VIRTUAL COLLABORATION:
Improving Communication in the South African Construction Industry

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DECLARATION

I, Clinton Fok hereby declare that:

- The content of this research report is my own original work
- All sources used or referenced have been documented and recognised
- This research report has not been previously submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification at any other recognised educational institution

15 February 2018

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Date

ABSTRACT

This thesis aims to explore the impact of virtual communication among professionals within the South African construction industry by analysis of responses to a distributed questionnaire and interviews which will highlight trends and hindrances to effective communication. It hopes to answer the key question of key factors affecting virtual communication from a global perspective to that of the current South African state in order to improve future forms of ICT to maintain and enhance global competitiveness.

To date, many construction organisations are autocratic and have a hierarchical organisational structure, which is often static and unable to change to current market needs. However, there is a growing trend for organisations to form specialised decentralised teams. These units are dynamic and are more flexible with knowledge transfer allowing their organisation to adapt to the ever changing global market. One particular adaptation in the construction industry is in information communication technology (ICT) which has resulted in organisations becoming more globally competitive. ICT is becoming more widely used in the construction project life cycle.

While the development of virtual collaborations has allowed for companies to be globally competitive, there are areas in need of improvement such as communication and information processing. The use of current communication methods and processes are technologically driven and do not consider the individual's psychological aspects. Social interaction within a workplace is important with a move away from autocratic information dissemination. These aspects have a direct effect on project delivery efficiency; productivity of labour force; as well as quality of the final product.

There is a distinct shift in the use of different media for communication and effective those medium has proved to be. The reluctance to change and how quickly individuals adapt to technological advancements also impact on the efficiency of communication.

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CAD	Computer aided design
FDT	Five dysfunctions of a team
GDT	Geographically dispersed teams
ICT	Information communication technology
IT	Information technology
LPT	Larry Prusack's trust model
OECD	Organisation for economic co-operation and development
VP	Virtual proximity

CHAPTER 1: LITERATURE REVIEW

1.1 Introduction

This chapter provides an overview of the research. It starts by looking at the background of the study and highlights the main issue to be explored in the problem statement. That is the lack of effective communication within construction project teams and how that impacts on successful project completion. The next section addresses the aims and objectives of the research followed by key research questions which guided the study questionnaire. Thereafter, a summary of the research methodology and the scope for the study is described.

Background to Research

The construction industry plays a crucial role in the economy of a country. Increased globalisation of many countries economy's has resulted in more money being used in the construction industry (Tai *et al.,* 2008). This has allowed for a number of countries to grow significantly (Pamulu, 2004; Diallo, 2004). As such, many governments have instituted policies to protect this industry.

Construction presents a unique environment within which to explore the concept of communications. Since the nature of construction is project-based, its groups and networks are temporary in nature, and relationships and interactions continually change to reflect the dynamic nature of the workplace (Dainty, 2006:98).

Given the rapid development within the construction industry over the last century, there has been an emergence of specialised professions within the construction industry; these include architects, engineers, project managers and quantity surveyors. In addition, there are a number of phases within every project and each phase heavily relies on the timely transfer of information amongst all parties involved, in order to meet the demands of the client (Lam, 2010). There are numerous cases of communication problems as well as information processing problems which continually occur in construction projects. This has also resulted in tension between the various members on the project (Matheu, 2005).

The aim of any project is the optimal use of resources and time to meet a deadline without compromising on its quality, however, time, cost and quality continue to be problematic

areas in any construction project. According to Dainty (2006) and Lofgren (2006), poor performance on any project has been the result of ineffective communication, as well as the speed of information transference amongst the teams members. Similarly, poor performance can be due to organisation fragmentation and poor information exchange Wikforss (2007). Thus resulting in delays in project completion, over expenditure, arbitration and litigation.

What is information communication technology (ICT)?

Information communication technology (ICT) is a term that includes any communication device or application, such as: radio, television, cellular phones, computer and network hardware/ software, satellite systems, as well as the various services and applications associated with them, for example video conferencing and distance learning. ICTs are often spoken of in a specific context, such as in education, health care, business management.

In the construction industry, the level of ICT available in today's marketplace is enormous and continues to improve and expand yearly. This allows the construction industry to thrive by using these technologies to enhance their business by enabling collaborations, faster productivity and enhanced quality of output (Sekou, 2012). The Organisation for Economic Co-operation and Development (OECD) of 2009 reports that the developments in ICT have led to an increase in the construction, transport and agriculture sector. Also, higher priority has been placed on developing accessibility to technology and communication for the poorer populace, rather than on developing the technology itself. Many countries have established organisations for the promotion of ICTs, because it is feared that unless technologically underdeveloped areas have a chance to catch up, the increasing technological advances in developed nations will only serve to exacerbate the already-existing economic gap between technological "have" and "have not" areas. (OECD report 2009).

ICT in the global construction context

Shen *et al*., (2004) states that the utilisation of information technology (IT) determines whether a project is a failure or a success in most industries which includes the construction industry. With the development of ICT, the increase in productivity is proportional to the amount of information which is exchanged within any project team (Lam, 2010; Ruddoch, 2006)

The use of ICT in construction is now being pushed further through commercial strategising, governmental policies and education, and not being limited through the basic implementation of particular operation in individual companies in order to improve in-house efficiency.

ICT in the South African Context

Over the past decade there has been a dramatic increase in the telecommunications sector within Africa (Kabanda, 2008). Likewise, in South Africa, the telecoms sector has been in constant change over the last decade from governmental level downwards. The South African telecommunication industry is the most advanced on the African continent. However, the South African telecommunications industry has not been developed enough in terms of costs due to service provider's price mark-ups, to be globally competitive compared to other African countries. As a result, the South African telecommunications sector remains one the most expensive in the world, second to Brasil.

While ICT in South Africa continues to show growth, particularly in the mobile sector, the growth has not met the national objective of being affordable to the masses and giving access to all communication services. Currently, while mobile services accessibility increases; continues to grow, fixed broadband (ADSL, fibre) remains very low in comparison to other developing lower middle income countries, and the prices of all communication services remain high by both African and global standards (Gillwald *et al*., 2012).

The South African ICT sector itself is continually being hampered by policies which has led to poor accessibility to communication services in order to drive the economy forward. By addressing need to improve telecommunications sector and making it affordable by all, it may stimulate economic growth and alleviate the low employment rate.

ICT influencing South African construction industry

According to Stats SA (2016), the South African construction industry has had constant growth between 2011 and 2013, which was marred by the mining sector strikes in 2010 (Figure 1). However since 2014, there has been a steady economic decline in the construction industry with 2017 (Figure 2) showing a negative result.

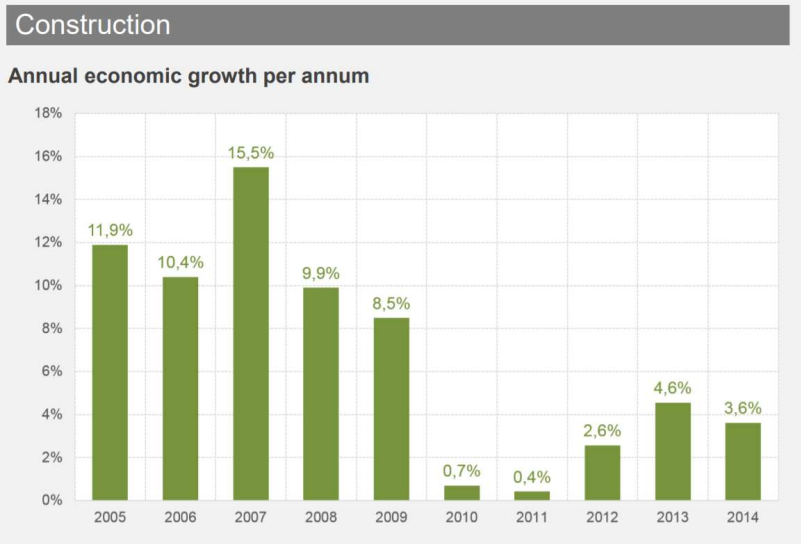

Figure 1: Construction growth per annum (Stats SA, 2014).

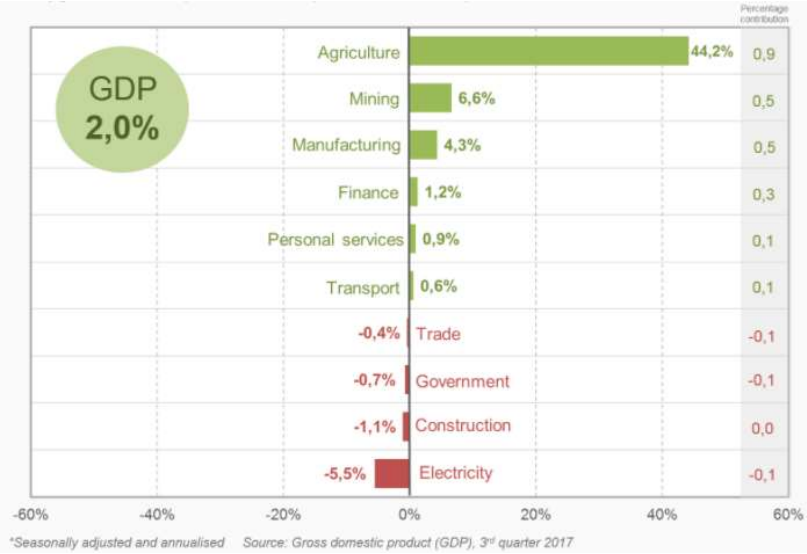

Figure 2: Sector contribution to total GDP (Stats SA, 2017).

As observed in Dainty (2006), the construction industry has evolved and become information intensive as a result of improved IT. Similar findings by Ozumba (2008), found that the demand for the use of ICT in the construction industry has been attributed mainly to lowering costs, completion of tasks in a specific timeframe as well as the increasingly complexity of projects.

The importance of ICT in the construction industry has been recognised especially for improving communication and the exchange and storage of information in construction processes and for creating new construction business opportunities. These aspects include

improved processing efficiency, improved workmanship quality, reducing costs and increasing profits while falling within the allocated project time frame. (Peansupap, 2005). However, the adverse side to this, according to Schalcher (2009), is that the quality and complexity of shared information has become the problem for the construction industry.

According to Pamulu (2004), there have been a number of research surveys concerning ICT carried out with regards to the construction industry in various countries. Pamulu further elaborates that ICT has the potential to improve on the current construction industry's processes through the use of smaller, more dynamic decentralised teams or cells, in order to handle the complexity of modern projects and information intensive organisational processes to allow for many projects to be dealt with simultaneously.

In any construction project, all parties involved require good teamwork and strong collaboration to achieve optimal coordination of resources, time and communication. Hence, the strategic use of ICT on projects has become vital to enable this goal to be achieved more effectively (Sekou, 2012 and Lofgren, 2006). While both the South African construction industry, as well as the ICT sector continues to grow and strengthen in order to become globally competitive, the growth in the ICT sector has not met the national objective of affordable access to the full range of communication services. As a result, effective communication is being stifled.

The speed with which ICT evolves and man’s dependency on the use of technology in increased productivity does not evolve at the same rate, the result is an imbalance of skills and technology to be used effectively. Therefore the understanding of ICT as a communication platform and how it may be integrated with people is essential, in order to improve communications amongst various organisations in construction projects.

1.2 Literature Review

Literature was sourced from books and scholarly journal articles via data bases to provide substantiating data to support claims made in the various sections of this report. In this chapter the focus is on studies on similar or relevant topics and is used for purposes of comparison with the current data collected from interviews and through observations, in order to contribute to theory building, enrich the analysis, and to strengthen the conclusions reached in relation to the research question.

The purpose of communication in projects

Using a basic communication model (Figure 3), the definition of communication is the expression of ones thoughts and feelings through action or verbal, pictures, sounds or behaviour and attitude towards another and vice versa.

This classical communication process model which consists of three key components of communication, namely the sender, the receiver and the message. This is based on Bagley's theory of communication, where it is viewed that communication is not a linear process but rather a two directional process (Dainty, 2006). The model ignores factors such as social and interpersonal dynamics and organisational environment.

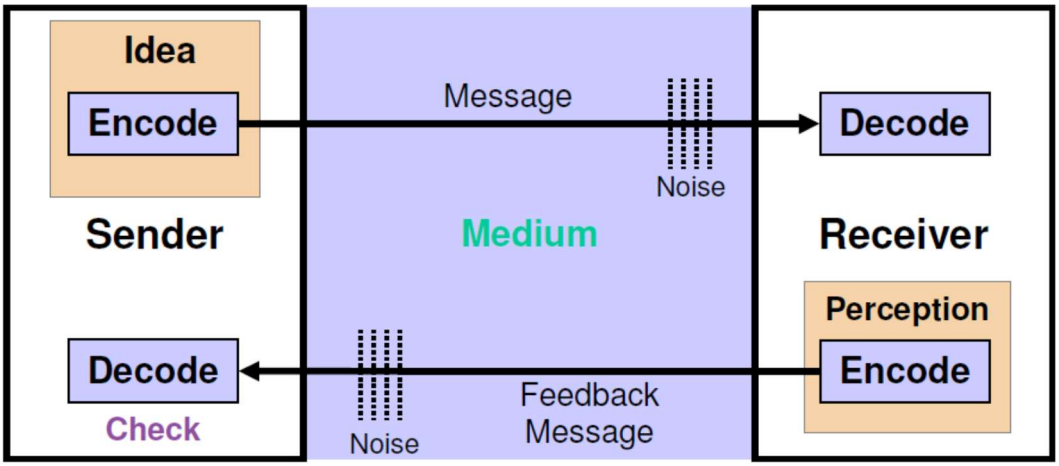

Figure 3: Basic communication model (www.mosaicprojects.com.au/whitepapers)

The main elements of the communication model are as follows:-

- **Encode:** The conversion of ideas or feelings that can be conveyed and understood by the receiver/recipient.
- **Message:** The thought or feeling that needs to be conveyed.

• **Medium:** The medium through which the message is sent; for example face-to-face, telephone or email message.
• **Noise:** barrier or distortion that interferes with the message during transmittal stage; for example culture, attitude, location.
• **Decode:** The deciphering of the message by the *receiver* after receiving from sender.

By the definition of ICT, it would be seen that the medium or vessel used for the transference of information is the key aspect and encompasses the core idea behind ICT. The noise in the medium is the interference of clear communication caused by human or technological fault.

Aucoin (2007:7) describes communications in any organisation as aimed at achieving the following outcomes:

- Obtaining results and reaching goals
- Adjusting with time
- Managing change
- Employee sense of value upliftment
- Accommodating the general staff.

The function of project communication is to transfer information that will enable the recipient of a communication to carry out actions that will take the project forward, and to provide feedback as to the outcomes of these actions and occurrences in the project environment to stakeholders. This is true for communications within the project team itself as well as between the project team and other professionals involved. Transmitting, receiving and acting on information forms the major part of any project involving multiple stakeholders.

Face-to-face interaction was found to be the primary method of communication in business and general day to day life (Berger et al., 2009:6), however, today, communication has dramatically shifted due to the onset of communication technologies (Zulch, 2014:1006). The manufacturing industry has had to reconsider the manner in which existing processes are done in order to remain globally competitive and to accommodate client requirements

which change constantly from a 'process' viewpoint. This shift in addressing processing needs of the client has challenged the traditional process and has improved on it.
(Cooper, 2008:1).

In the context of a construction project (Figure 4), the communication process has ICT being the messenger or process, with noise as the negative aspect of communication. This illustrates the dependency of communication on technology, which is user friendly in projects.

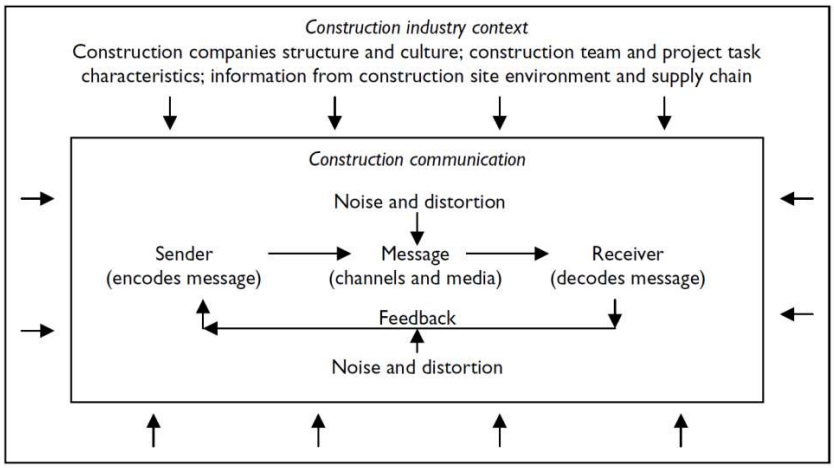

Figure 4: Construction industry context and the communication process (Dainty, 2006:58)

With the advancements of ICT in the construction industry, Figure 5 shows a flow diagram comparison between traditional communications techniques to IT communications techniques. Traditional meetings are replaced by project web or cloud conferences with a single common access point. Post and fax has been replaced by project web and email allowing for more faster delivery time of correspondence and immediate access to up to date information where needed. Traditional telephonic communications relies heavily on consultants and site offices having to communicate to each individual contractor separately whereas email allows consultants and offices to reach all concerned members simultaneously.

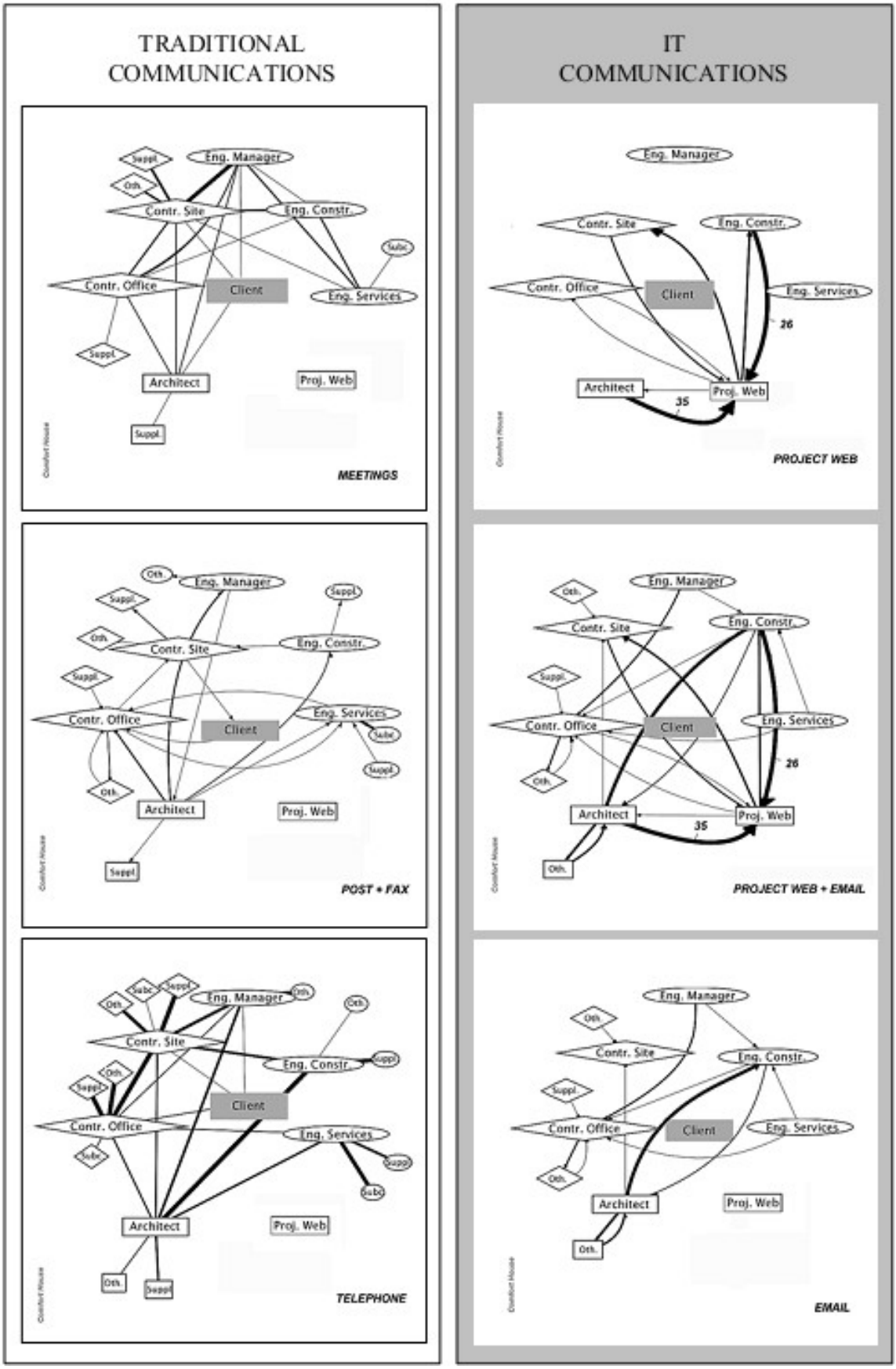

Figure 5: Traditional communication methods versus ICT affected communications. (Howard *et al*., 2001:7).

