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**Between communication and collaboration in virtual teams:
the mediating effect of interpersonal trust**

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ABSTRACT

Virtual teams are becoming more common in today's businesses. They mostly interact through information and communication technologies (ICTs) due to the geographical distance existing between teammates. Prior research has found that this lack of face-to-face interaction creates new challenges for organizations and their managers. Most of these challenges are related to processes involved in interpersonal relationships like communication, trust and collaboration. These three processes have been recognized as essential to the performance of the team and its quality of outcomes. Furthermore, several types of virtual team have emerged, each one with its own challenges. At first, virtual teams were essentially temporary, but in the last decade, ongoing teams have become more prevalent.

Firstly, this study intends to explain the differences between temporary and ongoing virtual teams in terms of communication, trust and collaboration quality. And secondly, this study proposes a model based on mediation to explain and understand the relationship by which communication and trust are antecedents of collaboration.

A mixed research method was used where quantitative analysis was conducted on virtual team members to study the differences between the two types of team and to study the nature of the relationship between communication, trust and collaboration. Then a qualitative analysis was conducted to help explain the interesting findings of the quantitative analysis.

This study highlights two main findings. The first is that ongoing virtual teams have higher levels of almost all communication, trust and collaboration processes than temporary ones. And the second is that trust has a mediating effect between communication and collaboration.

This analysis could help organizations and their managers to be more accurate in their decisions about the type of team to be formed and the means and style of communication to be used during its lifetime. It will allow them to increase the efficiency, performance and quality of outcomes of the virtual team

DEDICATION

I dedicate my work to my beloved wife, Delphine and to my four children, Anaëlle, Elia, Eitan and Daniel, who supported me all along this journey. Their constant encouraging words allowed me to achieve it.

I also dedicate it to my parents who have guided and taught me throughout my life.

This dissertation is in memory of my family members who perished in the death camps during the Shoah, Edith, Georges and Samson. May their memories be a blessing.

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Chapter 1 – Introduction

1.1 Introduction

With the Internet revolution of the 1990s, the world became a global village. The distance separating people shrank and a new era for organizations began. The development of information technologies, like the Internet revolution of the 90s and the mobile revolution of recent years, has provided the necessary infrastructure to support the development of new organizational structures. One of the changes that this revolution has brought to organizations is the creation of a new kind of team, in addition to the conventional face-to-face team: the virtual or distributed team. Thanks to information and communication technology systems, such teams can communicate across the globe. These new channels of communication, however, have created new challenges. One of these challenges is the lack of interpersonal relationships. Trust is deeply affected by this lack [Grabner-Krautera & Kaluschab, 2003] as it depends on interpersonal relationships and is critical to the proper functioning of a team. Team leaders need to find new techniques in order to overcome this problem and generate a high level of collaboration.

Five key factors have been identified by Bergiel et al [2008] as vital to the formation of a successful virtual team. These five factors are: trust, communication, leadership, goal setting and technology. This study focuses on the relationship between trust and communication in order to help team leaders to use ICTs¹ in the most effective way and improve collaboration within teams.

1.2 Aim of the research

Collaboration processes are critical for work teams to accomplish their goals in the most efficient way [Boughzala, et al., 2012]. The processes are complex

¹ Stands for "Information and Communication Technologies." ICT refers to technologies that provide access to information through telecommunications

and much research has been dedicated to finding and understanding their antecedents and relationship [Gray & Wood, 1991]. As will be developed in the framework section (Chapter 3), two factors were identified as essential for the proper development of collaboration: communication and trust. These factors, being reliant on interpersonal relationships, are more difficult to develop and build in an environment where face-to-face relationships are almost non-existent, such as virtual teams [Grabner-Krautera & Kaluschab, 2003]. Furthermore, both these factors are usually built and developed over time [Mayer, et al., 1995; Webb, 1975]. Thus, the dimension of time is also an essential factor in the development of the team's collaborative processes.

The aim of this study is to get a better understanding of the impact of communication and trust on collaboration processes in virtual teams. To achieve this goal, the study will first analyze the levels gap (if existing) of trust, communication and collaboration between temporary virtual teams and ongoing ones, in order to study the impact of the dimension of time. Then, it will study the relationship that exists between them in order to identify the factors which are most essential to the development of collaboration processes depending on the purpose of the team. Finally, it will study whether the dimension of time beyond its assumed impact on the strength of various factors also has an impact on the relationship itself. The findings of this study could help organizations to increase their efficiency, performance and quality of outcomes in order to be more competitive.

1.3 Rationale of the research

1.3.1 *Collaboration*

Collaborative teams have been found to be most effective at achieving and enhancing an organization's strategy [Boughzala, et al., 2012; Peters & Manz, 2007]. Much research has been conducted to identify the antecedents of collaboration in order to increase a team's effectiveness and the level of its outcomes [Mattessich, et al., 2001; Peters & Manz, 2007; Liedtka & Whitten, 1997; Osman, 2004]. The effectiveness of a team and the level of its outcomes will allow one to specify whether the team is a successful one or not.

In the current highly competitive climate, organizations must be dynamic, innovative and able to adapt quickly to new situations. Therefore, 21st-century organizations need teams to solve problems and conflicts, to share information and knowledge, to make the right decisions, to be innovative and creative. The quality and level of these attributes will define the nature of team collaboration, and then this collaboration will lead to improved team performance [Peters & Manz, 2007].

1.3.2 Communication

The quality of communication has effects on team collaboration and performance [Mattessich, et al., 2001; Qureshi, et al., 2006; Hosley, 2010]. These effects can be positive or negative depending on communication channels and styles. Therefore, communication is identified as an important process for any team. However, it is especially important for virtual teams. Communication is not only an important process; it is a real challenge in a virtual environment due to different cultures, time zones and the distances involved. The lack of physical contact makes it more difficult to establish strong relationships and bonds, making the communication process more challenging [Grabner-Krautera & Kaluschab, 2003].

Two aspects of communication can be identified within the team, Task-oriented communication and Social/Relationship-oriented communication [Lau, et al., 2000; Jarvenpaa & Leidner, 1999; Huang, 2010; Misiolak, et al., 2012]. The task dimension focuses on how well goal setting, project information, tasks and deliverables are being handled through communication. In other words, task-oriented communication moves the team forward in the accomplishment of its tasks and includes such communication as planning and scheduling work, coordinating subordinate activities, and providing necessary supplies, equipment and technical assistance [Yukl, 2012]. The relationship dimension provides the basis and desire for team members to communicate with each other over time. Relationship-oriented communication's aim is to maintain a positive psycho-social dynamic within the team, such as showing trust and confidence, acting in a friendly and considerate way, trying to understand subordinates' problems, helping to develop subordinates and further their careers, keeping subordinates

informed, showing appreciation for subordinates' ideas and providing recognition for subordinates' accomplishments [Yukl, 2012].

1.3.3 Trust

Trust has been identified by several scholars as an important ingredient in collaboration [Johnston, et al., 2004; Martínez-Miranda & Pavón, 2012]. The nature of this relationship between trust, collaboration and performance is still unclear. Some scholars argue that trust has a direct, well-defined impact on collaboration and performance. Others argue that trust is a moderator-mediator factor and therefore it has an indirect effect on success [Marguin, 2010].

Over the years, many trust models have been developed. Based on the concept that trust may have rational and emotional roots, two types of trust can be identified for collaboration in organizations, cognitive- and affective-based trust [Lewis & Weigert, 1985]. When trust is based on cognition, individuals employ rational thought in order to trust others. Cognition-based trust refers to trust that is based on performance-relevant cognitions such as competence, responsibility, reliability, and dependability. It is hoped that other people will fulfill their roles and that their actions are consistent with their speech. But when the interaction between the parties is intense, the emotional and mutual investment in the relationship becomes primordial; this is where the affective side of trust comes into play. The emotional attachment created by this intense interaction emphasizes empathy, affiliation and rapport, based on a shared regard for the other person.

1.3.4 Virtual Teams

The nature of the virtual team can have consequences on the quality and types of communication and trust as well as on the level of collaboration. The nature of the virtual team can be defined by several parameters. The common parameters explored in virtual team research are based on distance, culture and time-zones [Jarvenpaa & Leidner, 1999; Martins & Schilpzand, 2011; Kayworth & Leidner, 2002]; that is "is the team a local or a global one?" This study investigated another parameter based on time; that is: "did the virtual team work on a task or

project with a deadline?" and therefore, is it a temporary team or "did the virtual team work on a permanent basis and over time?" and therefore is it an ongoing team [Panteli & Duncan, 2004]? Trust building and its development will also be of a different nature if we are managing a temporary team as opposed to an ongoing team. In a virtual temporary team, the focus must be on the cognitive dimension, the team does not have the time or the motivation to develop affective relationships [Xiao, Wei; Wei, Qing-qi;, 2008]. On the other hand, in a virtual ongoing team, we need to develop both the cognitive and affective dimensions. In the virtual ongoing team, the affective dimension must play a primordial role if we wish to foster good interpersonal relationships throughout the team's lifetime [Saunders & Ahuja, 2006].

1.4 Research questions and assumptions

1.4.1 Questions

The first objective of this study was to check whether the nature of the team, i.e. the ongoing or temporary team, has an impact on the different interpersonal relationships. The study tried to provide an answer to the following questions:

- Is there a difference in the levels of task- and relationship-oriented communications between temporary and ongoing virtual teams?
- Is there a difference in the levels of cognitive- and affective-based trust between temporary and ongoing virtual teams?
- Is there a difference in the levels of collaboration between temporary and ongoing virtual teams?

The second objective of the study was to get a better understanding of the relationship between communication, trust and collaboration. For the purpose of this study, two types of communication style (task- and relationship-oriented) and two types of trust (cognitive- and affective-based) were used as a theoretical framework. Still within the framework, the researcher of this study has defined collaboration as a set of five processes (problem solving, knowledge sharing, decision making, innovation and creativity, conflict management). These processes are highly related to collaboration as described in the literature review section (Section 2.5). The study investigated two parameters: the existence of relationships (including the strength) between these variables and the interactions

between them.

The second set of questions that this study tried to answer:

- Is there a relationship between the two communication types and the two trust types? What is the nature and strength of this relationship?
- Is there a relationship between the two communication types and the five collaboration processes? What is the nature and strength of this relationship?
- Is there a relationship between the two trust types and the five collaboration processes? What is the nature and strength of this relationship?

