Publications.

YIN, R.K., 2009. *Case Study Research: Design and Methods*. 4th ed. Thousand Oaks: Sage.

Annexure 1 - Research Email Introduction

Good Day

My name is Kyle Hill and I am currently studying my Master of Science at Rhodes University. The aim of my research is to determine whether a unified communication technology intervention can be effective in supporting informal collaboration in virtual teams. This survey and subsequent team-based questions aim to gather your opinions on this matter and by taking this survey and participating in the team-based questions, you are consenting to the use of your responses for this research study.

Please note that the survey consists of 46 questions grouped into 6 sections that should take you approximately 10 to 15 minutes to complete. There will also be a follow up, semi-structured interview with you and your team mates to answer 22 team-based questions. Your participation is voluntary and you can withdraw from the research at any time should you wish to do so. Any information provided will be treated with strict confidentiality and will only be used for the purpose of this research study.

For multiple choice questions please tick all the categories that apply. When the 'Other' or 'Comments' options are available, please comment in the text box provided.

Your participation is very much appreciated. Thank you for your time and valuable contribution. Should you have any questions regarding this questionnaire please contact me on the details provided below.

Yours sincerely

Kyle Hill

kylohill@gmail.com

Annexure 2 - Part 1 Survey

Part 1 Survey

Welcome to Survey A
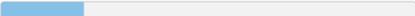
1 / 5   20%

Thank you for participating in our survey. Your feedback is important.

This survey is aimed at establishing the technical aspects present within the organisation in relation to a Unified Communications Technology and whether it is fit to conduct the experiment requirements of this research. This section contains 16 topics, each with several questions that have been defined from the Current Framework.

Please answer each question as accurately as possible. Space for comments is available where necessary.

Next

Part 1 Survey

Section 1: Sub Problem 1
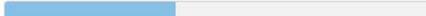
2 / 5   40%

Human communication comprises a system of symbols that collectively form a language (Conway, 1995: 327).

1. Skype for Business facilitates an exchange of messages.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

2. Skype for Business facilitates multiple languages.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Communication in its simplest form is the flow of symbols, which represent information between communicants or groups of communicants (Röcker, 2012: 1-15).

3. Skype for Business facilitates two-way synchronous communication.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

4. Skype for Business facilitates group communication.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Communication is found to occur both formally and informally (Conway, 1995: 327). As such, in chapter 2, Fay and Kline (2008) confirmed that formal communication on the whole can be divided into several groups.

5. Skype for Business affords scheduled interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

6. Skype for Business affords intended interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

7. Skype for Business affords opportunistic interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

8. Skype for Business affords spontaneous interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Crampton, Hodge et al. (1998) argue that certain points are common to all informal communication models.

9. Skype for Business facilitates supporting shared objects.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

10. Skype for Business facilitates the independence of physical proximity between communicants.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Function-wise, (Johnson, Donohue et al. 1994) explain how informal communication may perform several functions.

11. Skype for Business provides facility for tracking people.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

12. Skype for Business provides facility for taking or leaving messages.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

13. Skype for Business provides facility for making meeting arrangements.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

14. Skype for Business provides facility for delivering documents.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

15. Skype for Business provides facility for giving or getting help.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

16. Skype for Business provides facility for reporting progress and news.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Part 1 Survey

Section 2: Sub Problem 2

3 / 5   60%

Functional requirements now dictate who forms part of the team regardless of the distance between members (Lea, 1997).

17. Skype for Business negates distance as a factor between communicants.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Otubanjo, Amujo et al. (2010) suggest that several examples of teams are likely to be found in most organisations.

18. Skype for Business facilitates scheduled communication between teams.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

19. Skype for Business facilitates cross functional communication between teams.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

20. Skype for Business facilitates peer communication between teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

21. Skype for Business facilitates external communication between teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

22. Skype for Business facilitates project communication between teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Virtual teams do not have to be co-located and can interact mainly though technological means (Williams, 2006; Ubell, 2010).

23. Skype for Business supports collaboration in distributed teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

24. Skype for Business provides sufficient technological means for virtual team interaction.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Ubell (2010) states that virtual communication enables many individuals to virtually collaborate on several assignments and projects in both a synchronous and an asynchronous fashion.