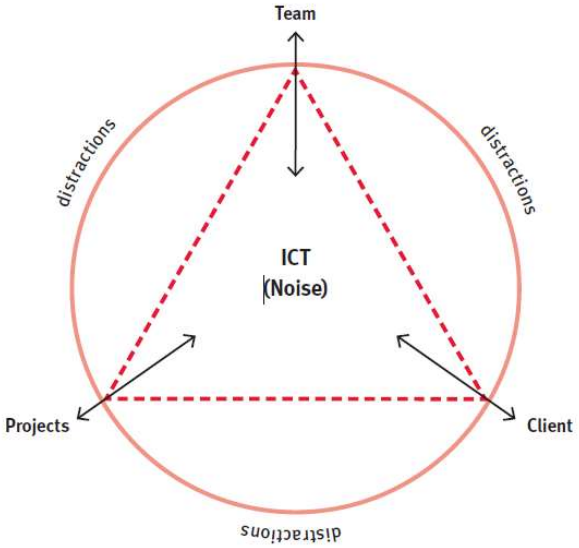

Figure 6: Information communication technology (ICT) at the core of any construction project (Rimmington, 2015:1369).

Although there is evidence that ICT has vastly improved communication, there are also negative results i.e.:

- *The reduced need for exchanging information*
- *Hoarding of information thereby bottlenecking processes*
- *Limited accessibility as well as the ability to use technology to its fullest and the ability to use, the web and mobile units.*

Before looking at ICT as a medium vehicle for communication, one must first identify the various types of communication that exist within any organisation. Dainty (2006) identifies the following three types of communication levels exist in every organisation

1. *Interpersonal communication*
2. *Group and team communication*
3. *Organisational communication*

1. Interpersonal communication

Interpersonal communication generally refers to the process of communicating between two or more people, usually through direct interaction between both parties. At the same time there is also intrapersonal communication, which is the individual persons internal thought process of communication. Although it may not be evident in the external process of communication (Dainty, 2006:76).

Various studies on interpersonal communication shows evidence that face-to-face meetings were seen to be more effective than formal communication methods, such as letters, faxes and emails, as a direct communication tool. Similarly, (Carlsson *et al*., 2001), studied communication in the Swedish construction industry and also found that direct face-face interaction was preferred to indirect interactions. However, formal means of recording such communications was required for future references. Hence it can be seen that verbal communication in the construction industry is extremely important.

The manner in which the sender will attempt to communicate with the recipient is dependent upon how they think the recipient will interpret and respond to the information transmitted to them. Effective interpersonal communication at all levels is always crucial to the performance of construction projects.

Although face-to-face communication has shown to be an effective form of interpersonal communication in construction project environments, this has only been effective so far as teams members are within reasonable distance of the site or to each other. Today, especially for large scale projects or joint-ventures, geographically dispersed teams as well as physical meetings have become a problem. This problem has grown as a result of globalisation of many companies. The need for physical presence by team members may require a person to have to travel both far and across different time zones which may affect a person's work and personal life as well as have health implications. As a result of this growing issue, the main focus of ICT, in recent years, is to address the face-to-face communication across large distances and across different time zones.

With globalisation of the construction industry, particularly with the need for specialised skills, one inherent barrier to interpersonal communication which is becoming more prominent, is the language barrier. As stated in the study limitations, this factor will not be discussed further in this thesis, but it must be noted as an important part of verbal interpersonal communication.

2. Group and team communication

In any construction project, there are a number of teams involved. These teams usually comprise of professionals with varied skills, knowledge and experience, who work together on order to achieve a common goal and ultimately, the completion of a project. In group and

team communication, it is important to first understand the ways in which teams form and develop to recognise how they communicate within the construction sector.

Group development undergo four stages before performing as an efficient unit (Dainty *et al.,* 2006:97).

Forming: This is the early stage of the group development where individuals become acquainted and determine strength and weaknesses of each other. Members are often more cautious at this stage so as not to cause offence.

Storming: In this stage, members become more secure and begin to exercise their opinions more openly which may result in conflict. Any possible issues or problems may be made aware so that it may be addressed appropriately.

Norming: This is when members of a group develop a sense of individual worth, how they can contribute to the group through each of their own responsibility and respective roles. Group norms then occur where there is interaction between group members and stronger relationship bonds form.

Performing: Through the group norms, a system is formed where there is unison amongst the group members working together.

3. Organisational communication

Organisational communication is communication which exists within organisations and their hierarchical levels from management to workers, to how communication flow exists between levels and across companies (inter-organisational). Interpersonal and inter-group communication exist throughout the construction process and despite advancements in ICT developments in recent years, as these forms of communications cannot be divorced from this process. The success or failure of any project is based on these communications and not the technology itself. So construction should be seen as an interaction hive where communication is the binding thread which keeps it all together. (Dainty *et al*., 2006:8)

Many organisations are continually trying to develop on a global scale using dispersed membership groups. The consistently changing globalised business environment has encouraged many businesses to enrol the use of virtual teams in order remain competitive (Lurey *et al*., 2001).

Virtual team, also known as geographically dispersed team, are a group of individuals who work together from different geographic locations and rely on communication technology such as email, and video/ voice conferencing services in order to collaborate (Peters and Manz, 2007)

The effectiveness of communication in any model hinges on four factors (Shonubi and Akintaro, 2016):

1. The effectiveness by which information is encoded and then transmitted through communication systems, channels and networks. How efficiently information is translated and transferred through various communication channels and networks.
2. The use of a suitable medium /channel for communicating.
3. The receiver's ability to decode, understand and react to the information transmitted.
4. Barriers/noise which slows down the processing speed of communication

In reality, these four factors are likely to be accounted for simultaneously by members involved through the ways they have developed to communicate effectively within their workplace environment. It is worth exploring each aspect in order to establish the principles of effective communication.

Need for ICT

Since the advancement of the construction industry, we now have specialist roles being created in a multidisciplinary industry. This new redevelopment of specialist professions has in fact fragmented the construction industry's various disciplines i.e.: architect; mechanical engineers; structural engineers; electrical engineers; project managers etc. Issues such as increased competition, low start-up costs for new companies, increased investment uncertainty and increased risk work has installed fear of possible bankruptcy in many organisations. As a result, the advanced development of ICT has enabled organisations to grow and compete on an international level on international projects and becoming more feasible (Evaristo, 1999). Thus, there has been an increased emphasis on the use of ICT, particularly in the construction industry (Figure 7).

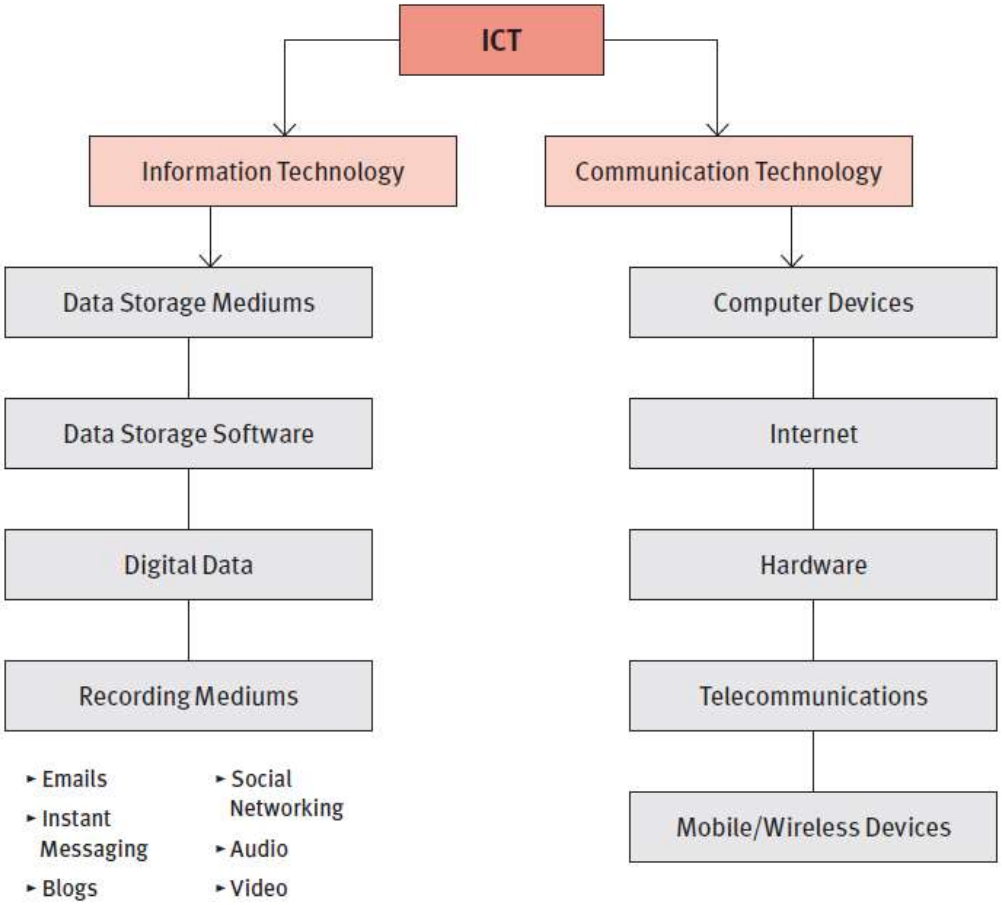

Figure 7: ICT at the core of any construction project (Rimmington, 2015:1368).

There have been many advances in the dissemination of information in projects particularly within the last decade. Wikforss (2007) questions the organisation of communication within projects. These are found to be more than just based on form and technology. He considers both the technological aspects along with the psychological aspect. Similar findings by Shelbourn (2007) supports this, and that organisations and human issues play an important part in successful collaboration, and not merely through the implementation of IT.

According to Fryer (2004), the management of information and the manner in which people communicate has improved in the construction industry in three ways:

1. *Information processing speed*
2. *Information accessibility*
3. *Improving management information systems to allow for faster change/ adaptibility.*

In the past, computer technology was very expensive and affordable only by large companies. However, Baines (1998), found that as technology improved and has become more affordable to smaller organisations, this allowed them to become competitive. According to Dainty *et al.* (2006), IT has now evolved to become known as information and communication technology or ICT. This indicates that IT is now being used more and more as an enabler of communication within modern organisations and society.

Long distance communication tools used in communications on projects such as facsimile, telephone and email has improved the efficiency and effectiveness of quality information. However according to Wong and Ng (2010), in his survey, lack of information planning has led to these techniques being used, in order to follow up on the delivery of information and to serve as a paper trail in the event of errors. It was also noted that when internet/technology based communication software was introduced, processes failed to meet deadlines, even project managers did not utilise the system to its fullest potential.

“Planning documents were not distributed via proper channels but were distributed among the parties involved, either by email or by hardcopy memo documents” (Wikforss, 2007: 30). Communication tools, introduced with a purpose of imposing better control and coordination of construction projects are an area of such knowledge contests. Communication solutions aim at breaking down barriers that professional groups carefully and successfully have built up over a long period of time. They aim at making construction knowledge more general, thereby challenging the expertise of that for decades has become more and more the province of specific professions and home to an ever increasing array of professional groups, which today all apply their own special routines and have their own particular ideas as to how coordination should be achieved. This may result in communication tools that are so generally conceived, so shallow and so uninteresting that they are accepted but are hardly ever used; or someone may take control of the tools and modify them to suit their own special needs, thus obtaining a toolkit that is both sophisticated and functional – for a few (Wikforss, 2007). Despite this, there is an advancement in terms of development of communication technology, ‘globally dispersed project teams are the new norm in every industry today (Daim, 2012). Once all these factors have been addressed, team maturity can be measured, which measures the aligned cohesion and its compatibility to one another.

Vorster (2003) emphasises that in order for virtual teams to be effective, there would need to be a strong integration between computer systems with peoples skills, knowledge and abilities in a harmonious manner without fear of inadequacy.

Communication diffusion theory

Rogers (2003) came up with the theory of diffusion in his book 'Diffusion of Innovations' in 1962. Within the book, he theorised that innovation is communicated through a social system. Within the Diffusion theory lies four key components:-

1. ***Adopter Categories.*** This is categorized as one's zeal to try a new idea or open to new thoughts or trends.
   Five categories of adopters have been identified (Figure 8), namely: innovators; early adopters; early majority; late majority; laggards.

2. ***Mass Communication Channels.*** This is exposure to new ideas or trends and the exchange of information through mass media. Mass communication channels will vary depending on the different stages of the adoption process. Mass communication channels are more available to early adopters. Findings by Rogers (1962) has shown that innovators depend on mass communication channels in order to obtain new knowledge. This is because when a new idea is adopted, very few people have the knowledge of the innovation.

3. ***Cosmopolitan Experience.*** Cosmopolitan experience is the exposure of the user to an idea from mass communication channels or external source. For the purpose of this research, this will not be discussed.

4. ***Demographics.*** Earlier adopters have more years of formal education, higher social status, greater upward social mobility, and larger-sized estates. In terms of age and gender, no consistent evidence about a relationship with early adoption was confirmed.

The diffusion-theory central theme is that the diffusion of technology innovations or assimilation follows a typical bell-shaped distribution pattern (Figure 8).

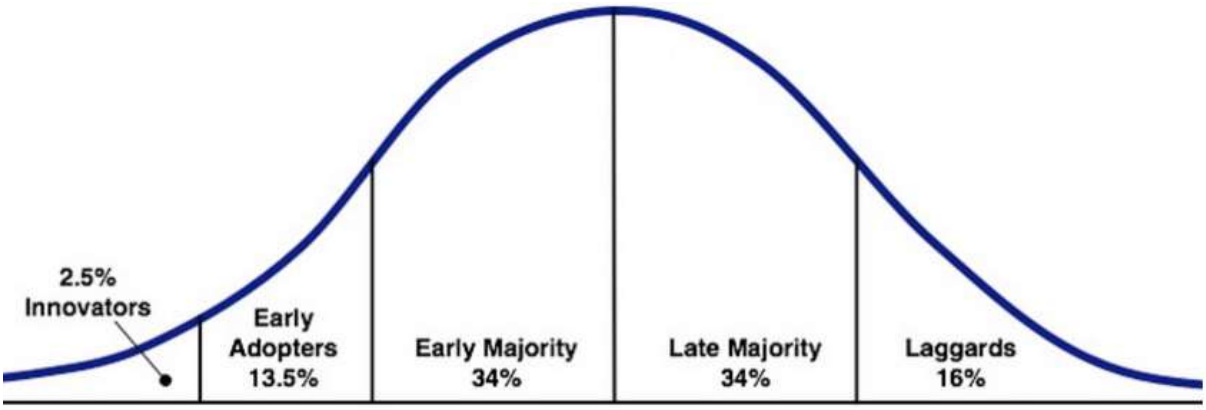

Figure 8: Rogers' Theory of Diffusion innovation categories (Rogers, 1962:247)

Similarly Adriaanse (2010) conducted her research based upon the user adaptation to ICT over a given period of time and reported that users experience ICT in three phases:-

1. ***Attempt to try the use of ICT***

Participants were seen to experience time pressure and as a result will resort to using traditional methods.

2. ***Start to use ICT in a structural manner***

Participants begin to use ICT as intended, however this is based upon authorities influence.

3. ***Adaptive use of ICT***

Participants use ICT where they see fit while at the same time using traditional methods in which they felt comfortable with (Figure 9). The study also demonstrates the factors which influence the use of ICT experienced by the user:-

- Personal motivation
- External motivation
- Knowledge and skill
- Acting opportunities

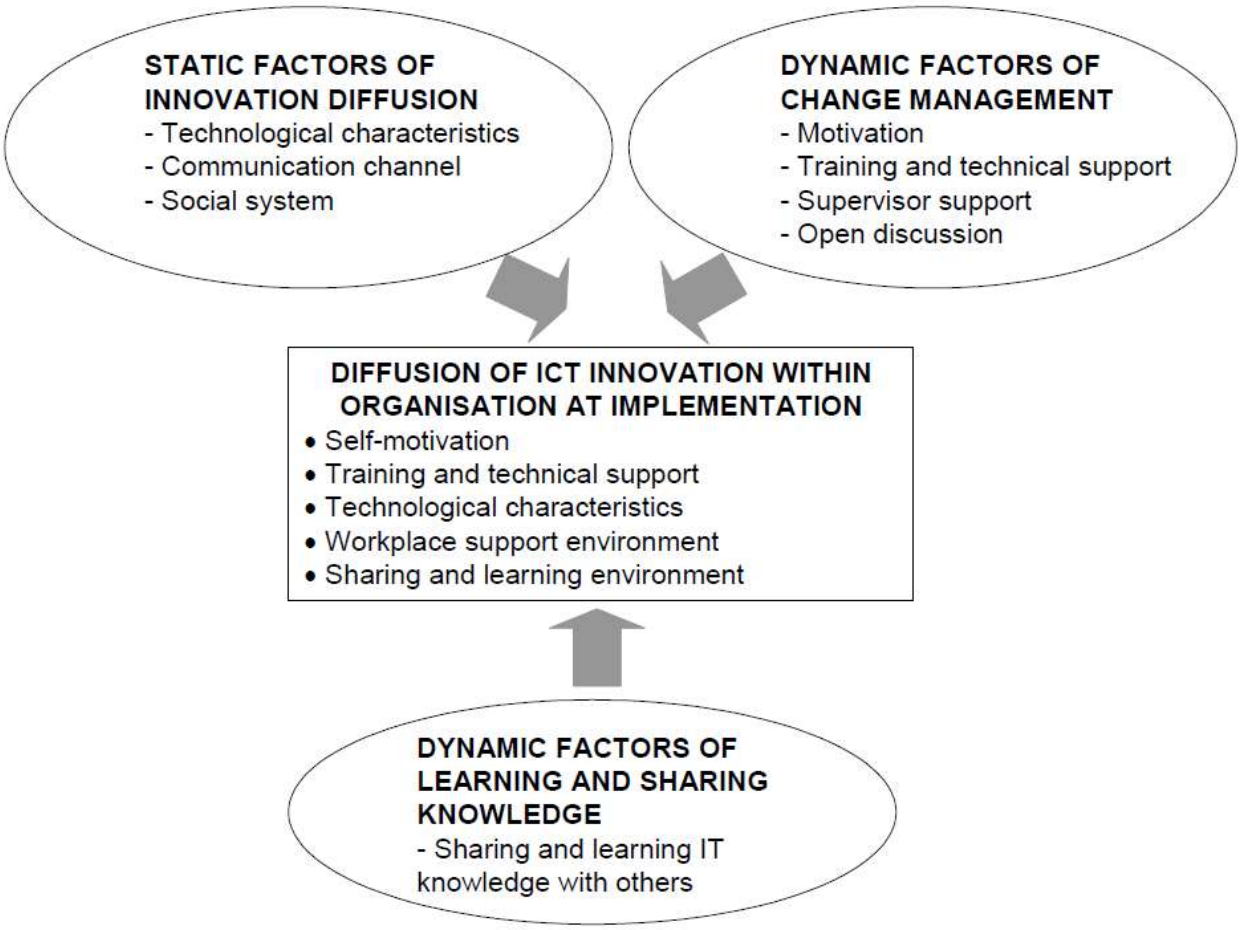

Figure 9: Integration of factors related to ICT diffusion (Peansupap and Walker, 2005:199)

Although there has been technological advancement in hardware and software in ICT, literature has indicated that human affinity has not advanced at the same pace as confirmed by Lam (2010).