Then, relating to the interaction between the variables, the study tried to answer the following questions:

- Does cognitive- and affective-based trust play a role between the level of both task- and relationship-oriented communication and the five collaboration processes? What kind of role is it? Is there a difference depending on the type of interpersonal communication and interpersonal trust?

The last investigation involved joining the two first objectives and checking the impact of the nature of the team (temporary or ongoing) on the interaction between the three variables (communication, trust and collaboration)

- Does cognitive- and affective-based trust, play the same role between communication and collaboration in temporary and ongoing teams?

1.4.2 Assumptions

To answer these questions, several assumptions were formulated. These assumptions were divided into three major sets. The first set of assumptions aimed to answer the first objective as describe above. This set assumed that the levels of trust, communication and collaboration within virtual teams are higher in ongoing teams than in temporary ones. This set of assumptions was split into three sub-sets. The first one dealt with trust (affective- and cognitive-based). The second one with communication (relationship- and task-oriented). And the third and last one dealt with collaboration, which was defined in the present study by five processes as described above.

The second set of assumptions aimed to answer the second objective and therefore to explore the relationship between the three variables (trust,

communication and collaboration). Based on the framework of this study, the assumptions assumed that a mediation relationship exists between these three variables where trust is mediating the relationship between communication and collaboration. To test these assumptions, the study firstly checked the existence of correlation between these variables and then tested the mediation model. This set was also divided into two sub-sets. The first dealt with the relationship between relationship-oriented communication and collaboration where trust acts as a mediator and the second tested the relationship with task-oriented communication rather than relationship-oriented.

The last assumption aimed at fulfilling the last objective. That is to determine if trust plays the same role as a mediating variable in both ongoing virtual teams and temporary ones. The study assumed that on the one hand, affective-based trust has a stronger effect than cognitive-based trust on the relationship between communication and collaboration within ongoing teams. On the other hand, cognitive-based trust has a stronger effect than affective-based trust on the relationship between communication and collaboration within temporary teams.

1.5 Overview of research design

The study used the mix method, both quantitative and qualitative approaches, to investigate the above assumptions. This method of improved understanding arises when quantitative [numbers, trends, generalizability] and qualitative [words, context, meaning] approaches offset the different weakness of the two approaches. Among the existing mixed methods research designs, the explanatory sequential design was used where firstly, quantitative data collection and analysis were conducted, followed up with qualitative data collection and analysis. The reasoning is that, via a large quantitative web-survey, the relationship between the variables can first be analyzed, then unexpected and key findings can be determined. After that and with the help of open-ended questions via a web-survey, the study tried to understand the reasons for these unexpected and key findings. This was done with the end goal of providing a deeper understanding of the collaborative processes. Explanatory studies are used when the intent is to conduct a qualitative phase of the study in order to help

explain the previous quantitative results [Creswell & Plano Clark, 2011].

1.6 Structure of the thesis

The thesis structure consists of eight chapters.

The first chapter is an introduction to the dissertation where a description of the context and background of the research is given to the reader. The aim is to explain the importance of the research subject and to give relevant information about the research environment; that is the virtual environment in the modern organization. Then, the chapter presents the research questions including the ensuing assumptions where the questions and assumptions are divided into three major groups. A brief review of the research methodology is also conducted to explain the approach of this study. And finally, the structure of the thesis is described with a short description of each of the chapters.

The second chapter consist of a literature review of the current knowledge and theories relevant to the research area. The topics covered by the literature review are virtual teams, including their challenges; interpersonal communication; interpersonal trust and collaboration processes. In addition, this chapter includes two more sub-sections to get a broader view of the research environment which are ICTs and team leader roles within the teams.

In the third chapter, the research framework is presented based on several studies, theories and models. The framework assumes that higher levels of trust, communication and collaboration are expected in ongoing teams rather than in temporary ones. In addition, the framework also assumes that a significant correlation exists between these three factors. And finally, the framework shows that a mediating effect of trust between communication and collaboration can be expected.

In the fourth chapter, the research model that has been developed is presented, based on the study framework defined in the previous chapter. As the model is a mediation model, a description and explanation of mediation models

is also included in this chapter. This chapter closes with a detailed presentation and enumeration of the research questions and hypotheses. This presentation also includes all the sub-hypotheses that flow from the main hypotheses.

The next chapter, the fifth one, is about the research methodology that has been chosen for investigating and validating the research questions. Two main topics are elaborated upon: methods of research design and data analysis. The description of research design provides an introduction to mixed method research followed by an explanation of explanatory sequential design. The data analysis methods topic is divided into quantitative and qualitative sub-topics. Both sub-topics include the reasons for the methods used in the analysis as well as a comprehensive description of them.

The next two chapters (six and seven) deal with the data collection process, data analysis and the results. The sixth chapter concerns the first phase, that is the quantitative phase, and the seventh chapter concerns the second phase, that is the qualitative one. The sixth chapter begins with a description and explanation of the sample design and sample size, the variables measurement design and a preliminary test of the variables' items in the form of question testing and Cronbach's alpha test. The parametric assumption and factor analysis are then checked before running the data analysis itself. Finally, a complete description of the data analysis concludes this chapter based on statistical techniques for each one of the hypotheses and sub-hypotheses, including the results of these analyses.

The seventh chapter also begins with a description and explanation of the sample design and sample size of the qualitative sample, followed by the qualitative questionnaire design based on open-ended questions and its testing. Then the data analysis is developed through Conceptualization, Coding, and Categorization of the data collected where thematic networks are designed and explained based on a thematic analysis.

The last chapter (chapter eight) discusses the findings of both the quantitative and qualitative aspects of the research. First, the quantitative results are summarized and interpreted. Then, the same is done with the qualitative results, i.e. they are summarized and interpreted. Next, the results are connected in order to discuss to what extent and in what ways the qualitative results help to explain the quantitative results. Finally, the implications of these findings for organizations are exposed. These implications will give them a better understanding of the collaboration process and mechanism in virtual teams, allowing them to increase their efficiency, performance and quality of outcomes in order to be more competitive.

Chapter 2 – Literature Review

2.1 Introduction

Collaboration is an essential ingredient in the success of organizations [Boughzala, et al., 2012]. Many of them organize training and seminars for their teams on a periodic basis in order to increase the level of collaboration and cooperation. Collaboration has been recognized as a process that can create outcomes that cannot be achieved by an individual alone [Peters & Manz, 2007]. Virtual teams, because of the distances between the teammates, need to develop ways for creating successful collaboration without face to face training or seminars, but with the help of E-collaboration tools [Hosley, 2010]. "Communication and collaboration are the two most important factors in team success. A virtual environment fundamentally transforms the ways in which teams operate" [Duarte & Snyder, 2011]. These E-collaboration tools are built on ICTs which allow teammates to communicate with each other on social and task dimensions. At first, virtual teams were created for limited time project or task purposes [Julsrud, 2008]. Therefore, swift trust [Meyerson, et al., 1996], based on cognitive trust only, was developed in this environment because of the temporary nature of the team. But in recent decades, other virtual teams called distributed work groups [Julsrud, 2008] have been created for ongoing tasks which have a permanent character and therefore swift trust is not enough to maintain a high level of trust. Affective trust, besides cognitive trust, will be a necessary ingredient in maintaining a high level of trust in such teams [De Jong & Elfring, 2010]. Communication and trust have been raised several times as components for team collaboration building [Barczak, et al., 2010]. In order to develop and maintain good communication [Sivunen, 2008] and trust [Webber, 2002], team leaders have to play a positive role in their team. Through a review of the literature, the main concepts that have been raised are defined: Collaboration, Virtual Teams (Temporary and Ongoing), Communication (Task and Relationship dimensions) especially via ICT, Trust (Cognitive and Affective dimension) and finally, Team leaders and their influence on their team in building effective communication, trust and collaboration.

2.2 Virtual Teams (VTs)

2.2.1 Definition

Salas et al. [1992] provide a good working definition of a team as "a distinguishable set of two or more people who interact dynamically, interdependently, and adaptively towards a common and valued goal/objective/mission, who each have been assigned specific roles or functions to perform". Salas et al. [1992] extend the definition, stating that virtual teams or distributed teams "have a limited life-span of membership". However, in recent decades, ongoing virtual teams, which will later be defined, have also emerged. Therefore, a more general definition is needed to define these teams. Hertel, Geister, and Konradt [2005] define virtual teams as: "distributed work teams whose members are geographically dispersed and coordinate their work predominantly with electronic information and communication technologies (email, video-conferencing, telephone, etc.)". It is widely agreed by scholars that the main element which defines a virtual team is that it comprises people who work together and are often dispersed across space, time, and/or organizational boundaries; furthermore, these groups of people collaborate and communicate through electronic technologies commonly called ICTs [Ebrahim, et al., 2009; Hertel, et al., 2005]. Hertel, Geister, and Konradt [2005] resume these two aspects of virtual teams (dispersed across space/time and communicate through ITCs) when they define them as: "distributed work teams whose members are geographically dispersed and coordinate their work predominantly with electronic information and communication technologies (email, video-conferencing, telephone, etc.)".

2.2.2 Virtual team vs. Face-to-face team

Traditional teams are known as face-to-face teams or collocated teams, in which the whole team is mostly working in the same space-time whereas virtual teams are not. Thus, virtual teams are different in several ways. Many researchers have tried to characterize the differences between virtual teams and face-to-face teams. According to Chudoba et al. [2005], there are six discontinuities –

geography, time, culture, work practices, organization, and technology – that capture distinctive aspects of the virtual team environment. Based on several former studies, Kuruppuarachchi [2009] made a comparison between virtual teams and face-to-face teams where he divided the comparison into two major groups. The first group of comparison concerned team communication. He defined a face-to-face team as a team with rich communication based on face-to-face contact which is always available and, with regular personal interactions that support the building of relationships and trust. Conversely, communication in virtual teams is heavily reliant on electronic forms of communication, often asynchronous media with several drawbacks. Thus, it requires careful planning for team integration and communication and also requires clear and precise communication, as immediate feedback or clarification is difficult. He also observed that in such communication problems can go unnoticed and that there is a lack of opportunities for building relationships and trust. The second group of comparison that he defined was based on team structure and leadership. He noted that in a face-to-face team, well-developed traditional team leading concepts can be used, monitoring of work of the team members is not difficult and the supervisor can motivate the members knowing their attitudes and requirements. Further, in this kind of team it is easy to implement effective reporting procedures and a common set of standards for various processes, including quality control. In contrast, virtual teams are much more complex to manage and lead, as Kuruppuarachchi [2009] noticed. In this kind of team, team leaders need to have skills to manage the diversity of the team's membership, crossing national boundaries and different time zones. They also need to be able to supervise without having direct observation of team members' work and work progress. The team leaders might have to set up different reward systems, as it is difficult to admire well-done work and motivate members. The establishment of standards for team processes, including quality control, could be complex and different assessment systems may be required for work, work structures, and work processes. Further, self-motivation and self-judgment are often required from team members. Despite the complexity of virtual team formation and development and despite several drawbacks (Table 1), these days most

organizations have teams which are working as virtual teams across distances, especially global ones. The reason is that with these drawbacks come also some crucial benefits that can overcome the disadvantages (Table 2). Martins et al. [2004], in a major review of the literature on virtual teams, conclude that "Virtual Teams are increasingly prevalent in organizations and, with rare exceptions all organizational teams are virtual to some extent".