25. Skype for Business affords the ability to work on several engagements simultaneously.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

26. Skype for Business affords the ability to conduct synchronous interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

27. Skype for Business affords the ability to conduct asynchronous interactions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Informal Communication requires communication without the use of face-to-face interaction (Lamont, 2010).

28. Skype for Business facilitates non-face-to-face communication.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Virtual collaboration usually occurs when two or more non co-located people work towards a common goal (Lamont, 2010).

29. Skype for Business facilitates collaboration between two or more non-collocated people working on a common goal.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Lawson, et al. (2009) indicates that the following concepts are both critical to virtual collaboration and its successful utilisation.

30. Skype for Business facilitates sharing in the virtual collaboration sense.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

31. Skype for Business facilitates shared context for virtual collaboration.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Flores et al. (2009), Isaacs et al. (2008) and Schauer, (2008), suggested several key points in relation to a virtual system and its support of informal communication and collaboration.

32. Skype for Business affords tracking the availability of recipients.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

33. Skype for Business affords "glancing".

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

34. Skype for Business affords message leaving abilities.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

35. Skype for Business affords recognition of public places.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

36. Skype for Business affords video.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

37. Skype for Business affords symmetrical interactions.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

38. Skype for Business affords storing of conversations.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

39. Skype for Business affords document availability and processing.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

40. Skype for Business affords privacy and access controls.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

41. Skype for Business affords instant Messaging.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

42. Skype for Business affords conferencing facilities.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

43. Skype for Business affords wireless voice over IP.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

44. Skype for Business affords IP enabled contact centres.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

45. Skype for Business affords application sharing.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Part 1 Survey

Section 3: Sub Problem 3

4 / 5 ��……▮ 80%

Social Capital has been listed as having eight generic elements (Bullen and Onyx 1998).

46. Skype for Business facilitates participation in the local community, relevant to virtual collaboration amongst teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

47. Skype for Business facilitates proactivity in a social context, relevant to virtual collaboration amongst teams

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

48. Skype for Business facilitates feelings of trust between communicants.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

49. Skype for Business facilitates neighbourhood connections, relevant to virtual collaboration amongst teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

50. Skype for Business facilitates connections to family and friends, relevant to virtual collaboration amongst teams.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

51. Skype for Business facilitates work connections.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Social Capital and Goodwill generation, is considered a large challenge in virtual teams. This generation is not always considered possible in organisations and as such, barriers to creation have been observed to exist (Nahapiet and Ghoshal, 1998).

52. Skype for Business eliminates barriers of trust by providing secured communication methods between communicants where trust can be established and maintained during interactions and collaborations.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

53. Skype for Business eliminates barriers of organisational norms by providing facility for spontaneous and opportunistic interaction and engagements between communicants without prescribed conversational norms.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

54. Skype for Business eliminates barriers of ambiguity by enabling communicants to develop shared meaning and context for their interactions and collaborations.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Prev   Next

Section 4: Sub Problem 4

5 / 5   100%

Through several case studies, (Sarkern and Sahay 2003; Williams 2006; Rutter 2009), suggest a generic list of features has should be deployed in order to appropriately facilitate informal virtual collaboration.

55. The available infrastructure to provide the Skype for Business services facilitates high speed LAN connectivity exceeding 100Mb\s per user

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

56. The available infrastructure to provide the Skype for Business services facilitates broadband internet connection exceeding 4Mb\s per user.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

57. The available infrastructure to provide the Skype for Business services facilitates backup and recovery facilities being available.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

58. The available infrastructure to provide the Skype for Business services facilitates email and scheduling functions.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

59. The available infrastructure to provide the Skype for Business services facilitates High Definition web cameras and sound devices per user.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Prev   Done

Annexure 3 - Part 2 Survey

4. What is the highest level of school you have completed or the highest degree you have received?

○ Less than high school degree
○ High school degree or equivalent
○ Some college but no degree
○ Associate degree
○ Bachelor degree
○ Graduate degree

5. Which of the following best describes your current occupation?

○ Management
○ Team Lead
○ Employee (Team Member)
○ Other (please specify)

[   ]

6. Which team do you belong to?

○ Strategic
○ Operational

Thank you for your participation.