Wikforss (2007), Huang (2007) brings to the forefront the importance of communication flow in any organisation. They highlight the problems associated with ICT and communication within organisations. These stem from an inability to adapt to new mediums to managerial processes which govern communication flow.

As mentioned previously, Dainty (2006) refers to the construction industry as a people-intensive, highly social industry. It is the constant interaction between individuals towards a common goal. As a result, we see the formation of teams in all projects.

Teams

There is a need for teams in any organisation or industry, as they may have multiple skill and abilities needed to reach an objective and can achieve more than individual workers acting alone. In this way, many business organisations have adopted this approach to all business projects (Baiden, 2011).

According to Cohen and Bailey (1997:241)

> *"A team is a collection of individuals who are interdependent in their tasks, who share responsibly for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems (for example, business unit or the corporation), and who manage their relationships across organisational boundaries*."

A team comprises a group of people connected to a common purpose. The use of teams are especially useful for undertaking tasks that are highly complex and require a variety of skills and abilities.

Qureshi (2006) explains that there is a noticeable trend towards smaller, more decentralised teams comprised of individuals with different abilities and skills. This suits the modern and more complex nature of organisations today as it adds more value in terms of skill and knowledge giving an added edge within the market.

In team organisations, there exist a basis of criteria which are needed for a team to succeed:

- Respect of cultural differences
- Interpersonal relations
- Leadership
- Trust

Virtual teams

As stated before, virtual teams are individuals brought together through technology and work together to reach a common goal. They are not restricted by location and distance from one another. Virtual work does not have the traditional characteristics of work in an

organisation, surrounded by people and the hustle and bustle of work activity; instead it takes place in the work place that is of one's on configuration and time. Virtuality is now associated with activities that can take place anytime, anywhere, and anyway one desires, with no physical, geographical, or structural constraint. Qureshi (2006)

Since the improvement of ICT and the continued globalisation of many industries, particularly in the last decade, we see the formation of virtual teams or geographically dispersed teams (GDT) (Kirkman *et al*., 2002; Evaristo, 1999; Ebrahim, 2009). Virtual teams began in the 1980's when organisational teams were becoming more displaced from one another, especially across time zones. During the late 1980's and early 1990's many organisations implemented self-managing or empowered work teams. This helped to improve service by reducing project cycle time. Team members were given more responsibilities for their roles and accountability was shifted to team members, rather than slowing down the processing time and waiting for approval from management. By the mid-1990's, the team concept was introduced to the European and Asian market. This was the start of globalisation of human resources and the formation of global dispersed teams. In short, a virtual team can be considered as, according to Lipnack and Stamps (1997), "small temporary groups of geographically, organisationally and/or time dispersed knowledge workers who coordinate their work predominantly with electronic information and communication technologies, in order to accomplish one or more organisation tasks"

Today, the use of IT is to strategically place people with different skills/expertise in their respective fields, who are geographic located from one another, to be able to work together on particular objectives (Laudon and Laudon, 2002; Yang, 2007). Specialisation or expertise is more easily accessible via intra-organisational or inter-organisational when using virtual teams. This is achievable through the use of ICT to coordinate the various operations of the organisation, in order for it to operate in unison. Therefore IT would be another criteria for virtual teams to succeed (Peters, 2007; Vorster, 2003).

Why Virtual Teams?

According to Raghuram *et al*., (2001), there are three main factors which led to the emergence of virtual teams. Firstly, IT is readily available within developed areas. For example: computers while costing less and becoming more powerful, as well as the use of the internet with larger network coverage, have provided employees information

accessibility for them to perform their work, in locations other than the traditional office spaces. Secondly, adjustment in the clients scope of works. Clients now demand a complete turnkey solution, from design, construction and repair and manage. Thus, there is a shift from product-driven through to a service–driven to a knowledge/technology-driven strategy to meet the client's changing needs. The third factor is the globalisation of the marketplace which attributes to corporate layoff, mergers and acquisitions, resulting in dispersed members in order for companies to survive.

Similarly, Vorster (2003:13) stated that more and more intellectual and service based industries in South Africa are shifting towards virtual, non-physical office based entities as a result of globalisation and advancement in IT. Vorster (2003) also adds that virtual teams can be seen as a way in which organisations could improve their strategy for change through enhancing and integrating key organisational resources such as people, space and IT to deliver greater business value and creating improved global presence.

Advantages of virtual teams

Vorster (2003) highlights the following advantages of virtual teams over conventional teams.

1 Specialised skills attainable:

Specialised skills are no longer restricted by areas or regions. Although it is possible for companies to hire employees from other areas, this would usually involve paying removal expenses, and possibly increased salary to compensate for uprooting families. The relocation of people and their whole families in order to acquire people with specialised skills would have an impact on some potential employee's domestic situations. Some of these could be that their spouses have good secure jobs, and they are comfortable in their current location and the children's social situation. Re-establishing a family may be quite daunting. It is for these reasons that some potential employee's may not be happy to relocate. Virtual teams avoid all these problems; as specialised skills are readily available and are easily reached.

2 Cost savings:

Vorster (2003) also suggests that the benefits of virtual teams include cost and time saving, along with increased productivity and skills development. Organisations that utilise virtual

teams show considerable savings of costs on resources. Qureshi and Vogel (2001), however have pointed out that although the benefit of utilising virtual teams have proven the need for such a business venture, it needs to be noted that the initial cost investment as well as the up skilling of workers may be a strategic business barrier in smaller organisations.

3 Time saving and increased productivity:

Virtual teams allow for time flexibility; transportation is unnecessary, resulting in increased time gained and increased productivity. Teams that are located across different time zones effectively increase productivity time. Having team members in multiple locations gives a company a larger physical presence and increased accessibility.

4 Small/medium businesses:

Virtual teams allow small or medium businesses to be competitive, since they have easier access to resources similar to large organisations, since marketing and communications can be outsourced globally.

5 Technologically dependent:

Virtual teams use cloud computing (information that is accessible anytime and anywhere), video conferencing, email, messaging, etc. which is extremely important in allowing virtual teams to communicate effectively amongst one another.

	Organisation	
Space/Time	Same	Different
Same	Co-located teams	Co-located teams Organisational teams
Different	Distributed teams	Distributed teams Organisational teams

Figure 10: Virtual team types categorised by organisation and place structure (Vorster, 2003:19)

Challenges of Virtual Teams

Virtual communication differs immensely from traditional office communication in many ways, as explained below:-

“As human beings, we have been endowed with multiple senses and forms of expression that we rely on in our interpersonal communication. When deprived of some of those senses and forms of expression, we must compensate with others. For example, when

asking for directions in a foreign country, we find a way to get an answer by using gestures and sign language that are seen and interpreted. In the virtual working world, we are deprived of the ability to employ all of our senses. Consequently, the information we receive from the senses that are being used must be amplified and translated. When we apply this situation to a team consisting of people from multiple cultures with different personal styles, the challenges grow even bigger." (RW3 Cultural Wizard, 2012:3)

However the following points have been observed as challenges facing virtual teams by Lam (2005):-

1. ***Lack of co-ordination***

Virtual teams have exhibited a general lack of coordination due to unclear designation of roles and responsibilities. If the initial start-up on a project was slow and as a result, various assignment deadlines were unable to be reached. Meetings were found to be unstructured and infrequent.

2. ***Minimal interaction***

Some virtual teams exhibited low levels of interaction amongst team members. This may be a conscious decision taken by some teams in order to develop constructive interaction and omit unnecessary interaction to complete the team project as fast and possible with no delays. Warkentin *et al*., (1997) states that 'because exchanging information is more difficult, virtual teams tend to be more task oriented and exchange less social-emotional information, slowing the development of teamwork.'

3. ***Lack of deep discussion***

Some teams displayed few meaningful discussions during team meetings. This may be caused by team member's perception that deep discussions may prolong meetings and therefore result in a delay in completion of the project. Another reason may be to avoid creating tension amongst the team and being opposed to another member's ideas.

4. ***Clinical rather than heated discussion***

In typical teams, when there is direct communication amongst team members, the reactions exhibited between individuals show spontaneity and interest or on other words a 'heated' discussion. Virtual teams showed no signs of heated discussions, instead it was found that

the discussions that took played were ‘clinical’ and very objective. This clinical nature of discussion of virtual teams may be the result of the communication tools being used where the need for immediate response has been removed and one has time to think about a question or comment and respond in an appropriate manner. In this way, heated discussion may be avoided by allowing a person time to ponder over a question or comment.

5. Dormant teams

Dormant teams are teams which only become active by an impending deadline, although the quality from the work from a dormant team may not always be of poor quality. Dormant teams may be a result of poor time management and procrastination by individuals. Dormant teams are usually associated with poorly organised teams who only show signs or activity closer to a deadline as opposed to well organised teams who consistently through a project..

6. Free loaders

Another phenomena which occurs in teams is the development of 'free loaders' (Salomon and Globerson, 1989), in which individuals contribute very little to the team and even in some rare instances, nothing. There is no evidence that says that this occurs more in face-to-face teams than it does with virtual teams. A similar concept known as ‘social loafing’ exists in the psychology literature, which refers to the tendency of individuals to shirk when their lack of effort can be easily disguised within the activities of the team as a whole. Harkins and Szymanski (1989)

7. Cultural/religious differences

The importance of communication determines the success of a project from the beginning to the end. Burke (2007) states that ‘ for a project to succeed there is a continuous need for effective communication to issue instructions, solve problems, make decisions, resolve conflicts, and keep everyone supplied with the information they need.’

Members of typical teams that have similar backgrounds and share similar values and ways tend to think in a similar fashion as opposed to virtual teams often have the same background and share the same traditions and habits (e.g. of the company). This leads them to think in a more single-minded way than virtual teams.

However, Lam (2005) suggests that personal issues, which occur with co-located teams especially in confidential discussion, results in time wasting, whereas virtual teams are not as open with one another and do not allow for personal issues to get in the way.

8. Virtual Proximity (VP)

Another challenge facing virtual teams is Virtual Proximity (VP). This is defined as one virtual team member's perception of distance of another virtual team member. This is warped as a result of the use of communication mediums and the possible variance of different time zones. A team member's actual geographical locations do not affect VP. The extent of usage of communication tools can affect VP. Chowdhury *et al*., (2013:5)

Effective communication = trust =good collaboration

As Shelbourn *et al*., (2007) pointed out, good collaboration does not result from the implementation of IT solutions alone, but considerations should be given to both organisational and people issues.

Hsu (2008) adds to the argument of successful team by illustrating that the teams psychological/ mental influence plays an important part in how effectively any team operates. A major area of concern is trust, and may be a reason for communication skills to be developed, which can determine the possible successful or failure of any virtual team's integration/collaboration. It is essential as it cannot be constantly monitored and therefore risk is placed. Brown (2004) explains that in virtual interaction, the importance of trust is paramount in order for collaboration is to be achieved. In order for trust to be built, both parties must be willing to open and honest with each other and work together to accomplish a task or overcoming issues or situations. Thus to maintain strong collaboration, continuous interaction is needed so no miscommunication is minimalized. Trust is therefore essential in order for strong collaboration to exist whereby both parties act in the interest of both parties and not opportunistically for the one.

Figure 11 shows the Leary Rose model (Leary, 1957) discusses interpersonal behaviour and the dynamics of team formation and describes the relationship formation in team dynamics, and as such a consequence. It demonstrates the relationship of any two parties that engage with one another as being either the dominant or submissive part.

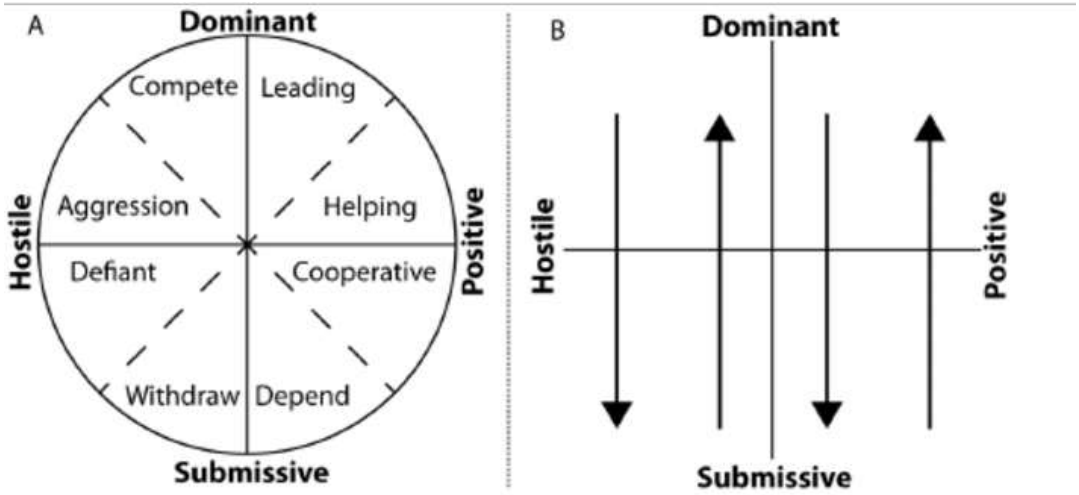

Figure: 11 Characteristics of team members. www.researchgate.net (n.d.).

Holton (2001) sees trust as an element which is formed through regular dealings with each other and those involved are at ease with each other and willing to open themselves to one another without any reservations. Individuals are not afraid of sharing ideas and challenging each other without possible fear of being judged and free to speak and voice their opinions.

Kirkman *et al.* (2002) highlights a strong point that virtual teams have demonstrated increased issues of trust rather than co-located teams. This conflicts with the findings of Uden and Naaranoja (2007)

Research by Holton (2001) define the following two factors as key factors determining successful teams:

- Trust
- Collaboration

Similar findings by Uden and Naaranoja (2007) corroborate these problematic areas of collaboration experienced by teams. These areas have been defined by the following:-

- Trust
- Interpersonal relations
- Cultural differences
- Leadership
- Technology

Why is trust important?

Trust is an important aspect needed by teams in any organisation in order to work together effectively by focusing on the project to be completed at hand and ignoring time wasters such as internal conflicts and politics

The definition of trust given by Mayer (1995:712)

> [Trust] is the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party.

Absence of Trust is considered as the base dysfunction of *the model* of *The Five Dysfunctions of a Team* as Lencioni, (2002) mentions:

> "This stems from members' unwillingness to be vulnerable within the group. Team members who are not genuinely open with one another about their mistakes and weaknesses make it impossible to build a foundation for trust. This failure of trust is damaging because it sets the tone for the second dysfunction: *fear of conflict.* Teams that lack trust are incapable of engaging in un-filtered and passionate debate of ideas. A lack of healthy conflict is a problem because it ensures the third dysfunction of a team: *Lack of commitment*. Without having aired their opinions in the course of passionate and open debate, team members rarely, if ever, buy in and commit to decisions, though they may feign agreement during meetings. Because of this lack of real commitment and buy-in, team members develop an *avoidance of accountability*, the fourth dysfunction. Without committing to a clear plan of action, even the most focused and driven people often hesitate to call their peers on actions and behaviours that seem counterproductive to the good of the team. Failure to hold one another accountable creates an environment where the fifth dysfunction can thrive. *Inattention to results* occurs when team members put their individual needs (such as ego, career development, or recognition) or even the needs of their divisions above the collective goals of the team." (Lencioni, 2002:188-189)

Figure 12: The 5 dysfunction of a team adapted from quote (Lencioni, 2002:188-189)

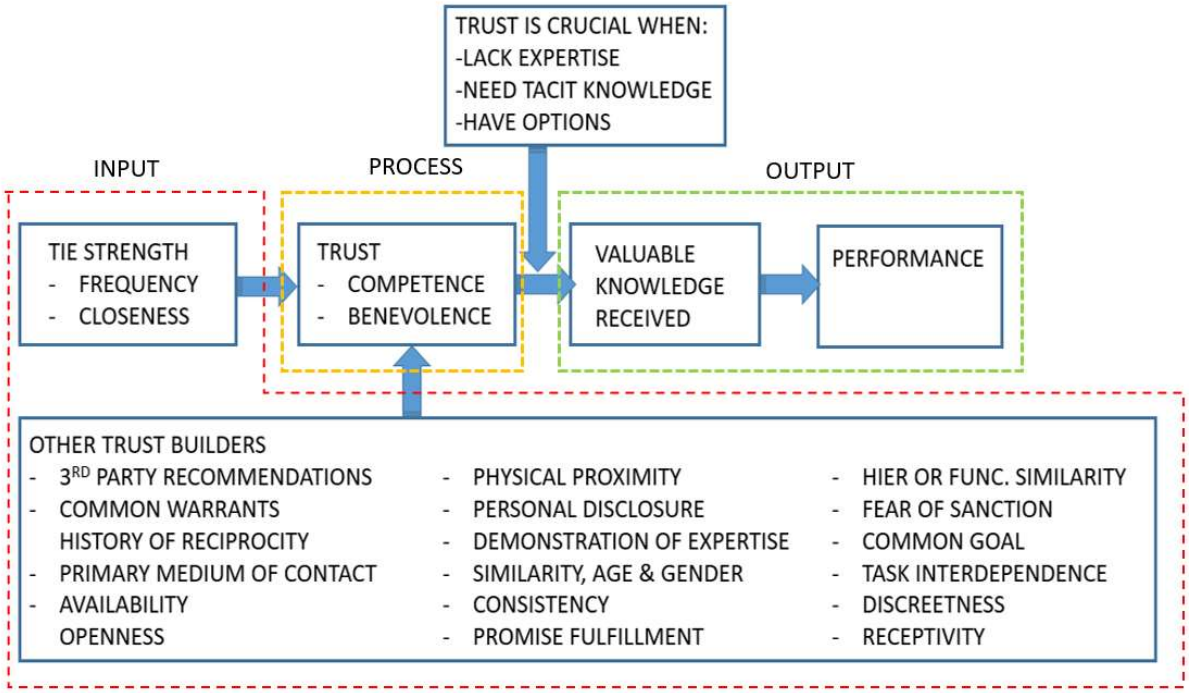

Figure 13: Prusack's Trust Model (Chowdhury *et al.*, 2013:11)

The Prusack Trust model	The Five Dysfunctions of a Team
Closeness	Avoidance of Accountability
Frequency	Fear of conflict

The Prusack Trust model	The Five Dysfunctions of a Team
Personal Disclosure (Openness)	Absence of Trust — Admit weakness and mistakes (confession); Ask for help; Skills and experience; Take risks; Mutual respect
Availability	
Demonstration of expertise	
Fear of Sanction	
Discreetness	

The Prusack Trust model	The Five Dysfunctions of a Team
Competence	Avoidance of Accountability
Benevolence	The Absence of Trust

Figure 14: Comparison of Prusack Model with the five dysfunctions of a team
(Chowdhury *et al*., 2013)

In figure 13, Larry Prusack's trust model (LPT), there are three main components- *input*, *process* and *output*. The input component comprises of strength (Frequency & Closeness) and trust aspects. The process component comprises of competence and benevolence which deals with skills, character and ability. The last component, output, is determined by both the characteristics and quality of the process in order to give the by-product. When compared to the input section of LPT model with the *Five Dysfunctions of a Team (FDT)*, similarities can be identified between them (Figure 13). *Avoidance of accountability* and *fear of conflict* aspects of the FDT relate closely *to* the closeness and frequency in Prusack's model.