Table 1 - Virtual team drawbacks [Kuruppuarachchi, 2009]

Drawbacks
• Ineffective communication in the absence of face-to-face communication
• Loss of vision—members may not know the goals and objectives clearly
• Structure may not fit the organization or operational environment
• Resistance to unstructured nature of teams
• Additional cost for setting up remote offices
• Too many members are possible on a team
• Lack of permanent reports or reports are not available centrally
• Lack of visibility of the work of the team members, including their workload and progress
• Conflicts are often invisible and complex—they could even be site-specific
• Quality control is difficult
• Some members may not be psychologically fit for virtual teams
• Supervision and monitoring and performance management are difficult
• Require managing multiple time zones, different cultures, and languages
• Require developing skills of employees on special virtual teaming supporting applications
• Require developing skills of individual members to work in virtual teams

Table 2 - Virtual teams benefits [Kuruppuarachchi, 2009]

Benefits
• Financial gains through improved productivity, reduced cost, reduced travel time, etc.
• Increased competitive advantages and improved customer satisfaction
• More flexibility on working hours for employees
• Improved business processes and cross-functional and cross-divisional interactions in the organizations
• Skilled, qualified, and talented workforce is possible regardless of the distance
• Availability of a pool of employees regardless of location, and possibility of easily expanding the workforce
• Enhanced information dissemination and knowledge sharing within the organization
• Stimulation of creativity and innovation most likely due to diversity of the workforce
• Creation of opportunities for employees in remote offices
• Flexibility in resource allocations and work scheduling
• Speed up product development and project management

2.2.3 Trust and Communication as Virtual Team challenges

Thus, this virtual environment poses some challenges for this particular type of team. In their research, Kirkman et al. [2002] described five challenges to the success of virtual teams. Building trust within this kind of team is the first challenge. They explain: "Most consultants and researchers agree that building trust is the greatest challenge in creating successful virtual teams and organizations". Trust building, development and maintenance are also described among the principle challenges in virtual teams due to the lack of time to interact, the lack of history, the lack of physical contact, the lack of face to face communication, etc [Mumbi, 2007]. Mumbi [2007] also affirmed, based on a study by Kayworth and Leidner [2002] that communication represents one of the most critical activities performed by virtual groups and presents a number of challenges for project managers tasked with implementing a virtual work environment. Similarly, Grabner-Krautera and Kaluscha [2003] argued that the lack of physical contact makes it more difficult to establish strong relationships and bonds that lead to high levels of trust, making the communication process more challenging. These arguments were empirically verified by a study on cross-functional distributed teams [Zolin, et al., 2003]. Thus, creating an effective communications strategy is considered one of the biggest issues for virtual team, just as is the case with trust building [Dagan & Mandell, 2006].

2.2.4 Different types of virtual team

In recent decades, much research has been conducted to try and better understand the process of trust building and communication within these virtual teams. To get a better understanding of these processes, researchers have studied trust building and communication in different kinds of virtual teams. Some studies have been conducted in global virtual teams [Jarvenpaa & Leidner, 1999; Martins & Schilpzand, 2011] and others in temporary virtual teams [Panteli & Duncan, 2004; Piccoli & Ives, 2003]. The differentiations between local virtual teams vs. global ones as well as temporary virtual teams vs. ongoing ones are the most common in the literature.

2.2.5 Global virtual teams and Local virtual teams

The local virtual team refers to a team of people that are located in a common geographic area and that share the same culture most of the time. In contrast, a global virtual team's members are separated by larger distances and differ in terms of cultural backgrounds [Nikoi & Boateng, 2014]. Such differences have impacts on several aspects of interpersonal relationships within the team; the quality of communication and the level of trust are among these aspects [Dube & Pare, 2001]. Based on previous studies, Martins and Schilpzand [2011] argue that developing and maintaining trust is more difficult in global virtual teams than in virtual teams in general. Therefore, they continue, the whole process of achieving trust in global virtual teams is more difficult than in local virtual teams.

2.2.6 Temporary virtual Teams and Ongoing virtual Teams

The other common differentiation in the literature is not dependent on geographical and cultural parameters like local and global virtual teams but on the longevity of the team. A temporary virtual team is characterized by discontinuity; it exists only to accomplish a specific task or a timely project, and then disassembles [Panteli & Duncan, 2004; Julsrud, 2008]. On the contrary, an ongoing virtual team is described as a team with continuity in the membership of the group; that is, a group of people working on a permanent basis and dealing with ongoing issues [Julsrud, 2008].

In his research, Julsrud [2008] refers to three kinds of teams working in a virtual environment. The first is known as a virtual task force. This group initially forms as a result of an acute or unexpected situation. The second kind of team defined by Julsrud as a virtual team is a group formed for a limited period of time in order to solve certain pre-defined tasks. Both of these kinds of team are temporary most of the time. Finally, Julsrud dubs the third kind of team a distributed work group. This group contains people from different geographical units within the same organization. Such teams are usually of a more permanent nature than virtual teams, as they work on an ongoing basis.

In the last decade of the 20th century and the first few years of the 21st

century, virtual teams were mostly based on temporary teams. Most of these teams were project teams [Mankin, et al., 1996; Pulnam, 1992], task forces [Hackman, 1990], or short-term project teams [Cohen, 1993]. Usually, temporary teams worked on non-routine, highly skilled technical or administrative projects, such as developing a new product or information system [Saunders & Ahuja, 2006].

Over the past few years, the second kind of team—the ongoing or long-term team—has also become more prevalent in the virtual context. This kind of team is dubbed a functional team [Hellriegel, et al., 1998] or work team [Pulnam, 1992; Mankin, et al., 1996]. These teams are typically characterized by cyclically recurring activities, and their members expect to be working together on future tasks [De Jong & Elfring, 2010].

Saunders & Ahuja [2006] defined these two kinds of team as follows: "Temporary teams engage in a single task, or, at most, a few tasks, to accomplish their goal. Their tasks are concrete and finite. On the other hand, ongoing teams are long term, often requiring multiple or repeated tasks to accomplish the many or recurring goals that are established at their inception or evolve over time".

Most scholars have based their work on temporary virtual teams [Misiolek, et al., 2012] and therefore they have developed theories like swift trust [Meyerson, et al., 1996] – based on cognitive trust for quick team trust building. Ongoing teams tend to be more focused on interpersonal relationships, which increase the impact of trust dynamics on team member interactions [Karau & Kelly, 2004; Saunders & Ahuja, 2006]. Unlike swift trust, which is highly fragile and temporal, ongoing teams must develop trust not only based on the cognitive dimension, but also on the affective dimension. These two dimensions of trust will be developed later in this chapter.

2.3 Communication within a Team

2.3.1 *Team communication*

Scholarly literature provides evidence that quality of communication has effects on team collaboration and performance [Hassall, 2009]. These effects can be positive or negative depending on communication channels and styles. Therefore, communication is identified as an important process for any team.

However, it is especially important for virtual teams [Saunders & Ahuja, 2006; Zofi, 2012]: "At the core of any virtual team process is communication" [Powell, et al., 2004]. Communication is not only an important process, it is a real challenge in a virtual environment [Mumbi, 2007] due to different cultures and time zones, as well as the distances involved. The geographical separation of team member implies rare physical contact, if any. When no face-to-face contacts happen, it is more difficult to establish strong relationships and bonds between the team members. Without these social interactions, the communication process become more challenging [Grabner-Krautera & Kaluschab, 2003].

2.3.2 Task-oriented and Social-oriented communication

Social activities like interpersonal communication are essential for the development of personal relationships to facilitate trust and collaboration. This observation was supported by a study which found that personal communication has a significant relationship with perceived trustworthiness and trust [Zolin, et al., 2003].

The literature often differentiates between two aspects of communication within the team, task-oriented communication and social/relationship-oriented communication [Huang, 2010; Lau, et al., 2000; Jarvenpaa & Leidner, 1999; Misiolek, et al., 2012]. The task dimension focuses on how well project information, tasks and deliverables are being handled through the communication. In other words, task-oriented communication moves the team forward in the accomplishment of their task and includes such communication as "planning and scheduling work, coordinating subordinate activities, and providing necessary supplies, equipment, and technical assistance" [Yukl, 2012]. The relationship dimension provides the basis and desire for team members to communicate with each other over time. Relationship-oriented communication's aim is to maintain a positive psycho-social dynamic within the team such as "showing trust and confidence, acting friendly and considerate, trying to understand subordinates' problems, helping to develop subordinates and further their careers, keeping subordinates informed, showing appreciation for subordinates' ideas and providing recognition for subordinates' accomplishments"

[Yukl, 2012]. Likewise, in a virtual team context, Lau et al. [2000] referred to the task aspect as the part of communication that is specifically directed toward getting the project work done on time and within budget, and the social aspect as communication that is directed toward building social relationships and solidarity among virtual team members.

2.4 Team Trust

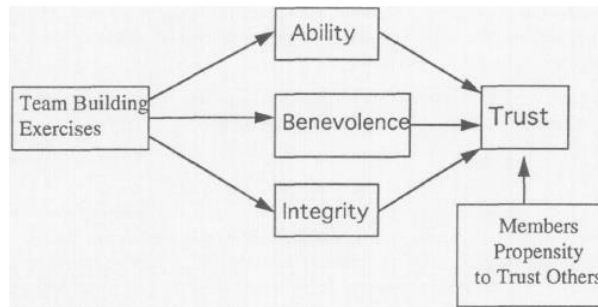
2.4.1 Trust definition

There are different definitions of trust in academic literature. Marguin [2010] refers to two of the most widely accepted definitions. The first is "one party's willingness to be vulnerable to another party based on the belief that the latter party is competent, open, concerned and reliable" [Mishra, 1996]. The second widely accepted definition is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trust or, irrespective of the ability to monitor or control that other party" [Mayer, et al., 1995]. This represents two definitions of trust in terms of the dyadic relationship. Cummings and Bromiley [1996] observed that trust also exists in collective relationships (groups, teams, and organizational units). They defined collective trust as: "A common belief among a group of individuals that another individual or group: a) makes good-faith efforts to behave in accordance with any commitments [...] b) is honest in whatever negotiations preceded such commitments and c) does not take excessive advantage of another even when the opportunity is available".