[Next]

Part B Survey

Demographics

2 / 9 ▬▬▬▬▬▬▬▬▬▬ 22%

These questions are for statistical purposes only and will not be used in way as a means of identification or bias.

1. Please indicate your gender.

○ Male
○ Female
○ Other (please specify)

[   ]

2. What is your age?

○ 17 or younger
○ 18-20
○ 21-29
○ 30-39
○ 40-49
○ 50-59
○ 60 or older

3. In what country do you currently reside?

○ South Africa
○ Other (please specify)

[   ]

Part B Survey

Use case 1: Employee productivity

3 / 9   33%

7. The tool provided helped me perform my day-to-day business tasks.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

8. The tool provided simpler ways to achieve common tasks.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

9. The tool encouraged engaging with colleagues in different channels.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

10. Productivity increased by having access to the tool.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

11. I used the tool for functions other than those business related.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

12. The presence capability helped in collaborating with colleagues.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

13. Distance became immaterial when collaborating with colleagues distributed in other teams and regions.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

14. I find myself collaborating more with colleagues.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

4 / 9   44%

15. I found myself reaching out of my usual set of colleagues to achieve a result.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

16. The Unified Communications Technology facilitates me engaging with colleagues that I normally wouldn't engage with.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

17. I found myself joining teams that are of interest.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

18. I found myself forming teams to address specific business challenges.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

19. I found that my team collaborates and communicates acceptably using the toolset.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

20. I found myself collaborating more with my team members.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

5 / 9   56%

21. I was more confident in addressing a complex business problem with the technology toolset provided.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

22. I responded differently to problems when using the available Unified Communications Technologies to collaborate.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

23. I included specialised colleagues in complex problem resolution as the technology affords wider collaboration.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

24. I assisted in problems and engagements that traditionally would be out of my expertise.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

25. The Unified Communication Tool gave me the ability individually to solve a complex problem.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

26. The Unified Communications technology equips my team more readily to solve a complex problem.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

6 / 9   67%

27. The tools provided were already installed.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

28. The tools provided were easy to use.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

29. The toolset work as anticipated.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

30. I required training to use the toolset.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

31. It was easy to achieve the business functions I wanted to with the provided tools.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

32. The toolset provided for all of my regular communication and collaboration needs? E.g. email, voice, IM, etc.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

33. What aspects of the technology toolset did you find hindering?

○ Comments

34. What aspects of the technology toolset did you find enabling?

○ Comments

Use case 5: Social Capital and Goodwill

7 / 9 ▓▓▓▓▓▓▓▓ 78%

35. The technology provided offered me the opportunity to learn from others.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

36. The technology provided offered me a medium to share knowledge with others.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

37. I was more willing to distribute knowledge with the toolset in place.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

38. I was empowered to find the answers to complex problems through the tool.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

39. I was adding to the overall knowledge of the organisation as a whole, using the toolset.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

Part B Survey

Use case 6: Security and Trust

8 / 9 ▓▓▓▓▓▓▓▓▓ 89%

40. The engagements I had using the toolset were private.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

41. The interactions I have using the toolset were secure.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

42. I trust the information provided by colleagues I engaged with using the toolset.

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

9 / 9 ████████████████████████ 100%

43. I would recommend this tool set to others.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

44. I will continue to use the toolset once this research has finished.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

45. Through the UC tool, my levels of collaboration increased with colleagues and team members.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Annexure 4 – Part 2 Semi-structured Interview

Employee productivity

You are invited to participate in a research study entitled 'the determination of whether a unified communication technology intervention can be effective in supporting informal collaboration in virtual teams'. Your participation and cooperation is important so that the results of the research are accurately portrayed.

Participation in this research is completely voluntary and you are not obligated to take part in this research study. Please note that you have the right to withdraw at any given time during the study without penalty. This survey will not try and identify you personally and us such, you privacy, anonymity, and confidentiality will be maintained throughout this survey process.

Thank you for your participation.

1. We have found that we are able to attend local meetings, virtually and participate effectively, using the technology?

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Comments

[   ]

2. We have found that we are able to attend regional\international meetings, virtually and effectively, using the technology?