The openness aspect in LPT model relates to admitting weakness and mistakes of the FDT. Similarly, *availability* in the LPT model has close ties to asking for help in the FDT. Demonstration of expertise, Fear of Sanction and Discreetness (LPT) are equivalent to Skills, taking risks and mutual respect respectively. All the attributes of FDT model falls under the category of *Absence of Trust*.

Finally, competence and benevolence in the LPT model relates the avoidance of accountability and absence of trust in the FDT model. These similarities in these different models prove that all those attributes do matter to build trust in an organisational context.

Due to the nature of GVT, trust cannot be developed in the traditional method such as social interactions. Another aspect is the possibility of future relations and associations. (Daim *et al*., 2012:206).

Most virtual teams experience trust through Swift-side theory, which is the rapid social identification association which virtual teams experience when individuals with specific expertise and common interests and values are able to establish trust quite quickly. Virtual teams are more focused on completing the task assigned to them rather than on the social-human relation. (Daim *et al*., 2012:206).

According to Chou and Collins (2012), many business practices have now looked at how important and how to improve trust amongst teams to improve their effectiveness within their organisations. Studies of teams built trust was conducted in different working environments. It was found that interpersonal trust was established through frequent social interaction, which helped the organisation and effectiveness in conventional teams. Institutional trust was found to be more important to improve team effectiveness in the virtual working environment.

Numerous literature studies around the topic of communication and trust have been discussed. The 3 main categories of any organisation in which trust is measured are:- (Franklin & Covey, 2016)

1. The trust levels.
2. Trust components
3. Trust effects

The first category is the first step in identifying the issue of trust and as such, awareness is brought to the forefront. The second category which is the trust components, looks at the behaviours that create or destroy trust. By looking at the behaviours of trust and identifying the positive and negative aspects is valuable (Figure 15). From identifying these positive

and negative aspects, focus can be directed at training, processes etc. to strengthen the behaviours which create trust. The third category, trust effects, looks at the economic impact of trust levels. The result of both the negative and positive impact of trust in an organisation is summarised as follows.

NEGATIVE TRUST EFFECTS	POSITIVE TRUST EFFECTS
1. Redundancy	1. Increased Value placed on employees
2. Bureaucracy	2. Accelerated growth
3. Politics	3. Enhanced innovation
4. Disengagement	4. Improved collaboration
5. Turnover	5. Stronger Partnering
6. Company restructuring	6. Better Execution
7. Fraud	7. Heightened Loyalty

Figure 15: Negative and positive trust components. Franklin & Covey (n.d.).

Research by Powell (2006) examined the team commitment and its development and found three concepts. Firstly, the study found member commitments to be significantly related to trust among collocated team members, but not among virtual team members. The study also examined team work processes as a reagent to trust, and found significant relationships in both virtual and collocated teams though more important for virtual teams. Finally, rather than looking at culture or socialisation as antecedents to normative commitment, this study extended existing knowledge by finding trust to be a significant factor in effecting the dimensions of commitment in both virtual and collocated teams.

According to Smith (2012), there are numerous characteristics of trust in literature. These have been considered in the context of communication in the teams.

- *Trust is a social necessity*

In any social unit or team, there is the willingness of one or more to trust others within that unit. Any social group or team relies on the notion of trust and how much trust exists within that group. The efficiency, adjustment, and even survival of any social group depend upon the presence or absence of such trust

- *Too much trust can be as bad as too little trust*

Optimal trust in organisation is a strategy aimed at improving an organisations position with other parties. It is where a certain amount of trust is placed while still being cautious. When complete trust is given, the outcome may not be the best as the resolution to a problem may be quickly reached without proper attention been given to it.

- *Trust involves risk*

The concept of trust is closely linked to the notion of risk where trust is required when risk is present. Whereby in any situation there involves a trustee and a trustor.

- *Willingness to risk is not equal to willingness to trust*

Trusting another person is not the same as place trust in an object or device that is designed to achieve the same result. This is because people are averse to being betrayed."

- *Trust is dynamic*

The decision based on trust does not depends on current situations and information, it may be based on historical contact and nature of the subject or trustee.

- *Trusting someone can be reciprocal*

Trusting or distrusting may be reflected back upon a person and result in them being treated the same way they treat others.

- *Trust can be impacted by systems*

Industrial and technological systems and processes create environments which may develop or diminish trust.

- *Trust contributes to economic growth*

Trust strengthens social integration and is essential in any successful business venture.

- *There are different kinds of trust*

Interpersonal vs. inter-organisational trust (i.e. trust between individuals vs. trust between organisations); Cognitive trust vs. affect-based trust (i.e. trust based on competency vs. trust based on emotional attachment); Relational vs. dispositional trust.

- *Trust is domain specific*

Trust is subject to an individual's cognitive reasoning which may vary from person to situations, where ewe might trust someone in some situations but not in others.

- *Trust can be measured*

A number of trust measurement tools and tests have be developed to measure the factors of trust which are consistency and reliability

- *Trust is a competency*

Trust requires continual action and is subject to growth and decline since it involves interaction by two parties. By acknowledging others and understanding how what we do affects others, allows us to get better at it.

An example of measuring trust in an organisation that has been carried out by Dan Oestreich of Oestreich Associates. In their survey, team dynamics and trust was measured through a series of trust related question as to how each team member perceives the level of trust which exist in the team. 5 levels of trust were established to exist among teams depending on the nature of the teams.

These 5 levels are as follows (ranked 1 being the most optimal and 5 being the most dysfunctional):-

1. **Ideal:** The ideal trust level is a self-motivated team where members completely trust one another on both a personal as well as professional level. They look at each other performance potentials and for the wellbeing of the teams' mission. People are genuinely *for* one another and each person's performance potentials are deeply tapped in service to the team's mission.
2. **High Functioning:** The high functioning trust level group displays general opening and constructive feedback in both professional and personal growth.
3. **Traditional Practice:** Traditional practice teams trust level is task focused. Clear communications, open expectations and good cooperation is expected
4. **Low Functioning:** Low functioning teams display a degree of interpersonal and organisational mistrust, and has a negative impact on the task needed to be completed with members having a mindset to get job done with little impact as

possible on themselves. Members People feel stressed, frustrated, and sometimes victimised.

5. **Disintegrating:** The team is literally in a spiral of disintegration, a painful process where blame, anger, self-doubt and other emotions dominate the team environment.

Therefore without trust, collaboration would be impossible.
Kabanda (2008) says that, collaboration is the process intended to foster sharing that is necessary among involved or affected groups or organisations, in order to achieve the collective gains or minimise the losses. It is promoted by collective goals, mutual understanding, informal activity, shared resources, and common vision which is also supported by Peters (2007).

Successful team environment

So, how does a successful team environment looks like? As per the five dysfunctions of a Team model (Lencioni 2002), the members of truly cohesive teams behave as follows:

"1. They trust one another.
2. They engage in unfiltered conflict around ideas.
3. They commit to decisions and plans of action.
4. They hold one another accountable for delivering against those plans.
5. They focus on the achievement of collective results." (Lencioni, 2002:189)

Although this model is developed for the face-to-face work environment, one could easily comprehend that the ideal virtual team environment would be similar as well. It is noteworthy that good communication and strong relationship building are fundamental to achieve that 'ideal' virtual environment.

Baiden and Price (2011:129) brings together the point of integration/collaboration where he states that *"within an integrated team environment various skills and knowledge are seen as shared, and traditional barriers separating the design process from construction activities are removed or marginalised to improve project delivery....Integration has been suggested as providing a demonstrable means of improving the effectiveness of teamwork and project delivery team performance.*

Various studies conducted on virtual teams across different industries exhibit certain trends associated with virtual collaboration. These include:-

- Flexible working hours
- Technology is becoming less expensive, more accessible
- Younger management is taking the reins
- Desire for a positive culture
- The need for transparency is growing

In 2010, RW3 CultureWizard– An intercultural training consultancy that specializes in creating online training tools and e-learning environment sent out survey invitations to clients, colleagues and other engaged in global business activities. The report on virtual teams in 2010 (Figure 16) has revealed that virtual teams have proven to be successful in their implementation.

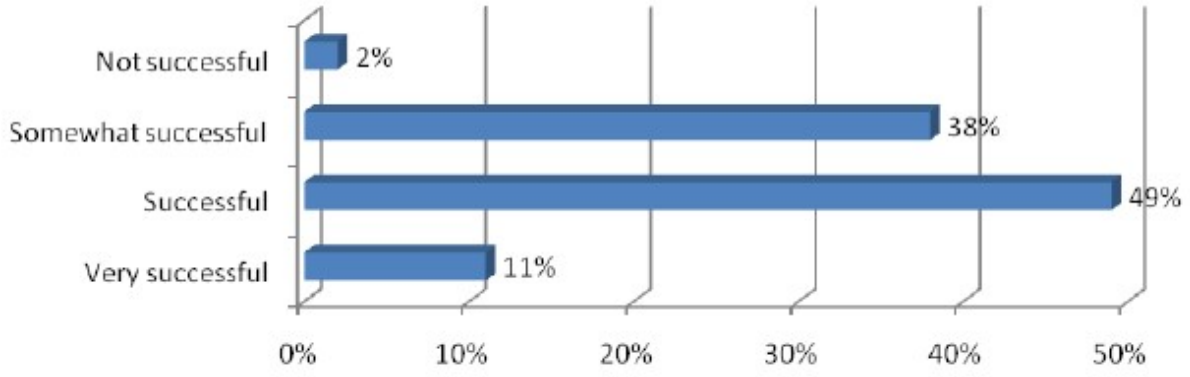

Figure 16: Global poll of success rate of deployment of virtual teams (source: 2010 virtual teams survey report, RW3 CultureWizard web: http://rw-3.com/)

Thomas and Bostrom (2010) identifies that successful collaboration/coordination is a direct result of trust formed from the individual to the virtual team, and that trust is a result of the individual's ability to adapt to ICT ; work environment and socially.

The figures 17 & 18 below shows initial relationship experienced by virtual teams by RW3 Cultural Wizard (2016). One can see that virtual teams in its infancy stage experienced many of the traits of the 5 dysfunctions of a teams.

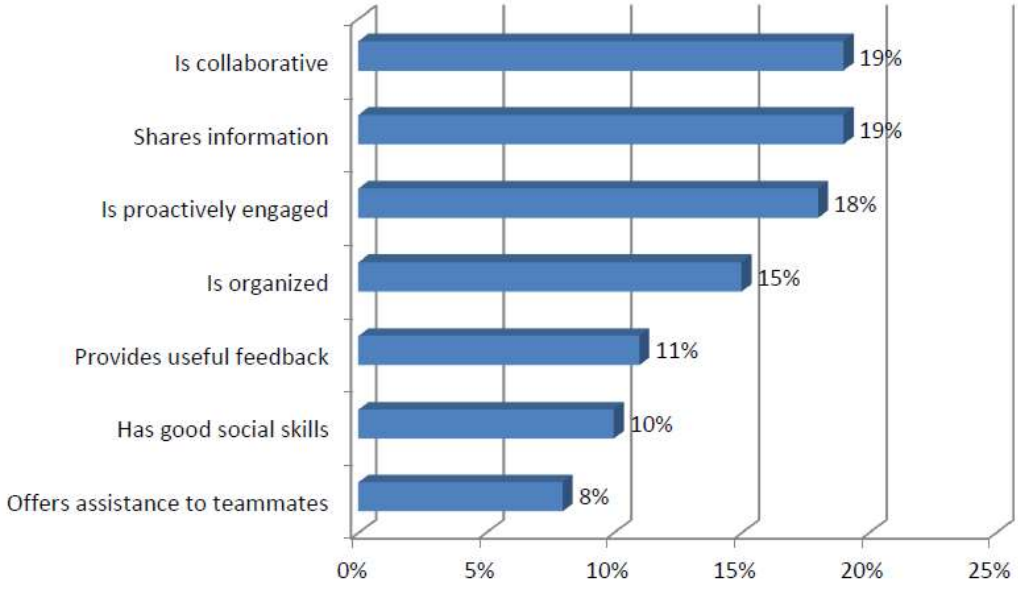

Figure 17: Successful virtual communication (source: 2016 virtual teams survey report, RW3 CultureWizard web: http://rw-3.com/)

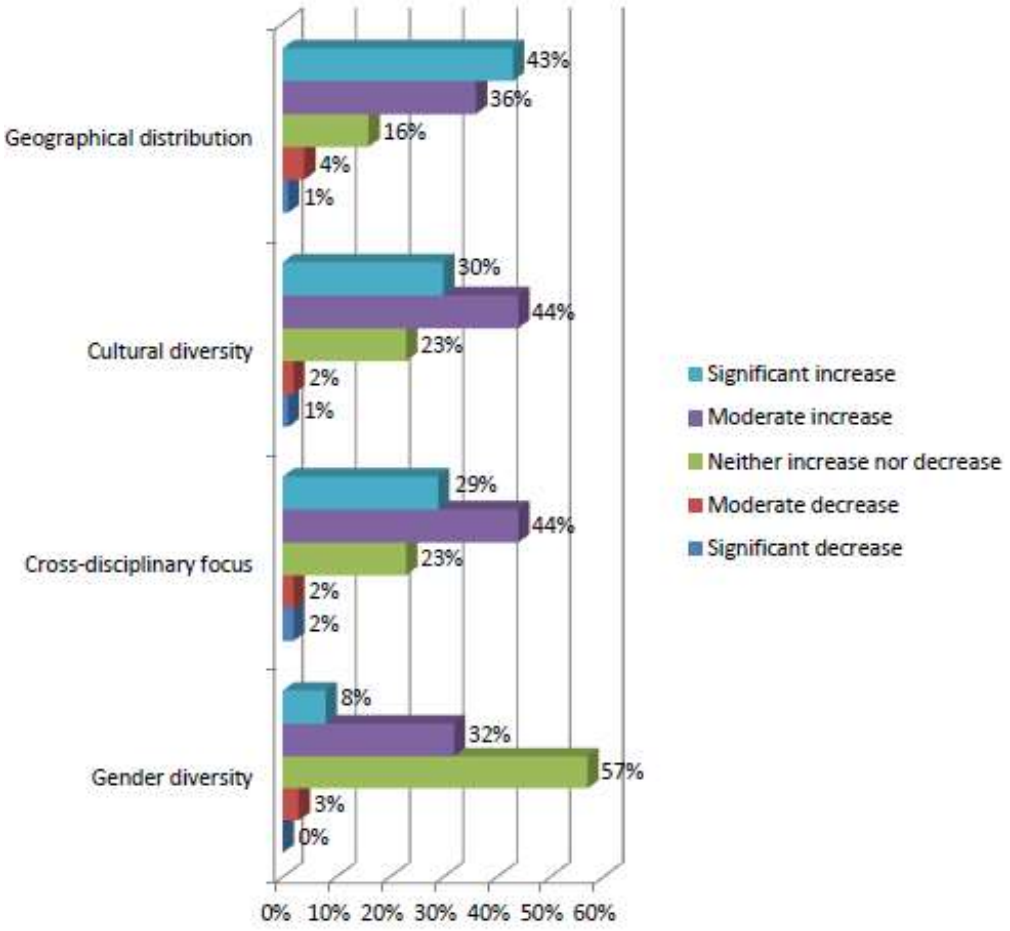

Figure 18: How teams have evolved in organisations (source: 2016 virtual teams survey report, RW3 CultureWizard web: http://rw-3.com/)

1.3 Problem Statement

From the background information presented earlier, it is evident that, the importance and emerging roles of ICT to the construction industry cannot be ignored.

The construction industry has evolved in many ways, in order to accommodate the clients demand for improvements on delivery of a finished product. These include substantial improvement in the quality of service, and the final product expected by clients. As a result of this improved performance, there is an expectation for improved quality of service and product by clients, to be facilitated by means of dynamic, versatile organisation entities on a global scale. Therefore, improved communication may be fundamental in the improvement of the industries performance (Dainty, 2006)

However, one of the challenges facing the South African construction industry today is that a substantial amount of information and the processing of that information still rely on physical documentation and traditional face-to face meetings for all processes such as working drawings, contract instructions and the need for frequent monitoring for the project status (Freeman, 2016).

According to Dainty (2006), fragmentation of the construction industry has been the main cause for its poor performance. There is a strong push for practices to deliver better value for money for clients, improving profitability and improving labour relations for workers. Other factors that also have a negative impact on project performance are ingrained cultures, fragmented delivery structures and peoples reluctance to embrace ICT solutions. Furthermore, more organisations are placing staff across the globe in order to create a presence for the company, so that they may capitalise on opportunities that may arise (Fanciulli, 2006; Dainty, 2006).

Denton and Vloeberghs (2003) observed that, as a result in the increasing shift into the electronic and digital era, organisations are forced to adapt to changes in operations and adopt new strategies in order to be industry competitive. Research by Chen (2011), suggests that construction sites are information intensive areas. As such, construction companies and the construction industry as a whole has shown more interest in developing their business strategy as well as productivity as a result of the rapid advancement of ICT (Ahuja, 2010). The processes required in any construction project is immense and the

amount of project data and information generated during the construction periods are enormous and may lead to costly errors if not handled correctly. The use of traditional paper hardcopies and documentation of processing and transferring data and information is still being practised due to the high investment cost needed for ICT (Delaney, R. and D'Agostino, 2015). Other factors include incompatibility between hardware and evolving software in every organisation as well as cultural issues.

According to Lipnack & Stamps (1993), South African companies face the following virtual environment scenario:

- Organisations using IT, allow for faster workflow, are more dynamic and adaptable. In this way, they are less dependent on the traditional office environment.
- Increased customer expectations adds new pressure to organisations to encourage customer relations to increase customer growth.
- E-forums formed teams which have better coverage to gain more market.

Denton and Vloebergh (2003) claims that South African organisations favour autocratic, hierarchical, controlling forms of management versus team structure. This may be seen to stifle organisations and in turn have a negative impact on the dynamic nature of the company's future lifespan.

They further state that organisations adapt to business risk through specialising areas in the business structure. Vorster (2003) agrees with this by supporting the example of the South African market incorporating external resources whose skills lie outside the organisations own capabilities.

Qureshi & Vogel (2001) explain that at this current point, organisations do not address the organisational processes and the skills staff require in order for them to adapt to the new work change. Employees are likely to work in a new technological context in the same way they were accustomed to in their traditional co-located teams. This is because although technology has improved and is becoming more user friendly, people are less inclined to change processes that they have become accustomed to in the working environment.

The last few decades has seen the advancement of electronic information and communication technology resulting in distributed work becoming much faster and more efficient, but consequently more in volume (Hertel et al., 2005).

As technology continues to grow and improve, new software and hardware are developed and thus new forms of collaborations are borne from this new technology to obtain specialised skills and information. When one speaks of the term “virtual”, it refers to the virtual substitution of a physical presence as well as the extensive use of IT (Vorster 2003:2).

With the increased de-centralisation and globalisation of work processes, many organisations in the construction industry have introduced teams that are adaptive to their changing environment and collaborate through the use of communication technologies across vast distances and different time zones, organisational and cultural differences to complete their tasks or complete a project.

The development of virtual teams that are flexible and more responsive to constant change, has today, revolutionised the working landscape (Powell et al., 2004).

Vorster (2003) explains that the formation of virtual teams can benefit from both the competitive synergies of teamwork, and the advancements in information and communication technologies. The use of information technologies enables changes in organisational processes and how they are structured so that organisations are capable of dealing

However, a high failure rate has been experienced with the implementation of virtual teams (Bal & Foster, 2000; Mackey, 2012). For that reason, virtual teams are not developed enough in the South African construction industry.