2.4.2 Trust within the team

Jarvenpaa et al. [1998] developed a model of trust in virtual teams based on the two theories of dyadic and collective relationships, as quoted above. Their model (Figure 1) extends the dyadic trust relationship between trust and trustee based on the perceived ability, benevolence and integrity of the trustee [Mayer, et al., 1995] to all team members. The fundamental hypothesis of their work was that, in a global virtual team, team trust is a function of the other team members' perceived ability, integrity, and benevolence, as well as of the members' own propensity to trust.

Figure 1 - Jarvenpaa et al. [1998] Research Model



In order to trust and therefore be willing to depend on another party [McKnight, et al., 1998], to take risks [Jones & George, 1998] and to be vulnerable [Mayer, et al., 1995], we must create social and interpersonal relationships with the other. One of the main challenges in virtual teams, as opposed to face-to-face teams, is "overcoming the isolation caused by the separation of the telecommuter from the social network in the traditional work space" [Kurland & Bailey, 1999]. This absence of physical contact negatively affects interpersonal trust because of the non-presence of social face-to-face interaction [Grabner-Krautera & Kaluschab, 2003].

2.4.3 Swift trust

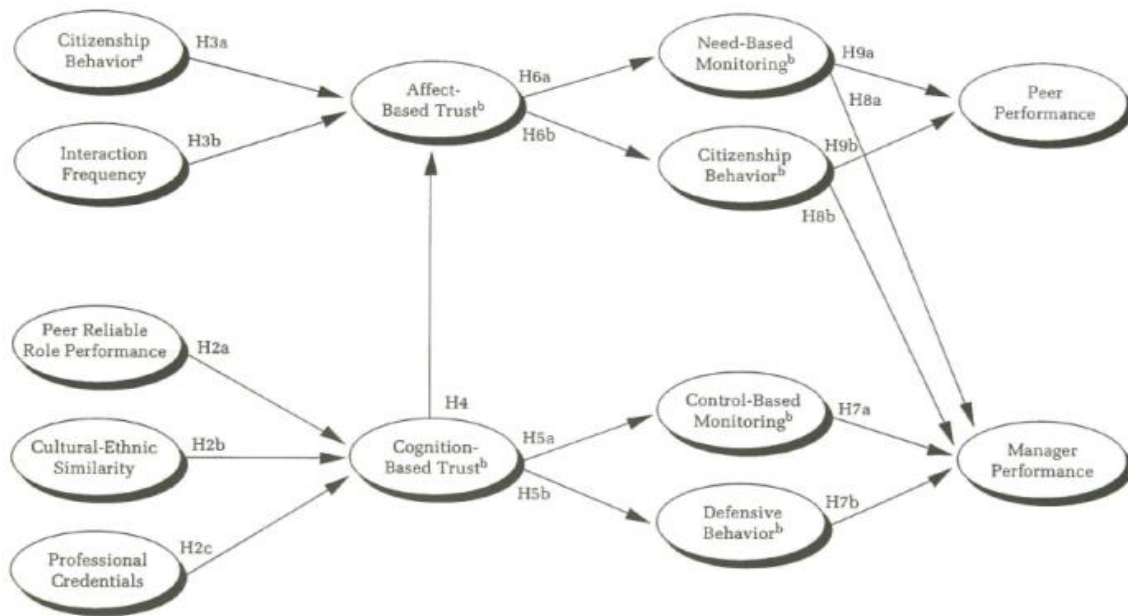
In order to find a solution for trust building in the first kind of virtual team i.e. temporary, Meyerson et al. [1996] developed the swift trust theory. This theory was used in most research conducted in the field of virtual team trust building and development [Jarvenpaa & Leidner, 1999; Panteli & Duncan, 2004; Kanawattanachai & Yoo, 2002]. Meyerson et al. [1996] argued that virtual teams must build trust quickly. Unlike traditional trust that is usually based on interpersonal relationships, swift trust replaces the need for interpersonal dimensions with broad categorical social structures and action. Virtual communities are composed of people who do not necessarily share a common past or future, and who are different in terms of culture, geography and skills. As a result, they cannot rely on traditional trust building. Rather, they must rely on a special form of trust that builds primarily on pre-existing stereotypes and on the current action of the community [Ngo-Mai & Raybaut, 2007]. In other words, this

form of trust is based on cognitive elements such as role-based interaction and category-driven information processing, rather than on affective elements. Over the past few years, the second kind of team—the ongoing or long-term team—has also become more prevalent in the virtual context. Unlike swift trust, which is highly fragile and temporal, ongoing teams must develop trust not only based on a cognitive dimension, but also on an affective dimension. Very little research has been conducted on virtual ongoing teams. One of the rare studies, conducted by Saunders and Ahuja [2006], argues that virtual ongoing teams have the time needed to develop roles and norms, establish deeper trust, develop communication patterns, and resolve sources of deep-lying conflict.

2.4.4 Affective-oriented and Cognitive-Oriented trust

Over the years, many trust models have been developed. Based on the concept that trust may have rational and emotional roots [Lewis & Weigert, 1985], a model of cognitive and affective dimensions in trust (Figure 2) has been developed by McAllister [1995] for collaboration in organizations. This theory was used by several studies in the field of trust within the organization. The studies explore the effect of interpersonal trust between the different types of workers like managers and employees [Costigan, et al., 2006]. As well as the impact of interpersonal trust on different type of outcomes [Mumbi, 2007; Schaubroeck, et al., 2011] and behavior [Evans, 2012; Chua, et al., 2008] within the organization.

Figure 2 - The McAllister [1995] model



When trust is based on cognition, individuals employ rational thought in order to trust others. Cognition-based trust refers to trust that is based on performance-relevant cognitions such as competence, responsibility, reliability and dependability [Schaubroeck, et al., 2011]. People hope that others will fulfill their roles and that their actions are consistent with their speech. But when the interaction between the parties is intense, the emotional and mutual investment in the relationship becomes primary; this is where the affective side of trust comes into play [Erdem & Ozen, 2003]. The emotional attachment created by this intense interaction emphasizes empathy, affiliation and rapport, based on a shared regard for the other person [Schaubroeck, et al., 2011]. In family relationships, such as spouse-partner, and even more so in parent-child relationships, the affective side is very strong and forms the basis for most of the trust in the relationship. In contrast, when we need the services of a specialist—such as a technical expert or consultant—the cognitive side is predominant. In a work environment, where colleagues work together toward a common goal, trust is initially cognition-based. However, to maintain this trust in the long run, we must develop the affective aspect of the relationship [McAllister, 1995]. Cognitive and affective dimensions are often tightly intertwined in work relationships and trust is assumed to develop gradually over time based on direct personal interaction and communication

[Mayer, et al., 1995; Lewicki & Bunker, 1995]. Individuals need time in order to trust another person; they need to develop both cognitive and affective trust. Other research has gone so far as to add other dimensions, such as the "early trust" suggested by Webber [2002] as an antecedent to both cognitive and affective trust, or the "intended behavior" defended by Cummings and Bromiley [1996] as a third dimension. Even if high levels of trust at an early stage are possible, and may be driven by cognitive cues from group membership and reputation, affective trust has been thought to develop later in the life of an interpersonal relationship [Williams, 2001]. Several scholars have tried to understand the relationship between cognitive-based trust and affective-based trust. The aim of their studies was to understand whether a dependency exists between the two types of trust and sometime even to identify the factors of the relationship. A study by McAllister [1995] shows that a team leader expressing a high level of cognitive-based trust in a peer will also report a high level of affective-based trust in that peer. Another study also shows that the more a team member has cognitive-based trust in the team leader, the greater the affective-trust will be [Schaubroeck, et al., 2011]. Furthermore, McAllister [1995] argues that some cognitive-based trust is necessary to develop affective-based trust: "People's baseline expectations for peer reliability and dependability must be met before they will invest further in the relationship". That is to say, in a teamwork environment, cognitive-based trust is an antecedent to affective-based trust. This argument has been supported by Schaubroeck, Lam and Peng [2011]. Moreover, Kauffmann and Carmi [In press] identified task- and relationship-oriented communication as factors that mediate the relationship between cognitive-based trust and affective-based trust where cognitive-based trust is the antecedent to affective-based trust.

2.5 Collaboration

2.5.1 *Team collaboration*

"The act of collaboration is an act of shared creation and/or shared discovery" in which "two or more individuals with complementary skills [interact] to create a shared understanding that none had previously possessed or could

have come to on their own" [Schrage, 1990]. Moreover, Schrage [1990] claims that the process of collaboration is differentiated from the process of communication by the fact that flooding a team member with knowledge and information does not necessarily make him a better thinker. He explains this by stating that sharing understanding and exchanging information are two different tasks. Therefore, collaboration is a far richer process than communication. It involves the creation of value beyond that which could be created with traditional communication or teamwork. Collaboration can occur only when team members understand that they cannot do something all by themselves and begin to listen, accept and respect the insights, questions, and ideas of others [Peters & Manz, 2007]. The process also involves decision making among interdependent parties that involves joint ownership of decisions and collective responsibility for outcomes [Liedtka, et al., 1996]. Thus, collaboration is a complex process which as a result of communication and interaction between parties, creates relationships between them, allowing the sharing and synchronizing of information for the purpose of decision making and achieving common matters or goals. Thomson and Perry [2006] defined this as a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways of acting or deciding on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions. To embrace all the above definitions of collaboration, Peters and Manz [2007] offer a wide definition of "team collaboration as the existence of mutual influence among members that enables open and direct communication, resulting in conflict resolution, and support for innovation and experimentation". They add that "in order for collaboration to be effective, new skills, mindsets, and corporate architectures need to be developed". Moreover, "team members must have an open mind and be willing to listen to, and trust in, their teammates. They [the teammates] must also possess the ability to deal with conflict productively and be supportive, rather than authoritative, in the team environment". In other words, it is widely believed that teams that collaborate effectively are more innovative, productive, and satisfied than teams that do not collaborate.