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Comments

[   ]

3. We have found that we are able to collaborate on documents simultaneously with other employees using the technology?

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Comments

[   ]

Team-based productivity

4. We have found that we are able to share screens and content with our team\team members using the technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

5. We have found that we are able to engage acceptably over the video and voice channels using the technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

6. We have found that we are able to facilitate formal and informal interactions using the technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

Organisational agility

7. We have found that we are able to rapidly respond to business problems using multiple programs of the Unified Communications Technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

8. We have found that we are able to engage in new channels and techniques of communication and collaboration using the technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

9. We have found that we am able to join new teams and share a commitment easily using the technology?

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree

Comments

[   ]

Usability

10. We have found that we are able to login without training or assistance and start using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

11. We have found that we are able to see my previous interactions for context, where necessary, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

12. We have found that we are able to perform common meeting and document functions without training, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

Learning and Growth

13. We have found that we are able to distribute knowledge and content effectively and from several sources, as necessary, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

14. We have found that we are able to solve a problem outside of the normal day to day business routine, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

15. We have found that we are able to find relevant knowledge when required, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments
[   ]

Security and Trust

16. We have found that the presence option enables us to know when to contact a fellow employee?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

17. We are confident that our messages and interactions were only received by the intended recipient?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

18. We have found that the Unified Communications Technology enables us to engage on multiple channels such as voice, IM, and email, in order to solve a business problem?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

Summary

19. We have found that we are able to engage with our team and team members more, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

20. We have found that we are able to know when and over which channel to interact on, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

21. We have found that we are able to be more productive individually, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

22. We have found that we are able to be more productive in our team, using the technology?

- ( ) Strongly Disagree
- ( ) Disagree
- ( ) Neutral
- ( ) Agree
- ( ) Strongly Agree

Comments

_____

Annexure 5 - Part 2 Descriptive Statistics

	N		Mean	Standard Deviation	Skewness	Std. Error of Skewness
	Valid	Missing				
Q1	27	0	3.8519	0.81824	-0.165	0.448
Q2	27	0	3.6296	0.6877	-0.123	0.448
Q3	27	0	3.7407	1.02254	-0.132	0.448
Q4	27	0	3.3333	0.87706	0.369	0.448
Q5	27	0	3.3704	0.83887	0.021	0.448
Q6	27	0	4.5556	0.57735	-0.879	0.448
Q7	27	0	4.2593	0.52569	0.269	0.448
Q8	27	0	2.7037	0.91209	-0.332	0.448
Q9	27	0	4.3704	0.56488	-0.136	0.448
Q10	27	0	2.4444	0.64051	0.222	0.448
Q11	27	0	3.1852	0.78628	0.162	0.448
Q12	27	0	3.1481	0.60152	-0.051	0.448
Q13	27	0	4	0.62017	0	0.448
Q14	27	0	3.7778	0.75107	0.399	0.448
Q15	27	0	3.7407	0.59437	0.122	0.448
Q16	27	0	3.6296	0.88353	0.477	0.448
Q17	27	0	3.5185	0.849	0.345	0.448
Q18	27	0	3.8519	0.7181	0.23	0.448
Q19	27	0	3.6667	0.96077	-0.094	0.448
Q20	27	0	3	0.83205	-0.433	0.448
Q21	27	0	3.2963	0.95333	-0.082	0.448
Q22	27	0	2.7407	0.6559	0.319	0.448
Q23	27	0	3	1.07417	-0.402	0.448
Q24	27	0	2.6667	0.83205	-0.577	0.448
Q25	27	0	3.037	0.7061	-0.052	0.448
Q26	27	0	3.5556	0.84732	-0.187	0.448
Q27	27	0	3.5556	0.84732	-0.187	0.448
Q28	27	0	4.1111	0.69798	-0.154	0.448
Q29	27	0	3.2222	0.57735	-0.016	0.448
Q30	27	0	3.4074	0.79707	0.573	0.448
Q31	27	0	3.1852	0.62247	-0.132	0.448
Q32	27	0	3.4444	0.64051	0.222	0.448
Q33	27	0	3.3333	0.91987	-1.067	0.448
Q34	27	0	2.963	0.75862	-0.508	0.448
Q35	6	21				
Q36	13	14				
Q37	27	0	3.7778	0.69798	-0.398	0.448
Q38	27	0	4.037	0.75862	-0.063	0.448
Q39	27	0	3.4815	0.75296	0.651	0.448