Importance of research

The importance of communication within any organisation/entity is paramount for its success. Myers and Sadaghiani, (2010) emphasize the importance of communication and how that communication is a mechanism through which people shape relationships. Thus the attainment of organisational goals is dependent on effective communication.

Many businesses are becoming increasingly reliant on ICT in order to be globally competitive, and utilise specialised skills which are not limited by time and distance. Ebrahim (2009)

Kabanda (2008) conveys in her report that ICT is an emerging trend, and is at the centre of global socio-economic transformations. Information has become an intellectual capital, a commodity which can be traded. This new trend has the potential to allow new small upcoming businesses the opportunity to compete with larger more well established companies.

1.4 Aims and objectives

This research aims to explore the current state of ICT in the construction industry, to obtain an up-to-date and general view of ICT, and how it has influenced the market state of the South African construction Industry. It looks at the use of ICT as a vehicle for communication within construction projects, and how effective that communication relationship is, in order to create trust, and ultimately how that trust improves communication and enhances collaboration

Since the emergence of virtual teams has only recently been evident within South African organisations, it is imperative that research be aimed at conceptual approaches and processes which promote an understanding of the background to and phenomenon of virtual teams (Vorster, 2003).

The general objective of this report is to analyse key barrier areas of communication, particularly in the effective use of technological mediums used by professionals in the construction field. It explores how communication has evolved through the advancement of ICT. This gives rise to the many businesses expanding globally, and the results are collaboration between members on a global scale.

Although the research talks about virtual teams as a subject, the essence of virtual collaboration is looked at more holistically, and from a human capital viewpoint. The research also looks at the individual's worth as part of a team and how that worth has an effect on the trust in the team through the use of communication.

When one considers the rapid globalisation of many organisations in many different industries, the use of ICT has indeed allowed for a more competitive market and more specialised skills.

There have been many different studies undertaken with regards to the study of virtual communication. Such studies include communication problems (Hoezen, 2006; Diallo and Thuillier, 2004); communication mechanisms (Chen, 2011; Yang, 2007); comparisons to co-located teams (Lee-Kelley, 2008); ICT utilisation (Alaghbandrad, 2012); virtual team dynamics (Hsu, 2012); cross cultural virtual teams; integration (Baiden, 2010); trust in virtual teams (Chowdhury, 2013).

Limitations

This research will look at factors of communication levels of project teams, in the South African construction industry, at a more broader scale, examine each aspect, and establish a link between the various types and how they influence trust in teams and ultimately affect the degree of collaboration that exist.

It does not examine individual software packages and how they are utilised, but rather instead, technology as a general entity and how people easily or are reluctant to adopt usage of such software.

This will look at certain factors which also contribute to barriers in communication which hamper effective communication and collaboration. There are many equally important barrier factors which impact heavily on effective communication. However, due to the time allocation for such a report, it was not possible to fully explore every possible factor thoroughly.

However due to time constraint, no test model could be designed and tested based on the findings.

CHAPTER 2: RESEARCH METHODOLOGY

This chapter describes the study design, the geographical area where the study was conducted, and the population sample. It also describes the methods used to collect the data, including methods implemented to maintain validity and reliability of the data collected.

Research strategy/approach and design

This research would comprise of a mixture of both quantitative research through the use of a questionnaire as well as qualitative research through interviews. Firstly, after a review of relevant literature, a questionnaire survey was conducted to identify current levels of communication usage within various companies in the construction industry, as well as factors hindering the level of usage in their respective organisations. The survey utilised a structured questionnaire approach. A questionnaire (Appendix, page 81) was used as it was the simplest method to collect data from a large number of respondents (quantitative). These respondents were identified as professionals in various fields within the construction industry.

Survey questionnaires are categorized as quantitative research, and this was preferred because quantitative approaches are deemed to be more specific and result oriented; and involves the collection of numerical data in order to explain, predict, and/or control phenomena of interest.

The theory of diffusion was used to identify *adopters* categories, identify diffusion channels, and make predictions. By looking at the sample respondents, a comparison will be drawn against Rogers' classic model.

In order to gain a better understanding of the general opinions and concerns, a quantitative approach was followed. Burns (1993) defines quantitative research as a formal objective, systematic process to describe and test relationships and test cause and effect interactions among variables. Therefore, a survey was selected because it provided an opportunity for individuals to give insight on possible problems with communications in projects, and the information may be tabulated by the frequency of occurrences and addressed by its importance to the project.

Since the goal of the methodology was to minimise the number of assumptions the reviewer will make of the project, the following methodology described below was adopted:-
A detailed literature review of the concept of communication theories, models and processes as well as current trends and methods of ICT by means of journals, books, and articles and use of web based articles. This helped the structuring of a questionnaire which was sent out to various construction practices as a means of quantitative research.

A descriptive survey was used to collect data for describing a population too large to be directly observed. It contains information from a sample of people of a particular demographic by means of a report containing the various participant's response to a series of questions set out by the researcher. In this study, the information was collected through self-administered questionnaires distributed via email and online surveys.

The Questionnaire

After a review of current literature and research objectives, a structured questionnaire was prepared and emailed to the various respondents both directly and indirectly. All the questions in the questionnaire contained closed-ended questions to ensure concise feedback from respondents. Some questions were left open-ended, since it was not entirely possible to design all questions as closed-ended

The purpose of the questionnaire is to gauge the frequency and preferences of the various users choice/mode of communication Therefore, the questions were grouped under the following main sections.

- **Communication Flow:** Effectiveness of the communication flow in and around the organisation
- **Coordination/Knowledge Sharing:** Extent to which important information is shared
- **Communication Barriers:** Aspects of the work environment that prevent the effective flow of communication
- **Accuracy:** Shared information is detailed and accurate
- **Reliability:** Shared information is reliable and consistent
- **Timeliness:** Shared information is received in a timely manner
- **Media Effectiveness:** Effectiveness of various media used to communicate important organisational news and day-to-day information

- **Interaction Frequency:** Extent to which employees receive communications about various topics, and use particular media to communicate on a daily basis

The three point type Likert ordinal scale system was used to measure level of usage by responding firms from: A= Agree, B= Neutral, C= Disagree, D= Not Applicable.

The final section "**Interaction Frequency**" asked responding firms to rate the various identified communication mediums and the preferred ranking of these mediums over one another in the construction industry. The Likert rating scale was again used to determine the preferred medium usage, where: 1= important, 2= neutral, 3= unimportant, 4= not applicable

Survey Questionnaire Administration

The questionnaire was distributed via email and through the use of an online questionnaire from March 2016 and completed in December 2016, as the main information gathering research process as this was seen as the fastest and most convenient and secure means of data collection for analysis from target groups. Questionnaires sent through professional organisations closely linked to the construction industry through networking have also been taken. A period of six months was allowed for the administration of the questionnaire; however, completed questionnaires were only retrieved by the 10^{th} month. A total of 85 questionnaires were retrieved. The data was collected over a period of 12 months.

The aim was to investigate various communication mediums and experiences of participants, frequency and quality of information distribution. The success of such mediums was hoped to become evident. Frequency of preferences/occurrences was taken into account. The use of secondary data analysis through literature review of existing surveys was used to draw a comparison

Survey Questionnaire Data collection

A questionnaire was chosen as the initial data collection instrument as they may quickly highlight problems experienced through communication during projects. A questionnaire is a self-report form designed to extract information that can be obtained through the written responses of the subjects. The information obtained through a questionnaire is rudimentary

and is usually followed up with a more thorough interview in order to gain more understanding of the respondent's personal reasoning.

The research objectives highlighted the various barriers that has influenced the successful use of communication. A thorough review of the literature was conducted for the purpose of identifying relevant studies. Examples of barriers to effective communication were identified and filtered, thereby eliminating lesser important barriers. These were then compiled into a survey questionnaire which was distributed. A 1 to 4 scale was used to assess the effectiveness and frequency of current information flow within various organisations.

Where the first option (A) was to disagree, (B) was neutral, and (C) was to agree. There was also a fourth option (D) which would not be applicable to certain organisations.

Questionaire Survey Analysis

After the data was collected, it was organised and descriptive statistics was used to analyse the given data set to measure central tendencies, and degrees of variations The Microsoft excel program was used to analyse the data by using descriptive statistics. Frequency tables were drawn, and from these the data was represented in bar graphs. Questions were grouped and sorted via quantitative content analysis with the aim of quantifying trends and anomalies. This determined major factors which determined the effectiveness of certain communication mediums.

Subsequently, upon receiving the initial responses to the survey questionnaire, the absence of human aspect to the research became apparent as the questionnaire did not allow for individual thoughts and opinions. Therefore, a qualitative approach was taken to further this report by means of interviews, in order to ascertain the psychological / human aspect side of communications of teams.

Interview questionnaire

From the use of secondary data, data which is not collected by the user of the research but by another group or person for another purpose, but may relate to the purpose of such another research and provide validity of existing trends related to the research topic being undertaken (Boslaugh, 2007), a further questionnaire with more substantiated questions was derived. Interviews with project managers was conducted to develop a deeper

understanding of current communications methods and reasoning, and effectiveness of such communications.

Qualitative research is considered to be subjective. The methods of collecting information involves mainly in-depth interviews with individuals of a particular focus group. Since the nature of this type of research is biased, exploratory and open-ended; small numbers of people are interviewed and/or a relatively small number of focus groups are conducted.

The quality of the findings from qualitative research is subject to interpretation of raw data, therefore it is dependent on the interviewer's ability to evaluate responses and ascertain key trends. This type of research is extremely effective in acquiring information about peoples' communications needs and their responses to, and views about specific communications. It is often the method of choice in instances where quantitative measurement is not required.

Secondary data was used in order to derive the interview questionnaire which was conducted with 15 project managers to develop a deeper understanding of current communications methods, and the reasoning and effectiveness of such communications. This was conducted over two months in addition to the initial survey questionnaire.

Interview Data analysis

A qualitative analysis was used to analyse the data collected and the data was grouped under the following headings interpersonal, technological, leadership and cultural; and brought together through goals, dependencies and common trends, and how these trends correlate with the literature review of functional / dysfunctional teams.

The quantitative aspect to research is to be taken with participants from target organisations, through interviews, based upon experience with regards to communication methods/mediums used in projects, from inception through to final completion of the project; the management expectations and experience, frequency of communication. By linking the various data and interviews, it answered the research question and achieve the research objectives set out.

Research setting

The study was conducted around the South African construction industry, particularly those professionals who work offsite away from direct contact with other team members. These professionals include engineers, architects, managers and construction managers as they all play an important role in any construction project team.

The study population and sample

The sample size was in the range of 70-100 participants from various design and construction companies involved in the construction industry. For this research, the chosen organisations were companies with more than 50 employees but not limited to years of experience in the construction industry. The reason for this was to gain insight on problems encountered by professionals with varying years of experience. The majority of the projects that the individuals were involved in were of a commercial nature as these proved to be more complex and more likely to encompass skills of significantly different individuals, although the research was not prejudiced to smaller projects.

Data Analysis

Secondary data analysis which was used is to compare the results found of those internationally, and compared to those found within the South African construction industry. In this way, it will reaffirm the hindrances and problems experienced in the context of South Africa.

Reliability

Reliability is seen as the degree of consistency with which an instrument measures the attribute it is designed to measure. The questionnaires which were answered by participant's revealed consistency in responses. Reliability can also be measured by minimising sources of measurement error like data collector bias. Data collector bias was minimised by the researcher being the only one to administer the questionnaire, and standardising conditions such as exhibiting similar personal attributes to all respondents.

Validity

The validity of an instrument is the degree to which an instrument measures what it is intended to measure. All the questions found in the questionnaire were based on

information gathered during the literature review, to ensure that they were representative of existing trends in organisations and structures. The questions were formulated in simple language for clarity and ease of understanding. Clear instructions were given to the respondents to prevent any confusion that may arise. The questionnaires were not completed in front of the researcher. For validation, the questionnaire was submitted to the ethics committee at the University of the Witwatersrand.

Ethical Considerations

The conducting of research requires not only expertise and diligence, but also honesty and integrity. This is done to recognise and protect the rights of human subjects. To render the study ethical, the rights to self-determination, anonymity, confidentiality and informed consent were observed.

The participants were informed about the purpose of the study, the procedures that would be used to collect the data, and assured that there would be no potential risks or costs involved. They were also informed of their rights to voluntarily consent to decline or participate, and to withdraw participation at any time without penalty.

CHAPTER 3: RESEARCH RESULTS AND DISCUSSION

This chapter presents data analysis and findings from the survey. It begins with the descriptive analysis of the demographics of respondents by their age and frequency of communication medium usage. This is followed by the analysis of the organisations' ICT infrastructure platforms, and current levels of ICT usage. Finally, the section discusses results taken from the secondary questionnaire, which was conducted via interviews and delves into the qualitative aspect of communication. The data collected from the questionnaires were tabulated and analysed according to the objective set out in this report. Bar and pie charts were created to illustrate the research findings, in support of the descriptive analysis to clarify their status. These ratings were confirmed through interviews conducted as part of the second part of the research.

Results 1: Questionaire

A breakdown of the findings from the questionnaire survey indicates the following:-

Lines of communication:

Communication flow exists from an autocratic "top down" dissemination indicating traditional style of organisational managerial disposition (Figure 19). Although information is distributed accordingly, bottlenecks are evident during the distribution resulting in delays to relevant individuals concerned. The coordination and sharing of knowledge indicates that information is generally available. The amount of information distribution being distributed from top managers is more than double than from middle managers. Perhaps as result of middle managers more involved with workers than with the sharing of information. General information sharing is more frequent amongst co-workers than through general meetings.

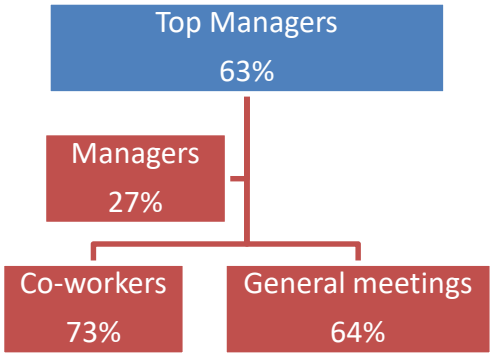

Figure 19: Communication flow chart

The frequency of communication amongst co-workers is substantially higher than through informal channels and from other departments (Figure 20). Results indicate that critical information is not withheld from relevant parties, preventing them from achieving their objectives. The majority of respondents (managers 27%; co-workers 73%) are comfortable sharing ideas with their top managers and managers respectively, however there is a disparity in their response with regards to “open” lines as the majority (55%) answered that information was not conveyed accurately to the top executives (Figure 21).

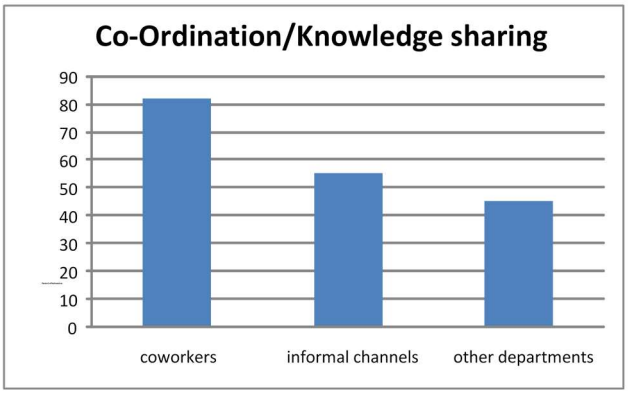

Figure 20: Coordination / knowledge sharing within an organisation

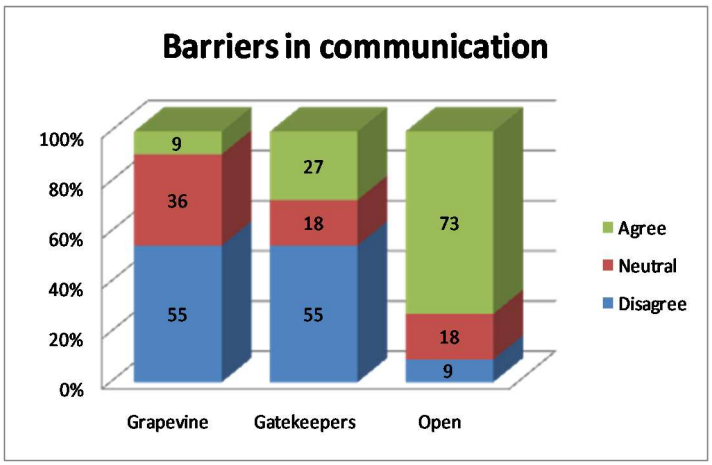

Figure 21: Barriers in lines of communication

Similarly to the findings of this report, Lee-Kelley (2008) also identified email as the main source of information diffusion. This form of communication has proven to be the most common yet stable source of information distribution in many organisations.

There is strong evidence suggesting that lines of communication are open and information and ideas are freely exchanged. There is no indication of information sharing bottlenecks occurring in the workplace.

Barriers to effective communication amongst teams indicate that although information is distributed, the restraining factor hampering effective communication is the hierarchical management level. This is seen to have created the impression of levels of importance of teammates. Results indicate that information which is vital in effective collaboration is used to enhance one's personal worth in an organisation, which may have an adverse effect on team collaboration.

Effectiveness of general meetings (Figure 22):

A) Only 46% agree that general departmental meetings are effective. This still suggests that more than half the respondents feel that meetings were not productive.
B) In the interdepartmental meeting, 46% of the respondents found that the meeting did not pertain directly to what was needed for the individual to complete his/her objective. This is because inter-departmental meeting issues are not generally involved with individual performance as much as departmental meetings.

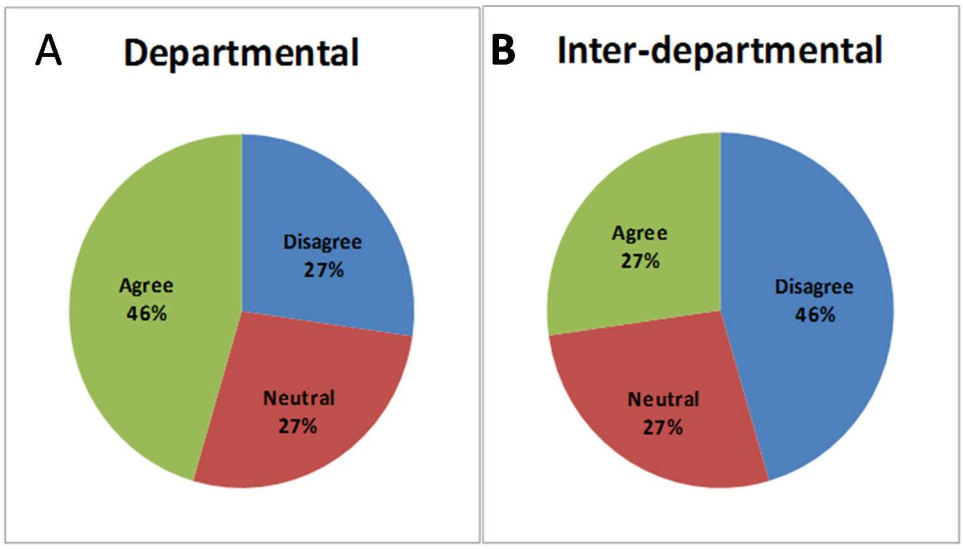

Figure 22: Relevance of general meetings within departments (A) and inter-departments (B)

A large percentage (64%) agreed that accurate and reliable information is passed down from the different hierarchies (top > manager > co-workers > departmental).

Effectiveness of communication and information reliability which is important for teams to operate effectively is seen to be predominantly accurate, although there is evidence of incorrect sourcing of information or inaccurate information being used. These were not seen to be intentional, rather instead by mistake.