Gray and Wood [1991] developed a theoretical framework for studying collaboration. This theoretical framework allows understanding of the process of collaboration that yields particular outcomes. They argue that scholars need to investigate three areas: antecedents to collaboration, the process of collaboration itself, and the outcomes of that process. However, during their research on collaboration, scholars often simultaneously associate antecedents with collaboration processes and outcomes. These lead to failures in differentiating the mediating variables from the outcome ones [Thomson, et al., 2010]. For the purpose of this research, only on one of these areas was focused upon, which is the antecedents of collaboration. According to Mattessich, et al. [2001], collaboration depends on twenty factors that influence the success of collaboration. Trust and Communication have a major role among these factors: "Collaboration depends on the existence of trust, shared vision, communication, and other ingredients." [Mattessich, et al., 2001]. Collaboration requires a dynamic relationship across various members and groups [Hosley, 2010], trust and communication will facilitate this dynamic relationship.

Five of the concepts associated with collaboration which are most frequently mentioned by these scholars are: Knowledge & Information Sharing [Osman, 2004; Bell & Kozlowski, 2002; Evans, 2012; Van Gelder, 2011; Ghaznavi, et al., 2013], Conflict Management [Osman, 2004; Pazos, et al., 2011; Atteya, 2013; De Dreu & Beersma, 2005], Problem Solving [Casalini, et al., 2007; Ghaznavi, et al., 2013; Dillenbourg, 1999], Decision Making [Bell & Kozlowski, 2002; Michie, et al., 2006; Turban, et al., 2011] and Innovation and Creativity [Osman, 2004; Evans, 2012; Ghaznavi, et al., 2013] Therefore, these five concepts were used to define the level of collaboration within the virtual team.

2.5.2 Knowledge and Information sharing

Information sharing is defined as "a process of making one's own stored and updated information accessible for other members of a group. Sharing presupposes consensus of a group about the interaction and is a necessary condition to be effective" [Den Otter, 2005]. Knowledge sharing is defined as "the willful application of one's ideas, insights, solutions, experiences (i.e. knowledge)

to another individual either via an intermediary, such as a computer-based system, or directly" [Turban, et al., 2006].

2.5.3 Conflict management

Relationship conflict is defined as "interpersonal incompatibilities among group members, which typically include tension, animosity, and annoyance among members within a group" [Jehn, 1995]. Conflict management is defined as "behavior oriented toward the intensification, reduction, and resolution of the tension" [De Dreu, et al., 1999], which hopefully leads to an opportunity to improve situations and strengthen relationships.

2.5.4 Problem solving

Problem solving is defined as a process used to obtain the best answer to something unknown, or a decision subject to some constraints [Mourtos, et al., 2004]. Collaborative problem solving is problem-solving done by peers, performing the same actions, having a common goal and working together [Dillenbourg, 1999].

2.5.5 Decision making

Decision making is defined as a group's "ability to integrate information, use logical and sound judgment, identify possible alternatives, select the best solution, and evaluate the consequences" [O'Neil, 1999]. Collaborative Decision Making typically evolves from either formal or informal deliberations in groups where the group members consider and debate various possible decision options. The decision issue is resolved through discussions, where argumentative logic and persuasive presentation are critical [Raghu, et al., 2001].

2.5.6 Innovation and Creativity

Innovation is a dynamic process through which problems and challenges are defined, new and creative ideas are developed, and new solutions are selected and implemented [Sørensen & Torfing, 2012]. Collaborative Innovation is defined as: "The recursive interaction of co-creativity, knowledge, and mutual learning

between two or more people working together toward a common goal of generating new sources of growth or wealth in an organization" [Lynch, 2007].

All these concepts are closely related to collaboration where a high level of cooperation between teammates is crucial for the success of the processes.

2.6 Information and Communication Technology

For decades, the impact of technology on collaboration has been the topic of much research, including empirical findings [Dennis, et al., 2001; Fjermestad & Hiltz, 1998]. Technology is evolving at an exponential pace leading to new collaboration tools like Web2.0 tools and social media. Former research [Dennis, et al., 2001] suggested that the use of different collaboration technologies could influence outcomes differently. The different technology characteristics may influence the level of collaboration of the team differently and therefore have various impacts on the performance of the team and its outcomes [Ustun & Pazos, 2012]. Information and Communication Technology refers to technologies that provide access to information through telecommunications media, such as the Internet, wireless communications and cell phones. It includes any devices, services and applications used in information systems management and processing [Heshmati & Lee, 2008]. In recent years, ICTs have provided a vast array of new communications capabilities that allow people and businesses to feel close proximity even when the physical distance between the communicators is large. This new kind of modern communications technology has created a "global village" where people can communicate all over the world and feel as though they are communicating with someone in the next room, or even the next cubicle. Technologies like instant messaging, Voice over IP, audio and video conferencing enable the exchange, sharing, development and management of information across the world while reducing the uncertainty and duration of many types of business transactions. ICT is considered one of the three major technological breakthroughs of the modern era, alongside steam power and electricity [Edquist & Henrekson, 2006]. ICT's rate of technological development has been much more rapid than that of any other breakthrough. ICT is still in its first stages, and

new technologies appear every day—including new software, hardware and services. This rate of development continues to grow exponentially, as illustrated by Moore's Law². The impact ICT has had on our lives is evident from the fact that some countries were able to take advantage of ICTs in order to accelerate their rate of growth and productivity [Edquist & Henrekson, 2006].

Beyond the fact that ICTs have a huge impact on modern life and economies, they are also major tools in virtual team management. Thomas and Bostrom [2008] declared that they "found evidence that virtual team leaders do manage information and communication tools (ICTs) in order to affect changes in team cooperation, through trust and relationship improvements". Thus, ICTs not only allow teams to improve trust and relationships via communication but through this improvement they also allow teams to improve collaboration and performance [Thomas, 2010].

2.6.1 ICT's and Virtual Team Communication

In a virtual team environment, face-to-face interaction is very uncommon. It is therefore critical for team leaders to master information and communication tools (ICTs), as these represent almost the sole means of communication with the team. Obviously, if team leaders cannot communicate with their teams, they will be unable to build trust among team members. Kasper-Fuehrer and Ashkanasy [2001] argue that, without appropriate ICTs to communicate trustworthiness, trust building in a virtual organization is compromised. Thomas and Bostrom [2008] found a strong correlation between technology adaptation and trust and cooperation. These findings have been confirmed by a study conducted by Adela et al. [2012]. Their study found that the density/frequency of ICT use and the level of trust between virtual community members were related. Thus, Kauffmann and Carmi [2014] argue that it appears to be essential for a team leader to

² Moore's Law is a computing term which originated from an article published by the "electronics news" in April, 1965; the simplified version of this law states that processor speeds, or overall processing power for computers will double every two years.

demonstrate basic knowledge and skills in the use of ICT. As an initial step, the team leader should learn about the different methods of communication and understand how and when to use them. Next, team leaders should ensure that their team understands the principles of ICT use. However, it must be emphasized that there are other factors beyond the use of technology that should be taken into consideration in order to build and maintain trust in a virtual environment. For example, Jalali and Zlatkovic [2009] argue that the team leader will also need to evaluate teammates for their ability to work in such environments, and to promote those with experience in these environments. Assembling teams of people who are already familiar with one another is also recommended [Xiao, Wei; Wei, Qingqi, 2008]. Another example is the use of outside experts to help team leaders establish an honest assessment of the cultural identity of their individual groups [Mancini, 2010]. ICTs provide support for both synchronous and asynchronous communication [Warkentin, et al., 1997; Ashley, 2003]. Synchronous systems enable interpersonal contact that simulates face-to-face contact. It has been argued that "asynchronous CMC (Computer-Mediated Communication) is closer to writing due to the fact that it allows for more syntactic complexity than synchronous CMC" and that "synchronous CMC is closer to speaking than asynchronous CMC because numerous communication strategies and a wide range of discourse patterns are found in the synchronous environment" [Hirotsu, 2009]. This difference will impact upon the optimal use for these channels. There are three different levels of channel, as defined by Bos et al. [2002]; the first is based on text-like writing or online presentation, the second on vocal contact and the third includes vocal and visual contact. The advantage of asynchronous systems is that they allow people to think before answering and to establish the reason behind a particular decision. Asynchronous systems also have these three levels of contact. The first level lacks the vocal and visual cues, thereby increasing the risk of miscommunication and misinterpretation. The second level essentially lacks visual cues that decrease the risk of miscommunication and misinterpretation. Finally, the third level, which has vocal and visual contact, considerably decreases this risk. In their research, Bos et al. [2002] show that audio and video channels facilitate cooperation far better than chat/messaging

channels. However, these two channels still showed evidence of delayed trust, since they took longer to reach high levels of cooperation than face-to-face interaction. Team leaders usually use these channels for task-oriented purposes. Using these channels, they send goals, tasks, schedules, questions, requests for updates and reports to their teams. Team leaders tend to forget, however, that these channels also affect social bonds. They forget the extent to which these same channels can be used to strengthen the ties between themselves and their teams, and between team members.

"We argue that these three social networking tools [instant messaging, email and knowledge sharing forums] can function as work task-oriented CMC tools. At the same time, these three CMC tools have the capability to shape well-connected social networks for the interlocutors at work, merging interpersonal and work relationships together with the aid of CMC tools. The utilization of these tools can help establish or improve quality communication processes, interactivity and relationship networks among interlocutors, subsequently leading to enhanced individual work performance" [Ou, et al., 2013].

In their research, Ou, Sia and Hui [2013] demonstrated that IM and emails have a significant impact on communication processes, interactivity and relationship networks. However, their research also showed that the various channels affect the communication process, interactivity and relationship networks differently. IM has the strongest impact, followed by email. Their study did not find significant bonds in knowledge-sharing forums. These findings are consistent with the previous statement about the two different kinds of channels (synchronous and asynchronous) and the three different levels (text, audio, and video) of contact. In addition to these differentiations between the different types of ICTs, Lau et al. [2000] also identified three major factors that enhance effective communication and affect channel quality. These three factors are: technology; time and space; and communication patterns. The technology factor concerns accessibility, synchronicity and the richness of the medium. The time and space factor concerns time zone differences and physical distances. For communication patterns, Lau et al. [2000] identified three different stages which teams undergo during the course of their projects: unidirectional, bidirectional and mutual

communication.