Annexure 6 - Part 2 Frequency Distribution

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Q1	Frequency	0	1	8	12	6	27
	Valid Percent	0	3.7	29.6	44.4	22.2	100
	Cumulative Percent	0	3.7	33.3	77.8	100	
Q2	Frequency	0	1	10	14	2	27
	Valid Percent	0	3.7	37	51.9	7.4	100
	Cumulative Percent	0	3.7	40.7	92.6	100	
Q3	Frequency	0	3	9	7	8	27
	Valid Percent	0	11.1	33.3	25.9	29.6	100
	Cumulative Percent	0	11.1	44.4	70.4	100	
Q4	Frequency	0	4	13	7	3	27
	Valid Percent	0	14.8	48.1	25.9	11.1	100
	Cumulative Percent	0	14.8	63	88.9	100	
Q5	Frequency	0	4	11	10	2	27
	Valid Percent	0	14.8	40.7	37	7.4	100
	Cumulative Percent	0	14.8	55.6	92.6	100	
Q6	Frequency	0	0	1	10	16	27
	Valid Percent	0	0	3.7	37	59.3	100
	Cumulative Percent	0	0	3.7	40.7	100	
Q7	Frequency	0	0	1	18	8	27
	Valid Percent	0	0	3.7	66.7	29.6	100
	Cumulative Percent	0	0	3.7	70.4	100	
Q8	Frequency	3	7	12	5	0	27
	Valid Percent	11.1	25.9	44.4	18.5	0	100
	Cumulative Percent	11.1	37	81.5	100	100	
Q9	Frequency	0	0	1	15	11	27
	Valid Percent	0	0	3.7	55.6	40.7	100
	Cumulative Percent	0	0	3.7	59.3	100	
Q10	Frequency	1	14	11	1	0	27
	Valid Percent	3.7	51.9	40.7	3.7	0	100
	Cumulative Percent	3.7	55.6	96.3	100	100	
Q11	Frequency	0	5	13	8	1	27
	Valid Percent	0	18.5	48.1	29.6	3.7	100
	Cumulative Percent	0	18.5	66.7	96.3	100	
Q12	Frequency	0	3	17	7	0	27
	Valid Percent	0	11.1	63	25.9	0	100
	Cumulative Percent	0	11.1	74.1	100	100	
Q13	Frequency	0	0	5	17	5	27
	Valid Percent	0	0	18.5	63	18.5	100
	Cumulative Percent	0	0	18.5	81.5	100	
Q14	Frequency	0	0	11	11	5	27
	Valid Percent	0	0	40.7	40.7	18.5	100
	Cumulative Percent	0	0	40.7	81.5	100	
Q15	Frequency	0	0	9	16	2	27
	Valid Percent	0	0	33.3	59.3	7.4	100
	Cumulative Percent	0	0	33.3	92.6	100	
Q16	Frequency	0	1	14	6	6	27
	Valid Percent	0	3.7	51.9	22.2	22.2	100
	Cumulative Percent	0	3.7	55.6	77.8	100	
Q17	Frequency	0	2	13	8	4	27
	Valid Percent	0	7.4	48.1	29.6	14.8	100
	Cumulative Percent	0	7.4	55.6	85.2	100	
Q18	Frequency	0	0	9	13	5	27
	Valid Percent	0	0	33.3	48.1	18.5	100
	Cumulative Percent	0	0	33.3	81.5	100	
Q19	Frequency	0	3	9	9	6	27
	Valid Percent	0	11.1	33.3	33.3	22.2	100
	Cumulative Percent	0	11.1	44.4	77.8	100	
Q20	Frequency	1	6	12	8	0	27