Timeliness is the time in which information is distributed. The surveys indicate that information is sent in a timeous manner, although there are instances where information may not reach relevant individuals on time, which may result in delays or inaccurate deliverables.

Media effectiveness (Figure 23) is the frequency and reliability of the information being distributed through various mediums.

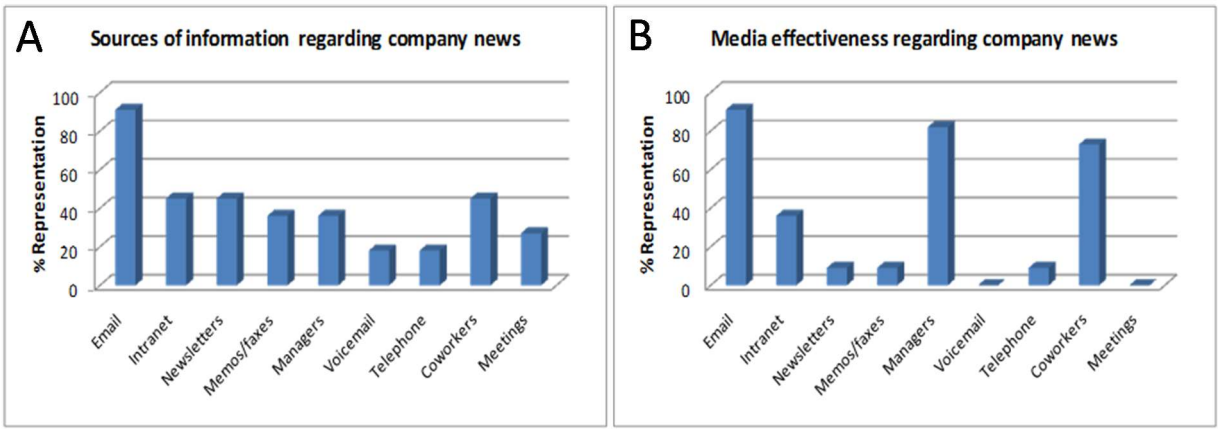

Figure 23: Media use (A) and effectiveness (B) with regards to dissemination of company news

In Figure 24, although much information has been shown to be distributed on a daily basis, evidence show that email is the most frequently used medium form. Telephonic communication is being used frequently; however it is proven to be ineffective. This may be a result of the fact that there are no paper trails in the event that a task or object has been forgotten about. Company intranets are also proving to be ineffective, as users do not frequently utilise company frameworks.

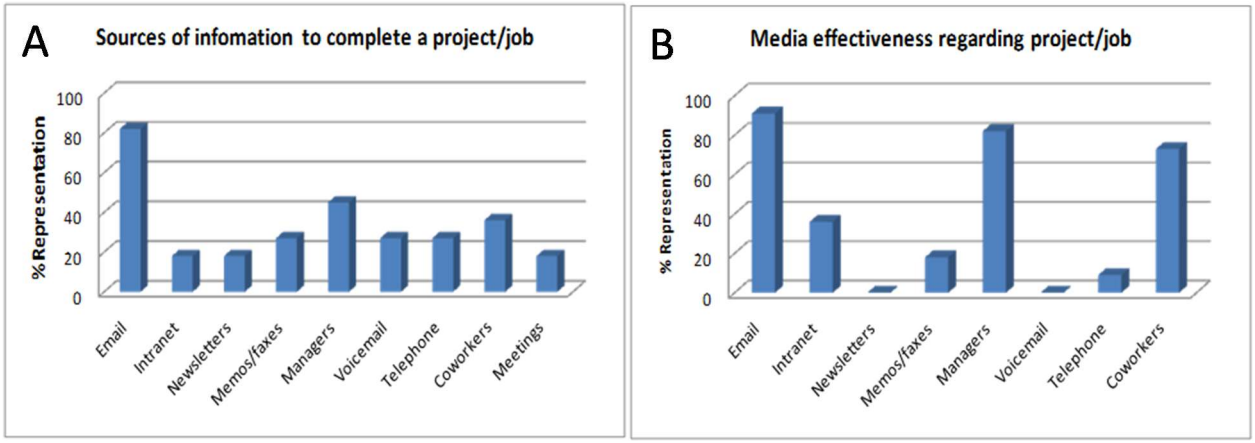

Figure 24: Media use (A) and effectiveness (B) for job completion

Of the different mediums used (Figure 24) for information distribution and its effectiveness, the three most prominent sources and its effectiveness are shown to be email, manager's information dissemination and co-workers. Evidence of communication as well as direct presence lessens the possibility of miscommunication as unclear information may be clarified immediately.

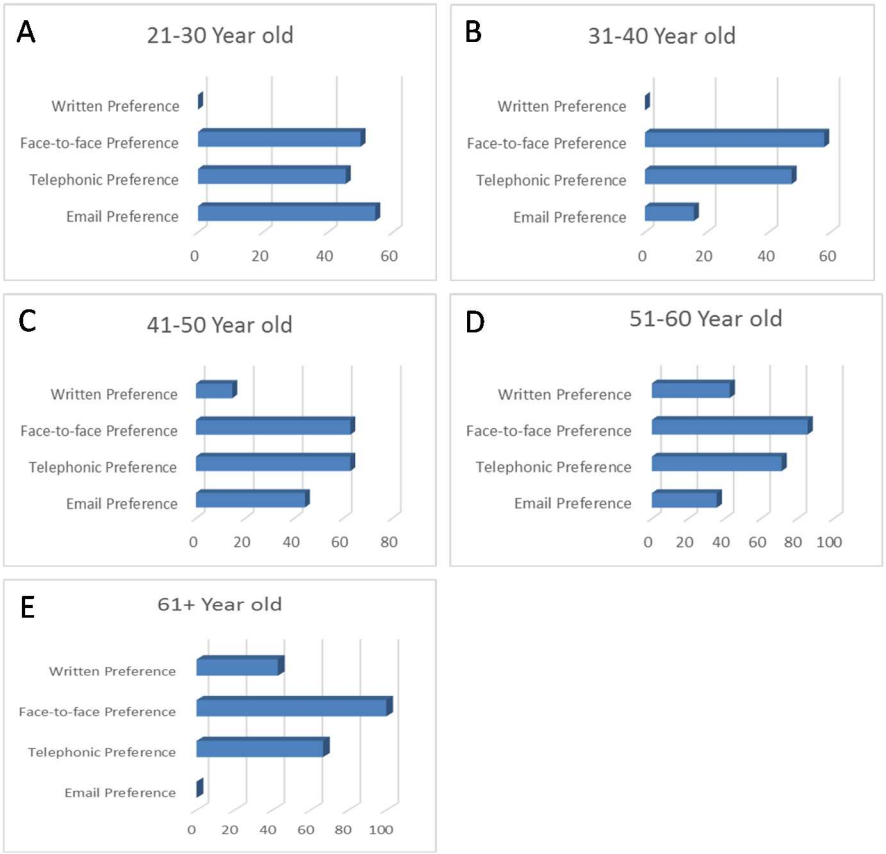

Figure 25: Communication preference in the workplace over different age groups A) twenty year olds, B) thirty year olds, C) forty year olds, D) fifty year olds and E) sixty year olds.

Discussion – Questionaire

The results indicate a strong preference to the use of email over other mediums. This was further confirmed through interviews of project managers after the initial questionnaire survey was received and analysed.

It was noted that teams were not hierarchical tiered as stated by Vloebergh (2003), instead, team members were seen to be equally important on a project. Although project teams did exhibit forms of hierarchical formality through communications particularly those within similar disciplines.

Adopter Categories

Based on the results from both the questionnaire and interviews (85 questionaire respondents and 15 interviewees) in Figure 26, one can see a strong correlation of ICT usage between the research and Rogers's initial experiment. Respondents found to coincide with Rogers' five categories: Innovators (3%) with 0-5 years of experience; early adopters (17%) with 6 to 15 years of experience; early majority adopters (31%) with 16 to 25 years of experience; late majority adopters (41%) with 26 to 35 years of experience; and laggards (9%) with 36+year of experience.

AGE	FREQUENCY-	PERCENTAGE (%)	CUMMULATIVE PERCENTAGE
21-25	9	11	11
26-30	13	15	26
31-35	12	14	40
36-40	7	8	48
41-45	14	16	64
46-50	13	15	79
51-55	7	8	87
56-60	7	8	95
61-65	3	5	100
66-70	0	0	100

Figure 26: Age of respondents of questionnaire and interviews

In Figure 27, a direct comparison of the various users in the use of main communication mediums indicates that the younger generation, twenty year olds, relies more heavily upon ICT than the older generation. If one considers the innovation adoption categories diffusion theory versus the use of use of new technology based upon age, there is a direct correlation between the two which supports Rogers (1962) Theory of Diffusion.

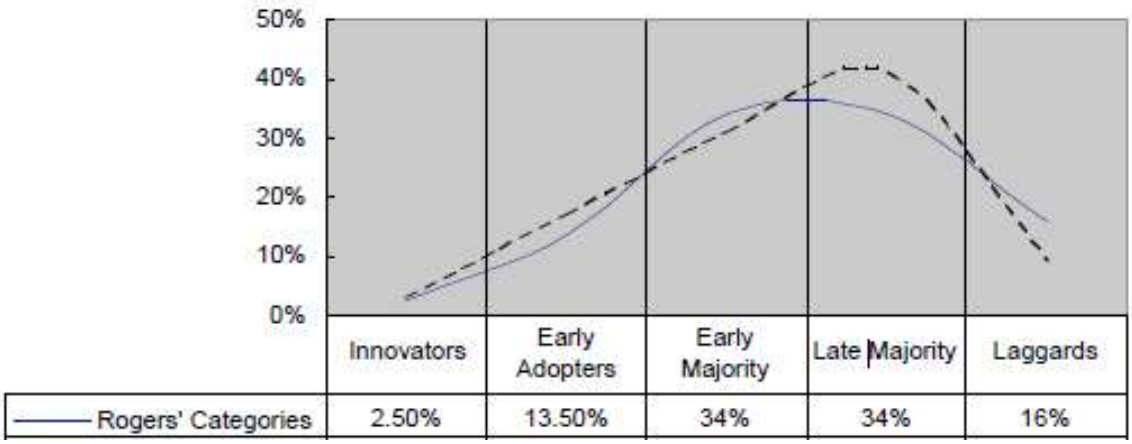

Figure 27: Rogers' Diffusion theory compared to sample

Mass Communication Channels

The communication channels that exist within organisations was predominantly found to be email; intranet; newsletters; memo/faxes; managers; voicemail; telephonic; co-workers and meetings. Managers, meeting and co-workers are also favourable means of information distribution.

Media is only effective by the following reasons:

- The accountability rests on the person responsible for the correct dissemination of information.
- Frequent meeting and recordings of minutes are followed up, and appropriate actions from the relevant person are required. This is effective as all relevant stakeholders are present and all parties are operating at the same level.
- Information is quickly circulated among co-workers although accuracy of information is questioned, as the basis is hearsay.

The survey revealed (Figure 28) that of the communication channels that exist within organisations, electronic communication (email) is the most frequently used form of communication and the most effective for every day means. This is due to the fact that information can be stored electronically without all the clutter, which comes with large filing systems. Requests and tasks can be set up, followed up, and information can be searched for quickly.

Similar findings by Faniculli (2006), found that brainstorming as well as the quality of a product through use of virtual communication tools proved to be less effective than face-to-face contact.

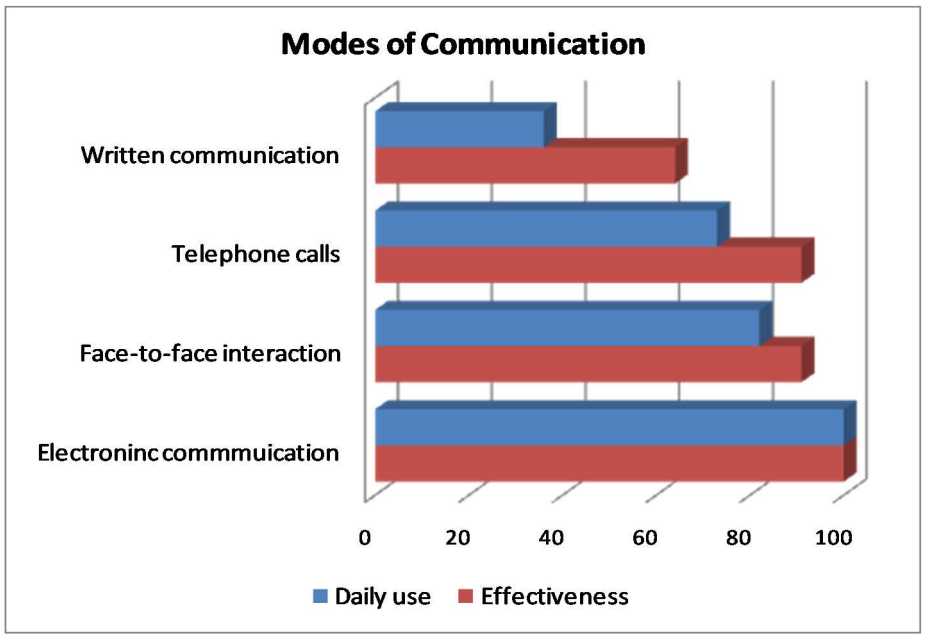

Figure 28: Frequency (%) of various modes of communication and their effectiveness

Face-to-face communication is also favoured considerably, as impromptu requests and small discussions or issues can be dealt with, without the need for sending formal emails. Although the drawback would be that smaller matters may be forgotten. There is also a potential for a biased conflict between two parties during face-to-face interaction.

Telephone calls are used less than face-to-face interaction, particularly in the absence of a person's presence, when small requests of matters are to be addressed or discussed. It is seen to be as effective as direct interaction. This has the ability of being enhanced through the use of video conferencing where multiple parties are able to converse visually and via audio from different locations.

Written communication is the least favoured means of communication. This may be because a physical copy which needs to be sent to a recipient may get lost in the process. This may also be seen as tedious and a waste of time, however, it is invaluable for record keeping.

It is preferable to appoint someone with experienced leadership, as well as a careful selection of team members who would work well together. Virtual team members would need self-discipline and self-motivation to be capable of working alone in solitude without external help. Since virtual teams rely heavily on clear and concise communication in order to be effective, all team members demonstrate good communication skills.

Upon interviewing key respondents, it was found that 12 out of the 15 respondents favoured face-to-face communication over electronic communication. It must be noted that the respondents were not virtual team members, but utilised technology as a communication tool. Meetings were in fact essential in the initial uptake of a project and during the implementation stage. Meetings became less critical near the end of a project.

Clear communication needs to be established with performance standards being emphasised, whilst ensuring that all team members are clear on the company's goals. All team members should be encouraged to participate in all discussions, feel valued as an essential part of the team and respected for their opinions.

Technology

Various responses from interviewees displayed an array of mixed feelings regarding the use of new software packages. Much of the younger respondents displayed a higher interest in up skilling in software packages whereas the older participants displayed less interest in up skilling themselves in new software. This supports the theory set out by Rogers' (1962) where the much of the innovators are in the late 20's/early 30's.

The main difference between the more experienced and younger generations is in the attitude towards the use of technology. Employees with more experience do not resist the increasing use of technology but they do not always prefer this method. More of the older generation consider face to face collaboration to be more effective than through the use of telephone and emails.

What was observed during the interviews was that none of respondents viewed 'technology' as a direct fault on communication issues. Instead, it was an enabler for blame for the individual shortfalls there it be physical or psychological reasons.

The younger less experienced construction employees appear to embrace ICT. This reflects their confidence and the cultural shift away from face-to-face working medium. Similar finding by Rimmington (2015), in UK, the construction industry mode of communication has shifted significantly from face-face communication in favour of electronic media correspondence.

Efficiency

Communication efficiency is seen to rest mainly upon the both parties (the sender and receiver). As noted by Rimmington (2015), “effective communication among team members and support units across organisational lines, good team spirit, mutual trust and respect, low interpersonal conflict promote in person communication yet the development, adoption and use of ICT does not guarantee these ideals occur or will be successful or that group performance will be more robust.”

From both the questionnaire and interviews, it was noted that ICT is more accessible improving the response rate and the communication efficiency. However, when issues arise within a project, project teams fall back into face-to-face communication i.e. the interactive in person collaborative approach. The findings from the interviews revealed that face to face communication is still preferred by many to be the most effective way of communicating. Electronic information is seen to be the most convenient as it allows for easier accessibility from any location at any time. However, it is also used as a method for shifting accountability.

As discussed in the literature review chapter, trust is extremely important in achieving successful collaboration. However, good communication is required in order for trust to be established. According to Burke *et al*., (2007), the key components of trust are a willingness to open oneself to others, positive expectations that interests will be protected and promoted with no need for monitoring, and positive belief in others' intentions, sincerity, motivations, character, reliability, and integrity. The literature further indicates that the willingness to accept vulnerability evolves over the course of a relationship through repeated interactions and a history of reciprocity. Therefore, for the purposes of the current effort, trust is defined as “a psychological state comprising of the intention to accept vulnerability based upon positive expectations of the intentions or behaviours of another”.

The willingness to accept vulnerability evolves over the course of a relationship due to repeated interactions and a history of reciprocity (Ceric, 2015).

As can be seen in the results, communication occurs more openly and frequently amongst colleagues and laterally among team members on projects whether intra-firm or inter-firm. Figure 29 from the survey, demonstrates the age groups within an organisation and their preferred modes of communication.

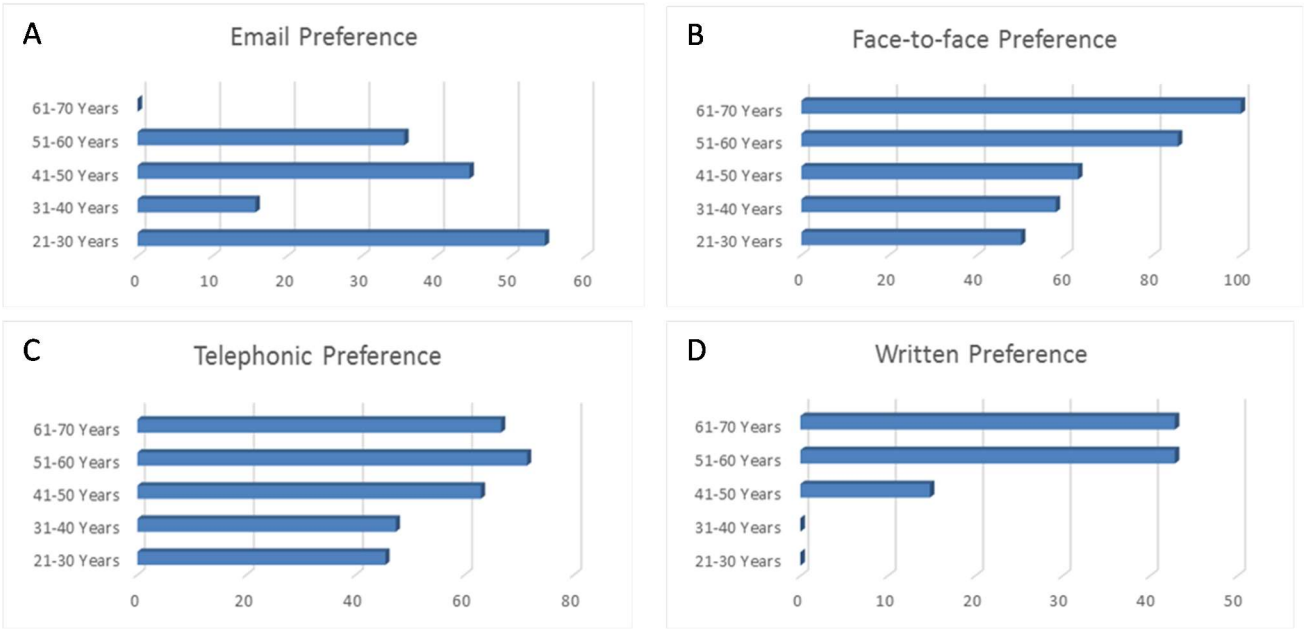

Figure 29: Various age groups within an organisation and their preferred modes of communication (A) email, (B) face-to-face, (C) telephonic and (D) written

These generational classes have a preference mode of communication which is characteristic of the period in which they were brought up, and their values which influence their way of working and communication skills.