Many scholars have classified ICT tools according to different parameters, such as synchronous/asynchronous [Lau, et al., 2000], medium richness [Roth, 2010] and text/audio/video [Bos, et al., 2002]. However, their studies, which preceded the recent development of social media technology, did not take the social media channel into consideration. Indeed, in the past few years, social media channels have emerged and have become a significant channel of communication. Thanks to Web 2.0 technology, the use of social media is becoming increasingly common within companies [Culnan, et al., 2010]. Some examples of social media include wikis such as Wikipedia and online social networking services such as Facebook. Kaplan and Haenlein [2010] referred to social media as “Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content”. Van Zyl [2009] argued that social media accelerates the development of trust, relationship-building and effective communications among people in communities. According to Remidez and Jones [2012], the main reason for this is that social media enables small talk. A study conducted by Pullin [2010] suggested that small talk supports familiarization, helps build rapport and creates a nurturing, supportive, collaborative and trusting environment. Even if, as Treen and Leonardi [2012] argue, "Scholarship has largely failed to explain if and how uses of social media in organizations differ from existing forms of computer-mediated communication", it seems that social media has created a new form of technology-based communication. This is largely due to the fact that it improves small talk and online creativity and exchange.

2.6.2 ICT channels and recommended ways of use

Based on scholarly research papers, several of the common ICT channels are reviewed, some of their strengths and weaknesses mentioned, and ways to use them recommended in the next sub-sections (Section 2.6.2.1 & Section 2.6.2.2). These channels were categorized into asynchronous and synchronous channels [Warkentin, et al., 1997], and then divided according to the three levels that Bos et al. [2002] defined: text, audio and video.

2.6.2.1 *Asynchronous*

Email is one of the most popular uses of asynchronous communication technology. On the one hand, it is easy to use, fast, enables the user to attach files, to send to one recipient or to many at one time, and is accessible to all [Lau, et al., 2000; Ashley, 2003; Wash & Maloney, 2007; Roth, 2010; Hosley, 2010; Ou, et al., 2013]. On the other hand, it can lead to miscommunications due to the lack of nonverbal cues and communication. We can easily overload an email communication with information, or send sensitive information to a third party in error. This technology is best used for exchanging information between several people and for sending attachments. It is also useful for quick updates or short requests.

Web pages allow anyone from anywhere, at any time, to access information about their team's work and download relevant documents [Ashley, 2003]. This communication channel, however, is one-way and no relationship or discussion can emerge from it. There is also a lack of transparency, since only the webmaster can publish information and documents. It is useful for sharing knowledge and information with people both inside and outside the team, and for public relationships.

Blogs (based on Web 2.0) allow people to self-publish ideas, knowledge, facts or anything else they wish [Ashley, 2003; Lu & Yeh, 2008; Van Zyl, 2009; Treem & Leonardi, 2012]. They resemble online journals that allow others to read, comment, add new ideas and share. Unlike web pages, they allow multi-way communication. Organizations can use blogs not only for problem solving and knowledge sharing, but also for people to share personal interests and information. Like email, however, blogs can lead to miscommunication due to the lack of nonverbal cues and communication.

Collaborative writing/online file sharing (based on Web 2.0) allows multiple people at different locations to work on the same document simultaneously [Lau, et al., 2000; Ashley, 2003; Van Zyl, 2009; Passig & Schwartz, 2007]. This is an efficient and convenient way for several people to write or update a document. Like blogs, online collaborative writing facilitates multi-way communication. It can increase cooperation and stimulate people to meet deadlines.

Wikis (based on Web2.0) can be used by team managers to create a place where team members can store documents, share information and collaborate with one another [Kim, 2001; Van Zyl, 2009; Treem & Leonardi, 2012]. Unlike web pages that only allow the webmaster to post documents or information, wikis allow anyone in the team to do so, and enable multi-way communication. They are useful for increasing information/document sharing and collaboration. In many ways, wikis resemble blogs. However, unlike blogs, which also serve as places for sharing personal interests and opinions, wikis are more task-oriented.

Forums (existed prior to Web2.0 but have improved with it) allow team members to hold conversations in the form of posted messages [Ou, et al., 2013]. Unlike chat rooms, forums archive messages for as long as needed. All team members can see one another's posts for complete information transparency. This channel can be used to develop long distance brainstorming, to leave messages within the team, and to share and develop ideas.

Social networking (based on Web 2.0) is similar to websites and other applications that enable users to communicate with each other by posting information, comments, messages, images, video and more [Treem & Leonardi, 2012]. This channel is useful for creating communities of experts or of people with similar interests, but it is also a fundamental tool for improving social bonds between the members of a group by allowing them to share their interests and personal information, thereby developing social interactions and personal relationships.

Voice mail has the advantage of conveying the sender's tone, which adds the dimension of vocal cues [Lau, et al., 2000], thereby reducing the risk of misinterpretation, as compared with email. This channel is recommended for sending short messages over different time zones.

Video streaming helps team managers or members express themselves through video [Ashley, 2003]. This channel is excellent for team training, since team members can watch their colleagues or manager explain a topic, rather than merely viewing a presentation. The disadvantage of this channel is that teammates cannot ask questions. The main advantage is that anyone can view the video at any time, irrespective of time zones.

2.6.2.2 *Synchronous*

Chat/instant messaging allows two or more team members to communicate simultaneously [Lau, et al., 2000; Ashley, 2003; Roth, 2010; Hosley, 2010; Ou, et al., 2013]. This channel facilitates the sharing of information on low-complexity issues, and is therefore useful for simple decision making. Like other text channels, its chief disadvantage is the lack of visual and audio cues.

Electronic meeting systems help to improve creative problem solving and decision-making [Lau, et al., 2000; Roth, 2010]. This medium helps increase participation and meeting quality, and represents a more official meeting format than chat/messaging, but still suffers from the same drawbacks as text channels.

Phone/VoIP is also a common means of communication. Phone calls are easy to use and thanks to advances in mobile phone technology, everyone has a phone nowadays [Lau, et al., 2000; Roth, 2010]. Costs, which were once prohibitive, have dropped, even for international phone calls. The major drawback, however, is the lack of visual cues. Team members who are not fluent in English, for example, would find communication in this medium challenging. However, it is ideal when urgent issues arise, when a face-to-face discussion with a fellow team member is not possible, and for conversations intended to motivate and support.

Conference calls are an easy method for communicating with multiple team members simultaneously [Ashley, 2003]. However, different time zones must be taken into consideration—and these can pose a serious challenge. Also, as with phone/VoIP, team members who are not fluent in the language used in the call would find it hard to participate. This medium is useful for tasks such as coordination when urgent issues arise, and for decision making. On a social level it can help foster team motivation by developing social relationships. This is a convenient means for regular team meetings, but someone must be responsible for summarizing the call/meeting.

Table 3 – ICT Channels based on Kauffmann and Carmi [2014]

		Technology	Some of relevant Advantages	Some of relevant Disadvantages	Useful for
Asynchronous	Text	Email	accessibility, easy to use, easy and quick attachment sending, Can send to specific persons (one or many)	Miscommunications, Information overload, mistakenly information sends	Information exchange, Document sharing, quick updates, short request
		Web Pages	accessibility, easy to use, Cheap	One way communication, Relationship and Discussion lack, limited person can post	One way knowledge, Document and information Sharing, Updates
		Web Blogs	Multi-Way Communication, anyone can post and react	Miscommunications, Irrelevant information and Information overload, Employee can spend too much time on posting	Problem solving and knowledge sharing, personal interest and opinion sharing
		Collaborative writing and Online Shared files	Multi-Way Communication, increase cooperation and stimulate to reach deadline	Miscommunications, Task oriented only	Sharing, Developing and updating Document
		Wikis	Multi-Way Communication, anyone can post, stimulate collaboration	Miscommunications, Employee can spend too much time on posting	Document storing and sharing, Information sharing, Social interaction
		Forum	Multi-Way Communication, Cheap	Miscommunications, Employee can spend too much time on posting	Problem solving and knowledge sharing,
		Social Networking	Multi-Way Communication, anyone can post and react	Miscommunications, Employee can spend too much time on posting	Personal interest and opinion sharing, Social interaction
	Audio	Voice mail	Cheap, easy to use	On way communication, Relationship and Discussion lack,	Quick updates, Short request
	Video	Video Streaming	Cheap, easy to use	On way communication, Relationship and Discussion lack,	Knowledge sharing
Synchronous	Text	Chat/messaging	Can be One on One or Multi-Way Communication,	You need to be able to type and read fast. Lack of Audio and Visual cue	Short factual messages, Simple Decision Making, Social interaction
		Electronic meeting systems	Multi-Way Communication, Increase creativity, participation, quality	Lack of Audio and Visual cue	problem solving and decision-making
	Audio	Phone/VOIP	One to One Communication Audio cue	Cost of VOIP tech., Can be a problem for people who are not no-fluent in English (for example)	Decision Making, Motivation and Commitment, Social interaction
		Conference-Call	Multi-Way Communication, Audio cue	Cost of VOIP tech. Unequal Participation (for not fluent foreign language people for example)	Decision Making, Motivation and Commitment, Social interaction
Video	Video Conference	Multi-Way Communication, Audio and Visual cue, The closest to Face to Face meeting	Cost, Unequal Participation (for not fluent foreign language people for example)	Decision Making, Motivation and Commitment, Social interaction	

Video conferencing is considered the closest communication channel to actual face-to-face meetings [Lau, et al., 2000; Ashley, 2003; Roth, 2010]. It is the preferred method for forging strong relationships, for open discussion, decision making and problem solving. It is also a useful means for getting to know new members. This is the best alternative to actual face-to-face meetings. Although there is no lack of audio and video cues, members who are not fluent in English may be reluctant to participate.

A summary of all ICT channels, including some relevant advantages and disadvantages, and their best uses have been grouped in Table 3 [Kauffmann & Carmi, 2014]

2.7 Team Leaders

2.7.1 Team Leader theories

If traditional leadership theories (the leadership traits approach, the behavioral approach, and the contingency or situational school of thought) are analyzed, it is hard to find a theory relevant to the team leader. Most people confuse the team leader's task with leadership in general: "Corporate leaders must orchestrate the performance-driven pursuit of long-term visions and strategies by hundreds, thousands, or even hundreds of thousands of people..." [Kazenbach & Smith, 1994]. These traditional theories and models have dwelt on the leader as a figure who stands out from the rest by being somehow different and "leading" everyone else [Bolden, et al., 2003]. This was supported by Zaccaro, Heinen, and Shuffler [2009] who noted that traditional leadership models tend "not to make the distinction between leader–subordinate interactions and leader–team interactions."