	Valid Percent	3.7	22.2	44.4	29.6	0	100
	Cumulative Percent	3.7	25.9	70.4	100	100	
Q21	**Frequency**	1	3	13	7	3	27
	Valid Percent	3.7	11.1	48.1	25.9	11.1	100
	Cumulative Percent	3.7	14.8	63	88.9	100	
Q22	**Frequency**	0	10	14	3	0	27
	Valid Percent	0	37	51.9	11.1	0	100
	Cumulative Percent	0	37	88.9	100	100	
Q23	**Frequency**	3	5	9	9	1	27
	Valid Percent	11.1	18.5	33.3	33.3	3.7	100
	Cumulative Percent	11.1	29.6	63	96.3	100	
Q24	**Frequency**	3	6	15	3	0	27
	Valid Percent	11.1	22.2	55.6	11.1	0	100
	Cumulative Percent	11.1	33.3	88.9	100	100	
Q25	**Frequency**	0	6	14	7	0	27
	Valid Percent	0	22.2	51.9	25.9	0	100
	Cumulative Percent	0	22.2	74.1	100	100	
Q26	**Frequency**	0	3	9	12	3	27
	Valid Percent	0	11.1	33.3	44.4	11.1	100
	Cumulative Percent	0	11.1	44.4	88.9	100	
Q27	**Frequency**	0	3	9	12	3	27
	Valid Percent	0	11.1	33.3	44.4	11.1	100
	Cumulative Percent	0	11.1	44.4	88.9	100	
Q28	**Frequency**	0	0	5	14	8	27
	Valid Percent	0	0	18.5	51.9	29.6	100
	Cumulative Percent	0	0	18.5	70.4	100	
Q29	**Frequency**	0	2	17	8	0	27
	Valid Percent	0	7.4	63	29.6	0	100
	Cumulative Percent	0	7.4	70.4	100	100	
Q30	**Frequency**	0	2	15	7	3	27
	Valid Percent	0	7.4	55.6	25.9	11.1	100
	Cumulative Percent	0	7.4	63	88.9	100	
Q31	**Frequency**	0	3	16	8	0	27
	Valid Percent	0	11.1	59.3	29.6	0	100
	Cumulative Percent	0	11.1	70.4	100	100	
Q32	**Frequency**	0	1	14	11	1	27
	Valid Percent	0	3.7	51.9	40.7	3.7	100
	Cumulative Percent	0	3.7	55.6	96.3	100	
Q33	**Frequency**	2	1	11	12	1	27
	Valid Percent	7.4	3.7	40.7	44.4	3.7	100
	Cumulative Percent	7.4	11.1	51.9	96.3	100	
Q34	**Frequency**	1	5	15	6	0	27
	Valid Percent	3.7	18.5	55.6	22.2	0	100
	Cumulative Percent	3.7	22.2	77.8	100	100	
Q37	**Frequency**	0	1	7	16	3	27
	Valid Percent	0	3.7	25.9	59.3	11.1	100
	Cumulative Percent	0	3.7	29.6	88.9	100	
Q38	**Frequency**	0	0	7	12	8	27
	Valid Percent	0	0	25.9	44.4	29.6	100
	Cumulative Percent	0	0	25.9	70.4	100	
Q39	**Frequency**	0	1	15	8	3	27
	Valid Percent	0	3.7	55.6	29.6	11.1	100
	Cumulative Percent	0	3.7	59.3	88.9	100	

Annexure 7 - Part 2 Semi-Structure Results

	All respondents	Team 1	Team 2	Team 3	Team 4
Q1 Mean	3.75	4	5	3	3
Q2 Mean	4	4	5	3	4
Q3 Mean	3	3	3	3	3
Q4 Mean	3.5	3	4	4	3
Q5 Mean	4.25	4	5	4	4
Q6 Mean	3.5	4	4	3	3
Q7 Mean	3.25	3	3	3	4
Q8 Mean	2.75	2	4	2	3
Q9 Mean	2.75	2	4	2	3
Q10 Mean	3.25	4	3	3	3
Q11 Mean	3.75	4	4	3	4
Q12 Mean	3	3	3	3	3
Q13 Mean	3.75	3	4	4	4
Q14 Mean	4	4	5	3	4
Q15 Mean	3.5	3	4	3	4
Q16 Mean	3.25	4	4	2	3
Q17 Mean	3.25	4	3	3	3
Q18 Mean	4	4	5	3	4
Q19 Mean	3.5	4	4	3	3
Q20 Mean	3	3	4	2	3
Q21 Mean	3.75	4	5	3	3
Q22 Mean	3.5	4	4	3	3