The cross correlation of frequency of communication with the associated workplace generations, corresponds with Rogers' diffusional theory. It has also been observed that verbal communication is favoured over written communication, most likely as it's faster to speak rather than write out. As anticipated, the older generation prefer physical hard copies to electronic softcopies.

The four different types of generational types found in the workplace, Figure 30, shows the difference in preferred communications mediums. This is strongly influenced by both technology and social. There is noticeable transition from a physical formal memo way of communicating to the digital format through email and voice mail.

Workplace Characteristic	Veterans (1922-1945)	Baby Boomers (1946-1964)	Generation X (1965-1980)	Generation Y (1981-2000)
Work Ethic	Respect authority, Hard work, Age = seniority, Company first	Workaholics, desire quality, question authority	Eliminate the task, Self-reliant Want structure and direction, Skeptical	What's next, Multitasking, Tenacity, Entrepreneurial
Work is...	An obligation	An exciting adventure	A difficult challenge, A contract	A means to an end
Leadership Style	Directive, Command and control	Quality	Everyone is the same, Challenge others, Ask why	Remains to be seen
Communication	Formal Memo	In person	Direct, Immediate	Email, Voice mail
Rewards & Feedback	No news is good news Satisfaction in a job well done	Money, Title Recognition Give me something to put on the wall	Sorry to interrupt, but how am I doing? Freedom is the best reward	Whenever I want it, at the push of a button Meaningful work
Motivated By	Being respected	Being valued and needed	Freedom and removal of rules	Working with other bright people
Work/Life Balance	Keep them separate	No balance "Live to work"	Balance "Work to live"	Balance – it's 5pm – I've got another gig
Technology is...	Hoover dam	The microwave	What you can hold in your hand: PDA, cell	Ethereal - intangible

Figure 30: Workplace generational habits
https://www.fdu.edu/newspubs/magazine/05ws/generations.htm 2005. Author: Greg Hammil

The research process began by considering to what extent has communication affected construction organisations today relative to how it was utilised a number of years ago. This lead the author to question not only the number of occurrences of ICT usage in organisations, but to consider the human side to communication barriers.

Results 2: Interviews

The findings from the interviews revealed the following trends which occurred more than once from the interviewees. These have been categorised according to the various categories of barriers to effective communication. These trends highlight key points which plague the South African construction industry.

Responses from interviewees (Figure 31) are collated according to the four primary categories of functional/dysfunctional teams. Some responses may be considered to fall into two possible categories. In these few exceptions, the responses were in what the author thought would be the more appropriate category. This eliminates the possibility of conflicting opinions.

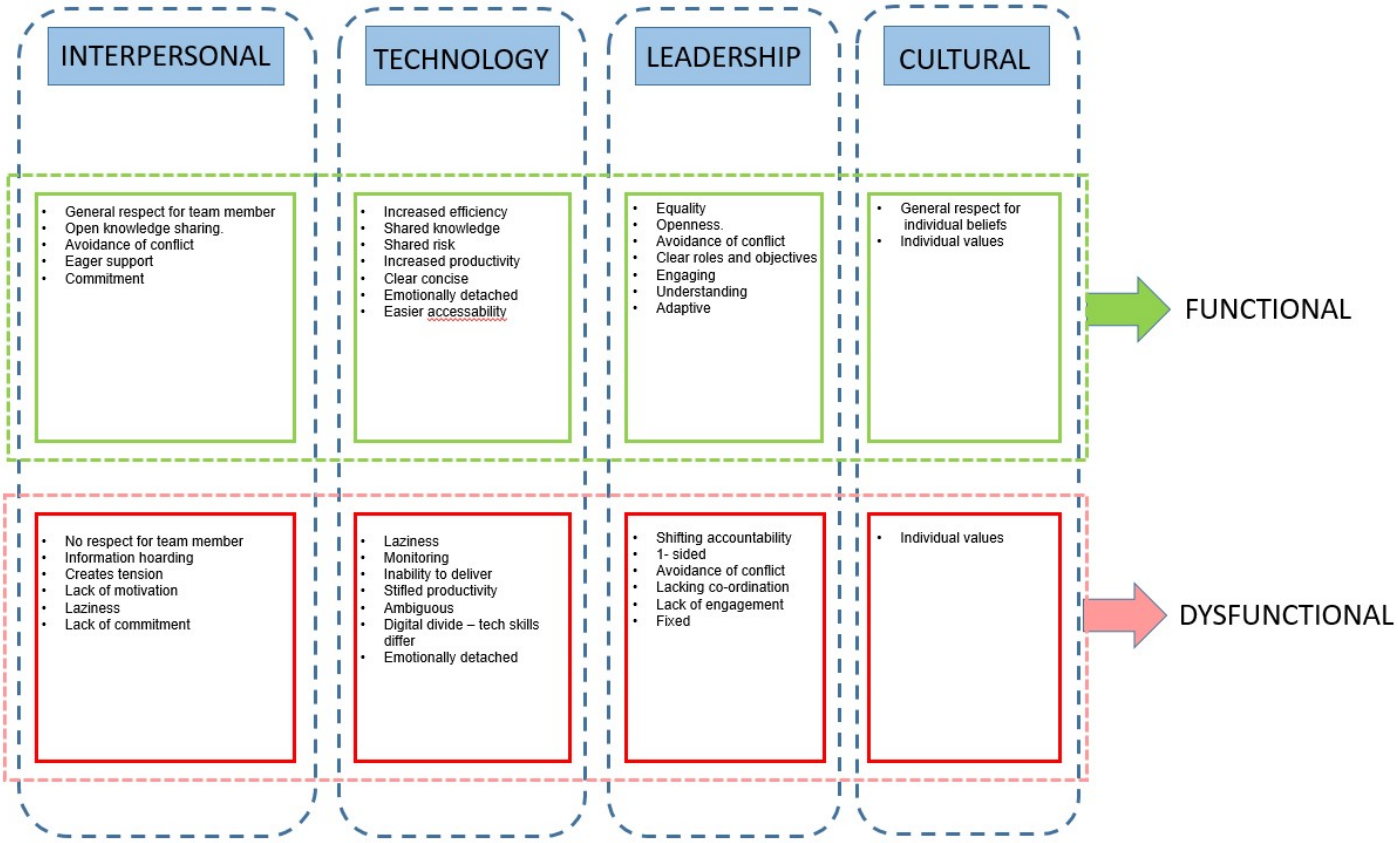

Figure 31: Trends in individual perspectives among interviewees

Discussion – Interviews

There were a number of positive points highlighted by the interview respondents (Figure 32). These points were similar to those in indicators by Oestreich's effective team survey. No ideal team scenario was concluded as there were some hindrances in communication each of the interviewee's experience.

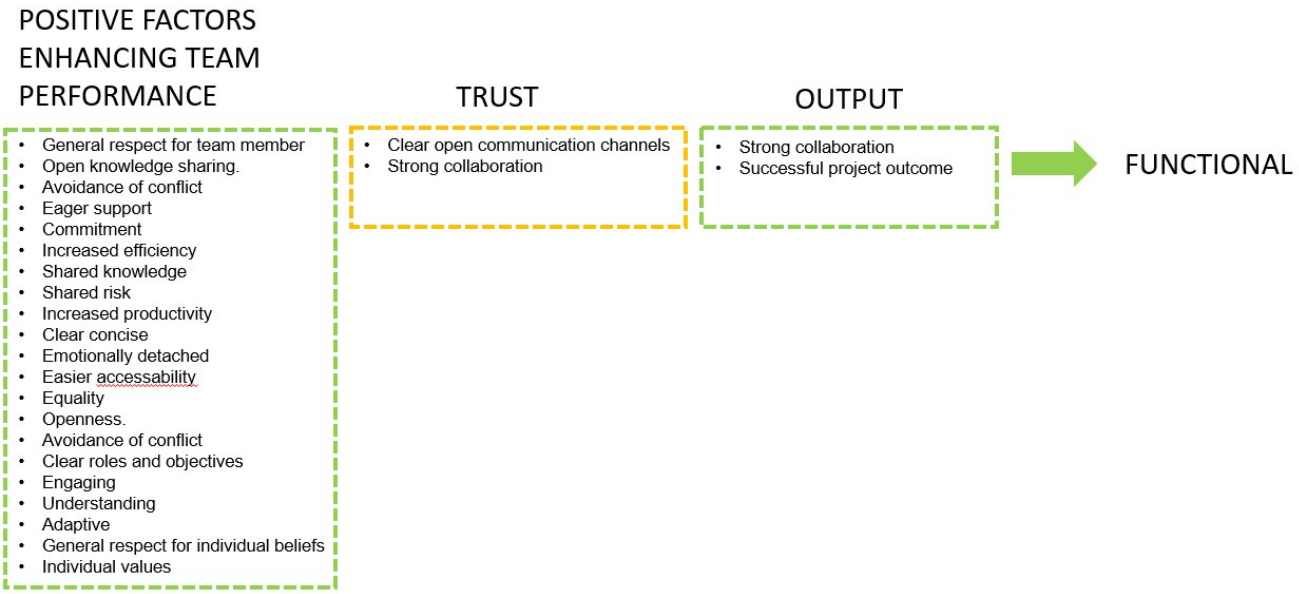

Figure 32: Positive functional team attributes extrapolated from interviews.

Where one notices a close correlation between the trends, which surface through the interviews, with those factors found in both Prusack's Trust model, and how those comments experienced by project managers about their experiences with communications amongst other professionals.

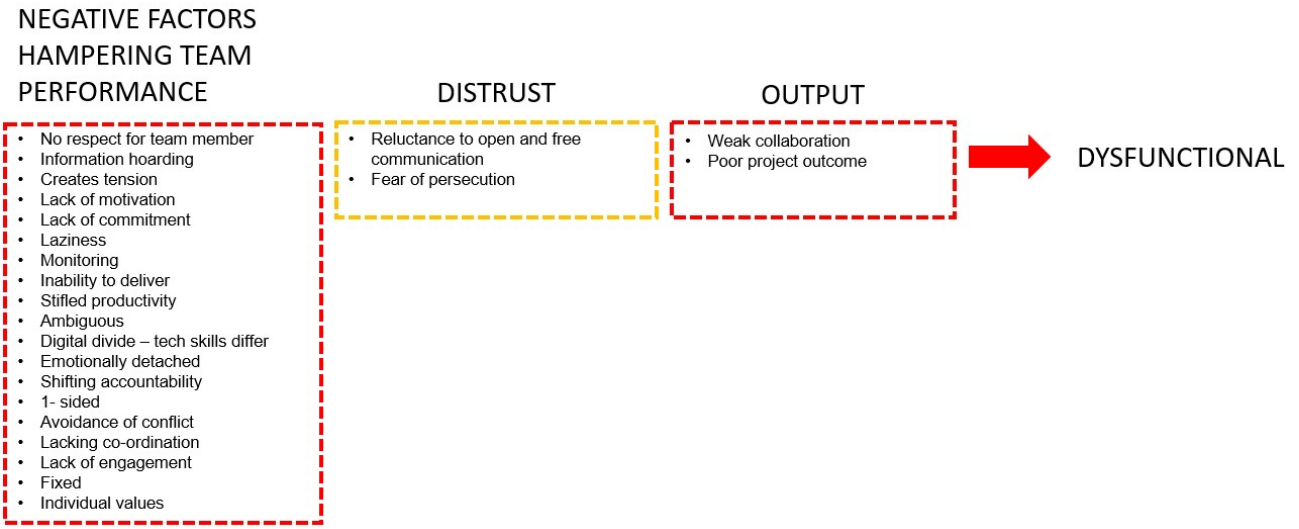

Figure 33: Negative dysfunctional team attributes extrapolated from interviews.

However, there have also been factors which have been noted to have the opposite effect (Figure 33). Both lists of negative/positive factors fall into 1 of the 14 characteristics of trust as discussed earlier by Smith (2012).

When compared these results with those test rankings of Oestreich, there a distinct relation between the negative and positive factors which came out from the interviews with those of Oestreich ranking system. The positive aspects/opinions given by the interviewees regarding their relationship with other team members correlated with those points indicated by Oestreich of high functioning and ideal teams. Similarly, the negative aspects/opinions given by the interviewees also show similar characteristics to those low-functioning teams. It must be noted that the findings are a general overall recollection of individual perceptions of communications, which exist in their respective teams and these findings are not of particular teams, rather instead they are general comments on the issue of communication in teams

Virtual teams (Figure 34) exhibit some challenges, similar to those discussed with interviewees, although not all challenges found in virtual teams can be compared to the findings of the research.

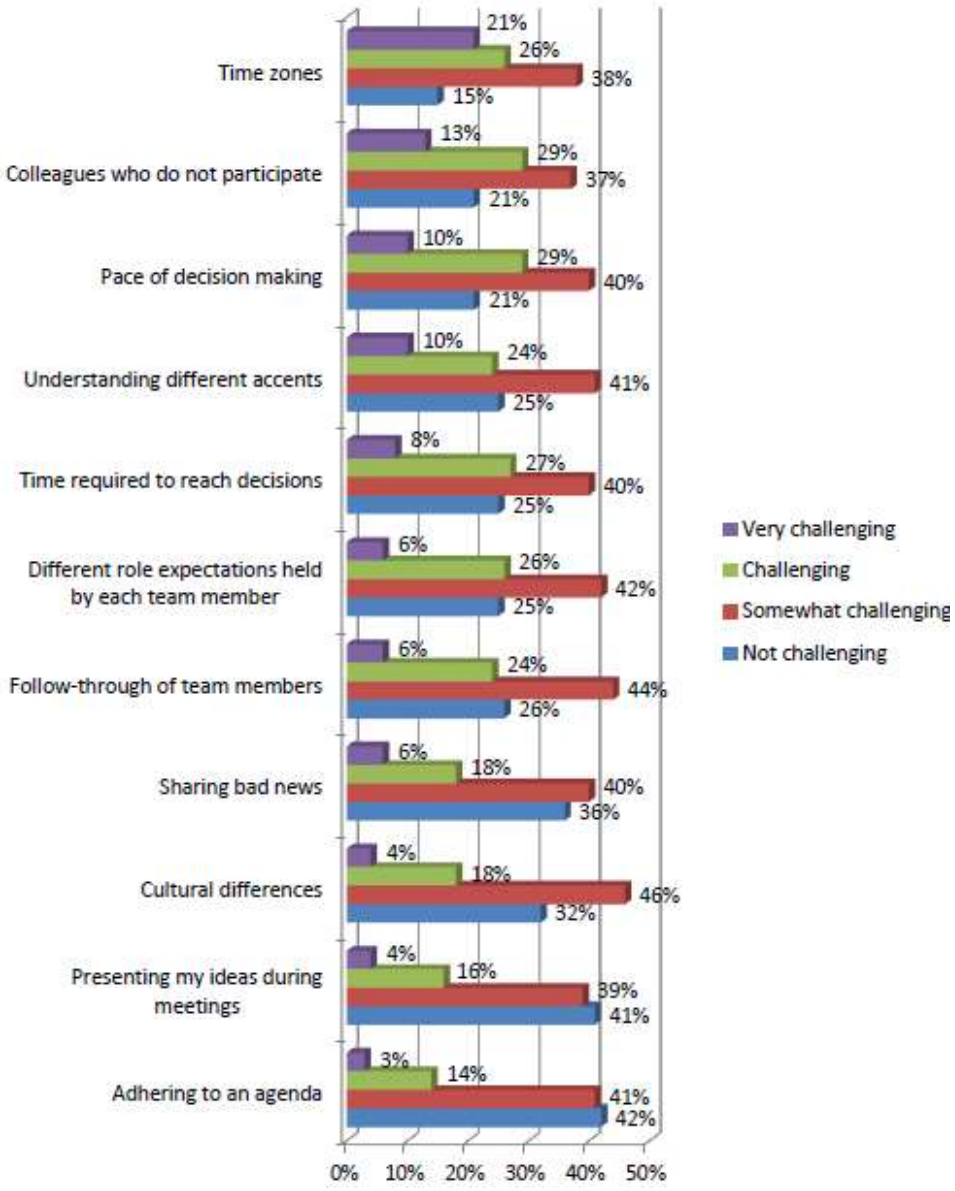

Figure 34: Challenges encountered by virtual teams (RW3 Cultural Wizard, 2016:19)

Langfred (2007) shows the following.

High/positive trust level teams have exhibited some of the following phenomena:

- Team members are more open with each other and lines of communications are easier on a professional and a personal level. Individual performance and interpersonal relationships in team meetings are addressed openly with constructive discussion, so as to resolve issues that may occur. Such issues can include large unintentional errors, ethics, or other possible serious issues within the group.
- Members are more inclined to discuss their personal challenges from other team members, if they feel valued. The result of such open communication is the increased potential in the individual and the whole team where they are not limited

by the expectations of their designated roles. In this way, the team is allowed it 'lead' itself without the need of an actual leader.

Ultimately, high performing, strong communicating teams are able to coordinate themselves and their roles and duties effectively, in order to meet their objectives as defined by themselves. Although they may still prefer to work in their own manner and ways, ideally, they strive for win/win solutions benefitting both the team and the client.

Low/negative trust level teams have exhibited some of the following phenomena:

- Team member are more critical of one another and as a result, people tend to be more closed and cautious in teams meetings and we see the formation of small alliances and cliques. When problems arise, instead of trying to establish and win-win situation, members compete with one another to be right and to protect their interests, and are concerned with other member's hidden agendas.
- Decisions take longer to be resolved, are contested, or are criticised by other meetings.
- People tend to be more critique of each other's does not have or does not do than on their positive abilities.
- Team leaders are necessary in order to guide the unit although this may also create tension in authority.

Thus, poor performing, weak communicating teams display more aggression and hostility towards one another, more often as a result of personal values, self-worth and authoritative reasons. As a result of this we see a strong breakdown in open communication.

General/ average trust level teams have exhibited some of the following phenomena:

- Members get along with one another with reasonable respect. They maintain positive professional decorum and stay focused on the task at hand. Individual interests and development are issues that are sensitive and thus avoided, although it is encouraged to be open to other members.
- Problems are usually handled quickly and fair to avoid much awkwardness.
- Clear roles and accountabilities and teamwork is expected for the team to perform adequately and respect the need to do their individual part to the best of their ability.

A responsible leader is usually nominated and guides the team while making most critical decisions in order for the team to efficiently accomplish its goals and projects.

- Members generally offer respect and recognition to each other, especially those who are considered highly competent due to their experience and skills.

Findings by Thamhain (2013) found that similar factors as mentioned above, which both hamper and enhance team performance was exhibited by individuals as a result of their individual performance. This has a strong effect on the performance of a team as well as across intra-organisational and inter-organisational lines.

It was the view of the respondents that these factors which are borne from individual's performances, values and attitudes. However, Wu (2006) argues that the development, adoption and use of ICT does not ensure better communication amongst team members and stronger collaboration.