Therefore, the definition of the team leader that is used in this study was based on the functional leadership theory [McGrath,, 1962]. According to Morgeson et al. [2010], this theory is the most prominent and well-known team leadership model. Bell and Kozlowsky [2002] and Zaccaro et al. [2001] also supported this observation. This theory suggests that the leadership role is "to do, or get done, whatever is not being adequately handled for group needs" [McGrath,, 1962]. Morgeson et al. [2010] defined team leadership as "...oriented

around team need satisfaction [with the ultimate aim of fostering team effectiveness]".

2.7.2 Team Leader functions and roles

Several studies have focused on understanding the principal functions of the team leader. Zaccaro et al. [2001] defined this leadership as social problem solving, where leaders are responsible for (a) diagnosing any problems that could potentially impede group and organizational goal attainment, (b) generating and planning appropriate solutions, and (c) implementing solutions within typically complex social domains. Bell and Kozlowsky [2002] split the team leader function into two primary categories: (a) the development and shaping of team processes, and (b) the monitoring and management of ongoing team performance. Morgeson et al. [2010] identified 15 different team leadership functions: compose the team, define the mission, establish expectations and goals, structure and plan, train and develop the team, employ sense-making, provide feedback, monitor the team, manage team boundaries, challenge the team, perform team tasks, solve problems, provide resources, encourage team self-management, and support the social climate. Earlier, Fleishman et al. [1991] also categorized the principal functions of the team leader with four superordinate functions and 13 subordinate functions. All these studies show that, on the one hand, team leaders must act as managers and be task-oriented [Gray, 2004], and on the other hand they must act as leaders and be people-oriented [Abbas & Asghar, 2010] in order to extract better performance and effectiveness from their teams. In their model of leader performance functions, Zaccaro et al. [2001] also referred to two task-oriented processes (team cognitive and coordination process) and two relationship-oriented processes (team motivational and affective processes) as necessary for team effectiveness.

2.7.3 Team Leaders as Mentors and Facilitators

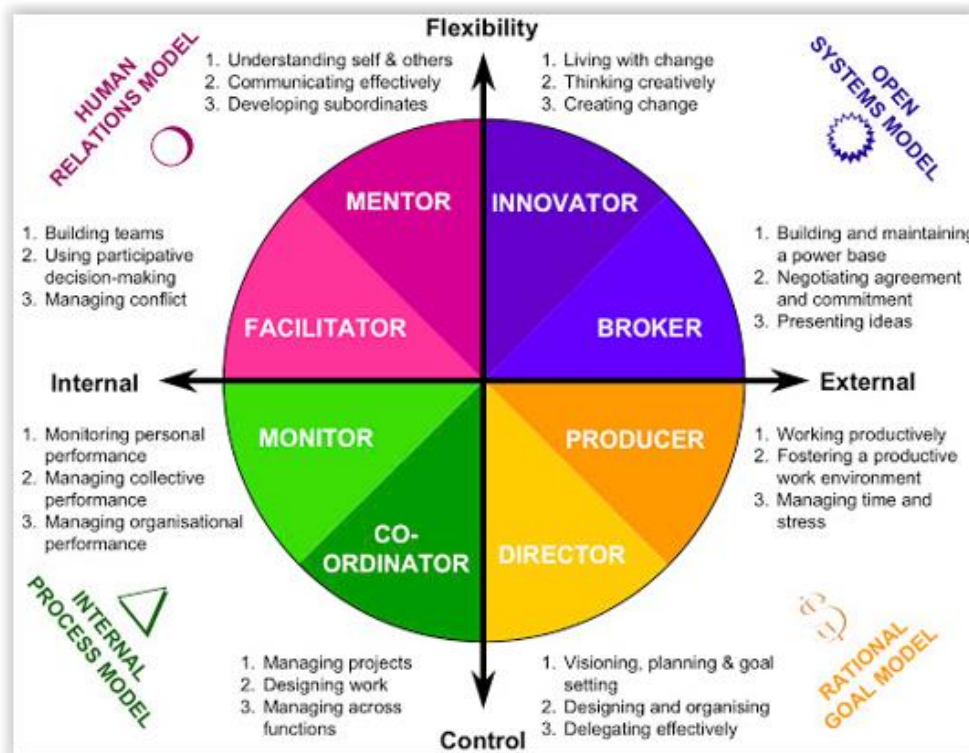
Beyond the argument that having cognitive and affective trust in the team leader results in improved team performance [Schaubroeck, et al., 2011], team leaders must foster a climate of trust among their team members. In her research,

Webber [2002] argues that team leaders are important agents for creating a climate of trust within their teams. Several years ago, Thomas and Bostrom [2008] conducted research based on McGregor's [2006] Theory X and Theory Y, where Theory X describes the mind-set of managers which will lead them to treat their employees as unmotivated ones who must be supervised, commanded and controlled by them. In contrast, Theory Y describes the mind-set of managers which leads them to treat their employees as self-motivated workers with whom they must improve, mentor and nurture the relationship. Their study demonstrates that Theory Y managers lead their teams by "linking actions", whereas Theory X managers lead their teams by "forcing action". They conclude that both methods have a positive impact on trust and collaboration among team members. In other words, the most important factor for trust-building within a team is the team leader's actions toward building trust, whether the method employed is "linking actions" or "forcing action". It is therefore inevitable that some trust-building actions will be based on commands and controlling actions, whereas others must improve and nurture relationships. Several scholars have identified the traits that enable leaders to influence their environment as emotional intelligence, behavior and personality. The team leader's emotional intelligence, behavior and personality can foster a positive team climate [Liu, et al., 2012] and have a positive impact on team trust, communication and engagement [Druskat & Pescosolido, 2008]. In a virtual environment, team leaders will need to improve the trust climate by adapting their behavior and using information and communication tools in order to express their personality and to use their emotional intelligence. It is therefore essential that they learn to master these tools.

Quinn, et al. [2010] argued that there are eight managerial roles for team leaders on their way to becoming a master manager (Figure 3). Two of these managerial roles have them acting as a mentor and a facilitator based on the Human Relations Model. As mentors, team leaders need to develop subordinates and to communicate effectively. Team leaders also need to teach and encourage teammates to communicate effectively. As facilitators, they need to build the team, to encourage decision making and resolve team conflict. Trust is an element of team building, and decision making and team conflict management

are part of team collaboration.

Figure 3 - Quinn et al. [2010] Model



Sivunen A. [2008] conducted research on the communication of leaders in virtual teams. The fourth finding of her research was that virtual team members expect their team leaders to give instructions on the use of communication technology and computer-mediated communication practices in general. DeRosa and Lepsinger [2010] and Duarte and Snyder [2011] also defended this argument and claimed that team leaders have an impact on their teams' communication skills.

Webber [2002] examined the challenges faced by Cross-Functional Teams and why these challenges facilitate the need for development of a team climate of trust. On the one hand, Cross-Functional Teams differ from Virtual Teams, as Virtual Teams have common goals while Cross-Functional Teams can have different goals. On the other hand, they have much in common like not working in the same space and time. Webber [2002] concludes that team leaders are major agents for building quick trust within teams. Hsu [2006] supported the hypothesis that the relationship between transformational team leadership and team trust has

a significant correlation in software development teams, and also supported Webber's argumentation about the positive correlation between team leaders' behavior and team trust. The importance of team leaders as mentors and contributors to the virtual team's trust level has also been outlined by DeRosa and Lepsinger [2010], Duarte and Snyder [2011] and Zofi [2012]. They argue that the virtual environment makes their roles in trust building more crucial than a regular team.

2.8 Conclusion

In this chapter, a literature review of the current knowledge and theories relevant to the research area was given where the four major concepts used in this study were elaborated upon, which are: virtual teams, interpersonal communication, interpersonal trust and collaboration.

In addition, this chapter included two more sub-sections to get a broader view of the research environment which are: ICTs and team leaders.

Chapter 3 – Conceptual Framework

3.1 Introduction

The key factors for a successful team in general and a virtual team in particular are high levels of trust, clear communication, strong leadership and appropriate levels of technology [Bergiel, et al., 2008]. The aim of the study is to help team leaders and organizations to get a better understanding of the communication and trust processes in the development of collaboration and to allow them to use ICTs in a more efficient way.

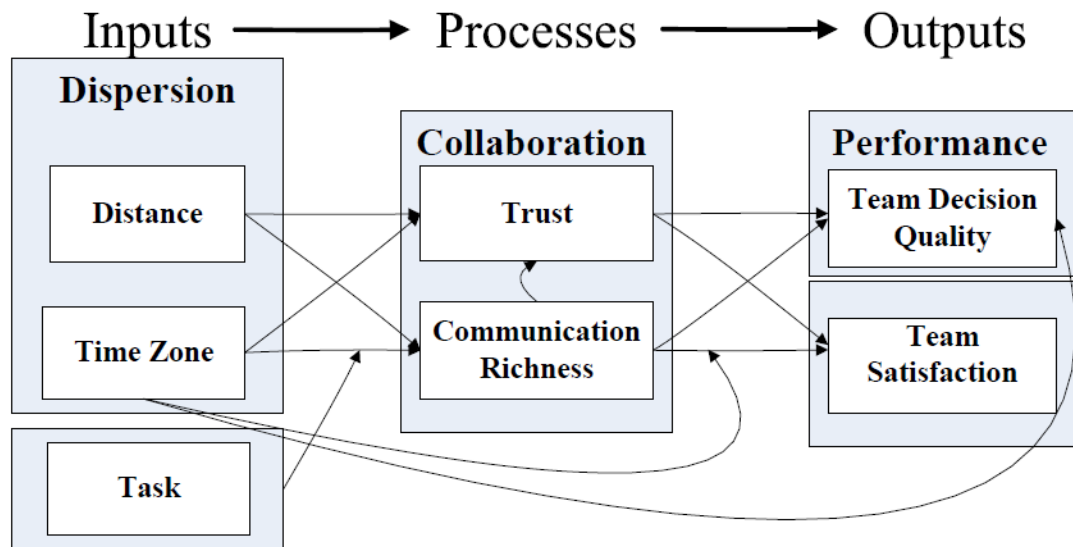
3.2 Temporary teams versus ongoing teams

Time has an effect on interpersonal relationships, therefore, the levels of trust, communication and collaboration will be affected depending on the type of virtual team (temporary or ongoing). Ongoing virtual teams tend to be more focused on interpersonal relationships than temporary ones [De Jong & Elfring, 2010]. The level of trust in an ongoing team is expected to be significantly higher than in a temporary team, because trust is assumed to develop gradually over time [Mayer, et al., 1995]. The same applies to communication skills that are also developed gradually over time [Webb, 1975], and therefore a higher level of communication is also expected in an ongoing virtual team [Misiólek, et al., 2012]. Because an ongoing virtual team will establish deeper trust and develop communication patterns [Saunders & Ahuja, 2006] and because collaboration is reliant upon trust [Johnston, et al., 2004] and communication [Hosley, 2010], the level of collaboration is also expected to be higher in ongoing virtual teams.