One can argue that all positive factors (Figure 32) induce trust, and that would result in strong collaboration and optimal function team. Likewise, negative factors (Figure 33) would result in dysfunctional team operation. However, Belbin (1999) sees the potential of individuality of each member within the team, and finding the balance of these different traits and abilities and skills so as to make the team more effective. Utilising two of Smith's (2012) characteristics of trust, i.e. 'Trust is dynamic' and 'too much trust can be as bad as too little trust' as the basis for this argument, where if there are too many positive factors within a team, it creates a false sense of security and much ease and the simplest solution may not be the best solution on a problem. Once needs some negative characteristics/factors to create some tension and in this way the team may become more dynamic.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATION

The research thus far has presented the background and review of the current state of affairs regarding communication within the South African construction industry and theoretical framework for the study aim and objectives. For the research methodology, a survey questionnaire was designed and distributed to those within the construction industry to identify current modes of communication or ICT, areas of communication success/failure and future preferences. Data from the questionnaire was then analysed and discussed.

At the end of the empirical study, the following was looked at:-
The ICT infrastructure level in various organisations, the degree of ICT usage, and a set of defining barriers which hinder the use of ICT as well as observing the viewpoints of various professionals involved in the construction industry. The research came out with key findings, some of which addressed the main aim and objectives.

The intention of this research was to identify the factors hindering the effective use of ICT by teams in the South Africa construction industry.

Summary of the research findings

Many organisations are striving to be globally competitive and have invested time and resources into the improved team efficiency and improved collaboration, through effective communication. Due to its specific characteristics, the construction industry, being fractured and dynamic, forms a complex communication environment where all operations are project based.
As such, many stakeholders prefer to engage with professionals and their services through the use of contracts. This culture demonstrates the issues of conflicts in the industry and lack of mutual respect and trust (Hoezen, 2006).

The use of ICT in the workplace (Figure 35) occurs on a daily basis, whether on computers, through email or mobile devices, through messaging services. There is a growing requirement in organisations to move away from face-to-face communication and more towards virtual communication, thus also allowing the efficiency of productivity to be monitored. The advantage of transferring information electronically allows for tracking of information, however, prioritising what is more important is difficult. Other issues related to

successful information transfer is decoding (whether the recipient understands the message fully or not), which affects the response (reaction) to that message. Information overload as a result of too much information being sent may result in misunderstandings and mistakes. This type of communication is preferred by the younger generation. Older more traditional workforce prefer face-to-face communication. The use of technology or the reliability on it varies according to the complexity of the project and information needed to be sent. The overuse and misuse of technology within the office environment may lead to miscommunication on a project, and there we see digression back to traditional face-to-face communication.

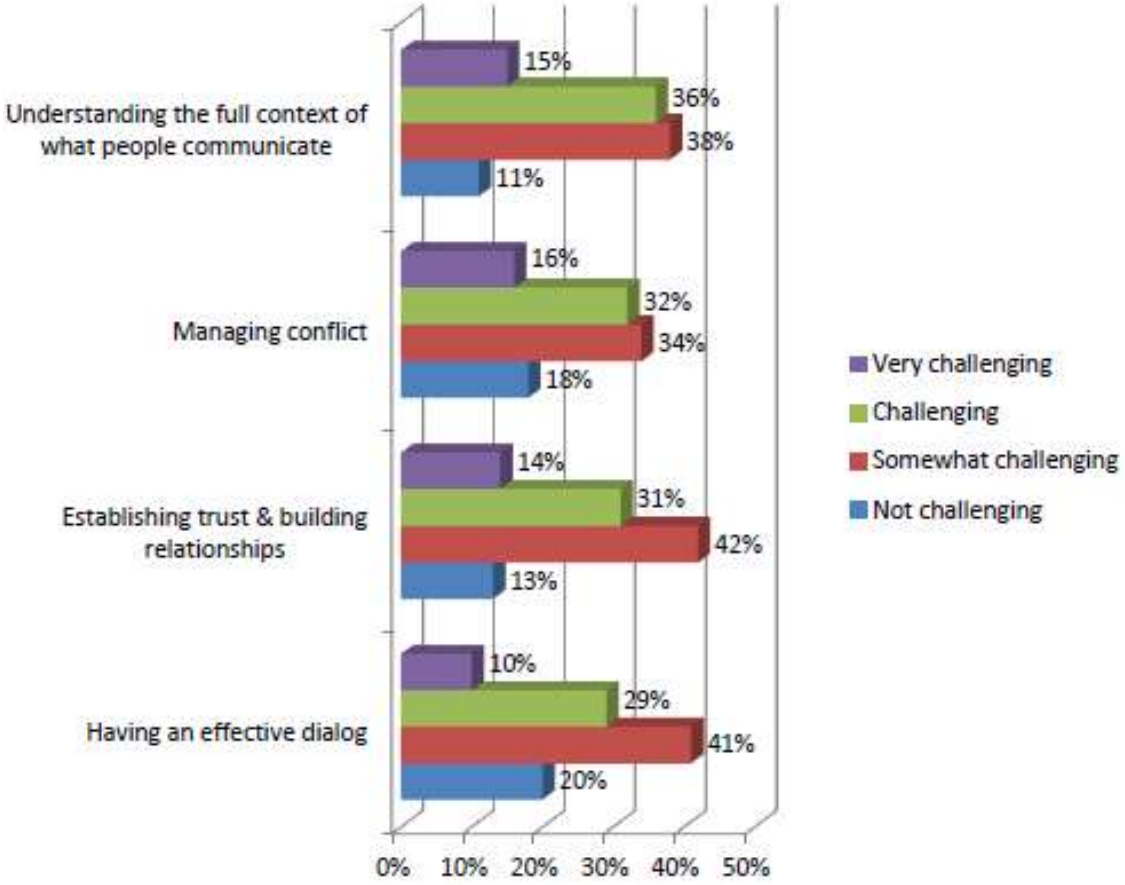

Figure 35: Lack of face-to-face contact affects productivity (source: 2016 virtual teams survey report, RW3 CultureWizard web: http://rw-3.com/)

In order for communication to be more successful in the South African construction industry, a number of issues need to be addressed. These include psychological (human) barriers, technological adaptation, as well as team dynamics, which play a crucial role in establishing trust and ultimately successful collaboration.

Communication flow is steady and reasonably accurate which indicates that barriers which may hinder effective communication lies not so much in the technology itself, nor the lack of investment into the program. The main barrier for the failure of communication is the user and its ability to use technology to communicate. Similar finding by Burlea (2007) supports this.

Individual/personal factors

Horwits (2006) described in his research that accountability and responsibility are found to be the main contributing factors to project commitment to the team's success and employee relations. Team dynamics, language and cross-cultural communication, conflict resolution and trust development and team cohesion are also key factors which affect the effectiveness of collaboration. Some respondents felt that some issues become more complex in a virtual environment. Part of this may be a result of technological skills, language and cultural variance. Some further cross-cultural differences found, include for example, that South African respondents felt that issues related to operating in virtual teams are relatively more complex. This may partly be attributed to lacking technology, but could also be result of factors like language differences or cultural diversity. Regarding conflict resolution, it has been noted that South Africans are least likely to compromise when disagreements arise based on historical antecedents.

Individuals who perform better themselves have a positive effect on a project's performance. Thamhain (2013) found that factors that influence these individuals positively, include, effective team communication, supportive units and low team conflicts and mutual trust. Although the above mentioned factors promote interpersonal communications, the advancement, assimilation and use of ICT may not always result in improved group performance nor successful teams (Wu *et al.,* 2005).

Social factors

A teams improved performance and communication integration is a product of teams having social interaction, rather than an autonomous relationship. Denning (2013) insists that communication should be more 'two-way street' focused rather than 'one-way direction focused. Any complex social network depends on the interaction of individuals within a workplace or environment, where direct physical interaction is preferred, as a show of trust and good faith, before interaction via electronic means takes place. Many employees felt

that this would help teams build trust quicker, however, this does not happen often in the workplace.

“The focus on the communication and collaboration for virtual interaction has been built on technological usage, with limited attention to importance of social relationships in teamwork” Chowdhury and Saleh, (2013). Lazaar and Preece, (2002) continues to emphasise that man is driven by social acceptance by society. Therefore it is natural to develop social strategies in order for acceptance by society. Egea *et al.,* (2006) extends this concept of social acceptance strategy for relationship building in virtual teamwork.

As stated earlier, it is important for employees or team members in any organisation or construction project to have some social skills to be able to build positive mutual relationships and networking while performing at their tasks. Maintaining social awareness while being able to adapt to technological advances in ICT and communication skills is crucial in order to survive in the ever changing project based environment. Many organisations strive to maintain an open policy and improved communications in their respective organisations through learning and sharing or information so that that organisations is successful and competitive Cascio (1995). In reality, it has been observed that most employees depend on job security and, through fear of job security, they work quietly in their work spaces and little interaction.

Excellence in Trust

Effective communication is dependent on developing trust amongst workers through the sharing of information, activity coordination; the use of various communication as well as team leadership skills Rahman (2012). Which in turn would lead to more successful collaboration.

Teamwork is the harmonious relationship of a group of individuals tasked to work together to complete an assigned task. It is a product of two important factors needed between two or more parties, trust and collaboration. Trust is a psychological factor, but collaboration is a social activity and may be affected through technology. As such, many organisations now look for better solutions to facilitate virtual collaboration Chowdhury and Saleh, (2013).

*"*Communication as a route to trust and collaborative working – effective communication is a prerequisite for effective working relationships founded on trust and mutual understanding. Collaborative and integrated working cannot occur, therefore, without the development of open channels of communication between all parties in the supply chain. Research is required to refine these channels and to establish the necessary conditions upon which successful communication can be founded."
Dainty (2006: 230)

Trust levels rely on human interactions with individual relationships and depend on the psychological aspect of team members. Teams, and organisations all have their own cultures based on shared assumptions about reality.

What facilitates trust?

An individual's self-awareness of their own mannerisms and in doing so, become responsible for their own actions and the effect that they may have on other people so that levels of trust begin to grow. When a person assists with another person's development, a 'relational field' of trust is formed as they share a sense of accomplishment for interpersonal change. An individual's personal improvement is dependent on that individuals' subconscious being, where that individual's desire for authenticity, self-knowledge, and personal meaning is kept. This means that high levels of trust cannot be forced. It is a choice by the individual not acting under duress. It is through the unselfish acts and opening oneself to others and reducing one's defensive behaviour to others that one begins form trust and a bond is developed with respect for each other forming, even on sensitive issues.

Trust is how and the degree to which people affirm other people or conversely, how they may undermine other people. Teams with high levels of trust show respect towards each other and positive recognition is given, which in turn, boosts the team's moral. It tells people, in one way or another, "I believe in you." When this type of recognition is unavailable, or when the focus is on people's problems and deficits, trust can go down quickly as members wonder what others think and how they are being perceived. However, when that recognition is absent or efforts are turned towards fault finding and undermining others, levels of trust quickly diminish. The result is low self-esteem, members wondering

how they are being perceived, shifting blame unto others, fault finding and ultimately poor performance by the individual and the team as a unit.

Conclusion

The South African construction industry relies heavily on the use of ICT, especially with the increase of globalisation of many companies. There are many factors to be considered in trying to achieve effective communications in construction projects. This is especially important in the context of South Africa with its cultural diversity. Similar finding by Lu (2005) on Chinese employees also suggests that general miscommunication, lack of trust, poor teamwork, poor individual work satisfaction and poor work performance has had an adverse effect on successful project execution. Construction project teams is not determined solely by the effective use of ICT. It is equally dependent upon the individual's psychological aspect; their relationship amongst other team members, as well as the willingness of that individual to embrace and adapt to technological change.

Recommendations

Construction project teams should be introduced from the initial stages of a project, in order to allow for the development of effective team communication. In this way, trust can be establish and developed by understanding how each team member thinks and works. Developing and encouraging interpersonal relationships, especially in the context of South Africa's diverse culture, should be considered as this will have an effect on the team dynamics and group development as an effective unit.

In any successful project teams, the appointment of a good project manager or team leader, with good soft skills, and an understanding of how people think, would be invaluable in guiding a team, as teams, generally, need guidance either as a push starter or and a reminder periodically. This would help in good teamwork and improved communications. Communications should not only be limited to the use of a single medium. Multiple medium platforms should be encouraged, depending on the situation. The use of communication tools/mediums, and the willingness of the user to adapt to new technology, should be emphasised and encouraged by all organisations.

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APPENDICES

Research Report Questionaire on Virtual Collaboration in South African Construction Industry

Please send responses to Clintonfok@gmail.com

DUE DATE 23-Sep

Communication is a vital process in every organization. People at work spend a great deal of time communicating with each other in meetings, over the phone, via e-mail, etc. Communicating effectively means being able to send a message across the organization that is easy to understand and accurate. When communication flows accurately and effectively, the organization will run smoothly. However, if there is a breakdown in the flow of communication, or the information is not accurate, the organization is likely to encounter performance problems. This survey aims to analyse employee opinions about the effectiveness of internal communication, communication flow, and preferences concerning communication media.

These survey results can be used to identify the strengths and weaknesses of your organization's communication network. The following is a brief description of the communication dimensions measured by the survey.

Communication Flow: Effectiveness of the communication flow in and around the organization (upward, downward, and horizontal)
Coordination/Knowledge Sharing: Extent to which important information is shared by employees, departments, etc
Communication Barriers: Aspects of the work environment that prevent the effective flow of communication
Accuracy: Shared information is detailed and accurate
Reliability: Shared information is reliable and consistent
Timeliness: Shared information is received in a timely manner
Media Effectiveness: Effectiveness of various media used to communicate important organizational news and day-to-day information
Interaction Frequency: Extent to which employees receive communications about various topics, and use particular media to communicate on a daily basis

Age:

Please select A= Agree, B=Neutral, C= Disagree or D= Not Applicable in the drop-down box

Communication Flow	
1 Most of the information I receive on a daily basis comes from my manager.	B
2 In this organization, my ideas are frequently passed onto top-management.	C
3 Most of the information I receive on a daily basis come from my colleagues.	
4 I feel comfortable sharing ideas directly with members of top-management.	
5 Most of the daily communication I receive comes in the form of "directives" from top-management.	
6 I feel comfortable sharing ideas with my manager.	
7 In this organization, the lines of communication are "open" all the way to top executives.	
8 This company frequently holds general meetings to pass along information.	
Coordination/Knowledge Sharing	
9 In this organization, important information is a scarce resource.	
10 In most situations, I receive the information I need to effectively perform my job.	
11 My colleagues and I readily share important information that is critical to our success.	
12 I receive most of the information I need through informal channels.	
13 My department readily shares important information with other departments.	
14 Other departments readily share important information with my department.	
15 The information shared by employees in other departments is often biased and reflects their own personal interests.	
16 Most of the group meetings I attend are informative and worthwhile.	
17 Most of the interdepartmental meetings I attend are useful for obtaining the information I need to do my job.	
Barriers to Effective Communication	
18 In order to share ideas/information with top-management I must go through my manager.	
19 In most departments, there tend to be one or two people that hoard important information.	
20 Top executives often seem hesitant to communicate news about the organization to lower level employees.	
21 In this organization, there appear to be cliques of individuals who control the flow of important information.	
22 Most of the information I receive on a daily basis is passed down through the "grapevine."	
23 There are too many "gatekeepers" in this organization that hinder the flow of important information.	
24 This organization appears committed to keeping the channels of communication "open."	
25 This organization encourages the sharing of information between departments.	
Effectiveness of Communication	
26 Most of the information I receive on a daily basis is detailed and accurate.	
27 Most of the information I receive from my manager is detailed and accurate.	
28 Most of the information I receive from my colleagues is detailed and accurate.	
29 Communication from other departments is typically detailed and accurate.	
30 Most of the information passed down from top-management is detailed and accurate.	
Reliability	
31 My colleagues and I rarely receive unreliable information from our manager.	
32 The directives that come from top-management are clear and consistent.	
33 Information from colleagues are consistant and reliable	
34 I feel comfortable passing along information that I receive from my manager to my colleagues.	
35 The information we receive from other departments is consistently reliable.	
Timeliness	
36 I receive the information I need to perform my job in a timely manner.	
37 I am often delayed in my job because I do not have the information I need.	
38 This organization releases company news in a timely manner.	
39 I usually hear company news months after the event has happened.	
40 It seems I am always the last to find out what is happening in this organization.	
Media Effectiveness	
41 I get most of my information about company news and events via email.	
42 I get most of my information about company news and events via the company intranet.	
43 I get most of my information about company news and events via company publications/newsletters.	

44 I get most of my information about company news and events via memos/faxes.	
45 I get most of my information about company news and events via my manager.	
46 I get most of my information about company news and events via voicemail.	
47 I get most of my information about company news and events via phone-in-hotlines.	
48 I get most of my information about company news and events via my colleagues.	
49 I get most of my information about company news and events via company-wide "town-hall" meetings.	
50 I get most of the day-to-day information I need to do my job via email.	
51 I get most of the day-to-day information I need to do my job via the company intranet.	
52 I get most of the day-to-day information I need to do my job via company publications/newsletters.	
53 I get most of the day-to-day information I need to do my job via memos/faxes.	
54 I get most of the day-to-day information I need to do my job via my manager.	
55 I get most of the day-to-day information I need to do my job via voicemail.	
56 I get most of the day-to-day information I need to do my job via phone-in-hotlines.	
57 I get most of the day-to-day information I need to do my job via my colleagues.	
58 I get most of the day-to-day information I need to do my job via general meetings.	
Using the following scale, please indicate how effective the following methods are for communicating company news.	
59 E-mail	
60 The company intranet	
61 Company publications/newsletters	
62 Memos/faxes	
63 Manager	
64 Voicemail	
65 Phone-in hotlines	
66 colleagues	
67 Company meetings	
Using the following scale, please indicate how effective the following methods are for communicating information you need on a daily basis to do your job.	
68 E-mail	
69 The company intranet	
70 Company publications/newsletters	
71 Memos/faxes	
72 Manager	
73 Voicemail	
74 Phone-in hotlines	
75 colleagues	
Please indicate how frequently you use the following methods of communications on a daily basis	
76 Face-to-face interraction	
77 Electronic communications	
78 Written communication	
79 Telephone calls	
Please indicate how important the following methods of communication are in helping you effectively do your job.	
80 Face-to-face interraction	
81 Electronic communication	
82 Written communications	
83 Telephone calls	

INTERVIEW QUESTIONAIRE **DATE**

Technology

- What is the most frequent medium used in your projects?
- How have team members kept up to date with software packages skills?
- Does the company provide for software skills courses or is the onus upon you?
- What has been the main challenges when communicating with other members on a project in your experience technologically?
- What is your view on new software packages?
- What is your opinion on new software packages when they are introduced into the system?

Effectiveness

- How long is the generally effective turnaround time on a situation which arose?
- Has situation ever occurred where there has been a delay? If so, what has been the cause of such delays?
- Have you or any members missed a deadline, if yes, how frequent and what has been the implications of missing such deadlines?
- Has there been a situation arise where conflicting opinions has had an adverse effect on projects?
- Do people understand their roles and responsibilities on a project?
- What has been the main challenges when communicating with other members on your project?
- How often do you have meeting to discuss project progress?

Behaviour

- What is the general state of people within the team?
- When a situation arose, was it dealt with immediately or how was it dealt with? (social support, attitude/ denial).
- Have you seen or experienced any resentments to other member as a result of work issues? (Laziness, due performance, incorrect information, relaying blame)
- Have you had a conflict or disagreement at work, if so, was it resolved and how was it resolved?
- Are efforts rewarded for innovative ideas and efforts?
- Do you feel you work well under pressure?

- Do all your projects have clear direction?
- Are you encouraged to engage actively with your team?

Interpersonal relation

- Are you comfortable with your team ie: do you relate to them more than merely through work or does social aspect also come into play?
- Are team members open towards other team members during meetings or is there a distinct awkwardness between team members?
- Is there open recognition or affirmation within the team? Conversely, is there resentment or ulterior intentions?

Cultural differences

- Is there gender equality in your team or do you feel there is a distinct mindset on abilities of the opposite sex?
- Are there noticeable alliances or cliques within teams?

Leadership

- Do all team members take responsibility for their actions?
- Is there a designated project leader/project manager who oversees the project, or are all team members on equal footing?