3.3 Communication, Trust, Collaboration and the relationship between them

In 2010, Roth conducted research to analyze Virtual Team Effectiveness as a Function of using Computer-Mediated Communication (Figure 4). His model was formed with three main parts: Inputs, Processes and Outputs.

Figure 4 - Roth's Model [2010]



The collaboration process is characterized by trust and communication richness, while communication in virtual teams is mostly if not entirely based on Computer-Mediated Communication. Roth explores the links between Inputs, Processes and Output but does not explore the links between Communication, Trust and collaboration (his hypothesis only proposed a link between communication and trust). The present study intends to explore the connections between these three variables.

3.4 Communication and Trust relationship

Communication plays an important role in the development of a trusting environment. According to the results of their study, Javenpaa and Leidner [1999] observed that in a global virtual team: "Trust might be imported, but is more likely created via a communication behavior established in the first few keystrokes. Communication that rallies around the project and tasks appears to be necessary to maintain trust. Social communication that complements rather than substitutes for task communication may strengthen trust". In making this comment, Javenpaa and Leidner [1999] were arguing that communication is an antecedent to trust and, more specifically, that task communication is necessary to maintain trust and that relationship communication is not only a necessity like task communication but could also strengthen that trust. Task and relationship communication will

have different impacts on the trust environment. The effect of social communication on trust is also supported by Remidez and Jones [2012], who claimed that when communications are delivered through social media, they are potentially a valuable resource for developing trust between team members. Therefore, it is important for team leaders to understand the relationships among communication practices, trust development and the effect that social media have on them. A strong positive relationship between trust and communication was also observed in a study exploring the relationship between communication, commitment and trust in an organization [Zeffane, et al., 2011]. In that study, it is argued not only that communication is closely related to trust but that: "communication is a major predictor of interpersonal trust, therefore underpinning a one-way relationship between the two variables".

Within a virtual environment, trust is mainly created via communication behavior established in the first few keystrokes. To maintain this trust, it seems to be necessary for the communication to gather team members around the project and tasks. Social communication that complements rather than substitutes task communication may strengthen trust [Jarvenpaa & Leidner, 1999]. Kasper-Fuehrer and Ashkanasy [2001] argued that, without appropriate ICTs to communicate trustworthiness, trust building in a virtual organization is compromised. In Thomas's study [2010], sixty-four correlations were evaluated to determine whether a significant relationship existed between virtual team trust and the frequency of use of communication technologies. Most of the sixty-four correlations were found to be significant and thus the study validated the assumption of a significant correlation between several communication means and trust. However, some of these correlations were found not to be significant for certain communication means. In another study, Roth [2010] found a correlation between the richness of communication and the level of trust when the working hours and days of the team members overlap. However, it must be noted that no significant correlation was found in the opposite case where working hours and days of the team members do not overlap. Therefore, the relationship between the communication means and trust must be studied in greater depth, taking into consideration several factors. Some communication means could have

different impacts on trust as well as some external factors e.g. if working hours and days of the team members overlap or not.

Tucker and Panteli [2003] conducted a study within a global IT organization of 18 global virtual teams. The study involved interviews with individuals who were employed within a specific organization and who were part of culturally diverse, geographically dispersed and technology-enabled global virtual teams. They categorized the teams as high-trust teams and low-trust teams. They then divided their findings into three major factors: factors related to shared goals, power and communication behaviors. From their findings, it can be noticed that on the one hand, global virtual teams with high-trust used communication frequently include social interaction. On the other hand, teams with low-trust used communication less often with almost no social interest (Table 4). Indeed, the teams with high trust were more aware of using communication that suited other team members by taking advantage of face-to-face meetings and using synchronous communication when possible. Conversely, the low-trust teams did not place much consideration onto communication and time disparities.

Table 4 - Communication behavior in global virtual teams according to trust level

Communication	
High-trust Global Virtual Teams	Low-trust Global Virtual Teams
Face-to-Face where possible (computer-mediated communication)	Asynchronous CMC
Regular synchronous CMC	Adverse effects of time difference
Social interaction	Little or no social interest

Source: Tucker and Pantelli, 2003, p.91

It should be pointed out that the relationship between these two factors is more complex. Indeed, some studies also found trust or types of trust acting as a communication antecedent. Thus, even if Zeffane et al. [2011] argued that communication is a major predictor of trust, they also report that several studies found and argued that trust can affect communication. Therefore, it seems that some factors or types of communication are a consequence of trust (or types of trust) but other factors or types of communication are an antecedent to trust (or types of trust). For example, a study conducted by Kauffmann and Carmi [In

Press] found that communication can have a mediating effect between cognitive-based trust and affective based trust. Consequently, in this study Kauffmann and Carmi [In press], communication is anterior to affective-based trust but cognitive-based trust is anterior to communication. Thus, the relationship between communication and trust is complex and still unclear. For the purpose of this research and as a part of its framework, the theory of Javenpaa and Leidner [1999] that trust is mainly created via communication behavior was used.

3.5 Trust and Collaboration relationship

Trust has been identified by several scholars as an important ingredient in collaboration. In collaboration between two companies, trust has been found to be the primary basis for successful collaboration [Johnston, et al., 2004]. In their analysis, Johnston et al. [2004] found that there is a relationship between the degree of trust and the level of cooperation. This finding was confirmed by research conducted by Osman [2004] where he also argues that without trust, companies will not engage in business relationships at all. Thomas [2010] reported in her research on the effect of ICTs on trust in virtual teams that several researchers have indeed identified trust as a fundamental aspect of effective collaboration. During research on working teams, the impact of trust was tested according to several performance variables like "level of collaboration", "quality" and "timeliness". The variable most affected by trust was "level of collaboration" [Martínez-Miranda & Pavón, 2012]. This relationship between trust and collaboration has also been examined in virtual environments and the findings have confirmed that trust has a positive impact on collaboration in such environments also [Peters, 2003; Peters & Manz, 2007]. However, it is important to emphasize that the relationship between those two is also more complex. Indeed, when trust leads to collaboration, if the outcomes of this new collaboration are successful, then trusting attitudes are again reinforced. The relationship between them is not a simple unidirectional process from trust to collaboration, but is a cyclical process [Vangen & Huxham, 2003]. Yet for the purpose of this study, only the relationship between trust and collaboration is included in the framework.

As has been noted in the literature review section (Section 2.4.4), Lewis and Weigert [1985] defined two types of trust and that were applied to the organizational environment by McAllister [1995]. Therefore, this study analyzed separately the relationship between cognitive-based trust and collaboration as well as the relationship between affective-based trust and collaboration.

3.6 Communication and collaboration relationship

Research has found that communication and coordination are fundamental elements associated with the collaboration of virtual teams [Mattessich, et al., 2001; Qureshi, et al., 2006; Hosley, 2010]. According to Qureshi, Liu and Vogel [2004], effective collaboration is an outcome of successful communication in virtual teams.

Through effective communication, the team can share knowledge, solve problems, manage conflict, make decisions and be innovative. Hosley [2010] noticed that knowledge sharing as a part of collaboration requires communication in order to let knowledge flow among virtual team members. With extensive communication, analysis, deliberation and negotiation, the team members can work together to analyze and prioritize alternative solutions to problems and choose one alternative [Turban, et al., 2011]. Turban, Liang and Wu [2011] also argued that group decision making involves series of activities that need interactions and communication like deliberation, asking questions and collecting answers. Related to innovation and creativity, Osman [2004] claimed that one of the inputs for innovation is the need of communication to transfer knowledge across the virtual team.

Because ICTs are the main if not the only means for communication within virtual teams, the effective use of ICTs will have positive effects on collaboration where the type of media [e.g. synchronous and asynchronous technologies] and the purpose of the communication have impacts on the effectiveness of collaboration [Lau, et al., 2000; Qureshi, et al., 2006; Hosley, 2010]. Each type of technology has benefits and constraints due to the nature of the technology [Lau, et al., 2000; Kauffmann & Carmi, 2014]. In other words, various media meet differing needs for the purposes of collaboration.

As has been noted in the literature review section (Section 2.3.2), there are two types of communication that act out different aspects: task-oriented and social/ relationship-oriented [Jarvenpaa & Leidner, 1999; Lau, et al., 2000; Huang, 2010]. Therefore, this study analyzes separately the relationship between task-oriented communication and collaboration, and the relationship between relationship-oriented communication and collaboration.

This sub-section shows that an essential relationship exists between communication and collaboration. However, even if effective communication (both task-oriented and relationship-oriented) is a necessary antecedent to collaboration. It is not a sufficient condition [Cohen & Mankin, 1999]. Thus, the study examined the influence of another factor, trust, as a mediating factor between communication and collaboration.

3.7 Trust as a mediating factor for collaboration

Some scholars argue that trust has a direct, well-defined impact on collaboration and performance. In Trainer's [2012] definition, "Trust, or more precisely perceived trustworthiness, is a crucial ingredient of effective and productive collaborations". Others believe that the relationship is still ill-defined: "All these studies show evidence that, in some way, the trust relationship between the members of a work team affects the performance of the team in its tasks or activities" [Martínez-Miranda & Pavón, 2012]. In her research, Marguin [2010] brings together two different points of view held by academic studies about the relationship between trust and performance in virtual teams. The first point of view sees trust as an antecedent to success [DeRosa, et al., 2004; Sarker & Valacich, 2003]. The second argues that trust is a moderator-mediator factor and therefore has an indirect effect on success [Dirks, 1999; Dirks & Ferrin, 2001; Qureshi, et al., 2006; Brahm & Kunze, 2012]. The framework of this study was based on this second argument and referred to trust as a mediating factor which plays a role between communication and collaboration processes.

3.8 Conclusion

Based on the above theories concerning the distinction between temporary and ongoing virtual teams that emphasize the fact that ongoing virtual team will establish deeper levels of trust and more complex communication patterns than temporary ones [Julsrud, 2008; Saunder & Ahuja, 2006], the study assumed that the level of trust, communication and collaboration is higher in ongoing virtual teams than in temporary ones.

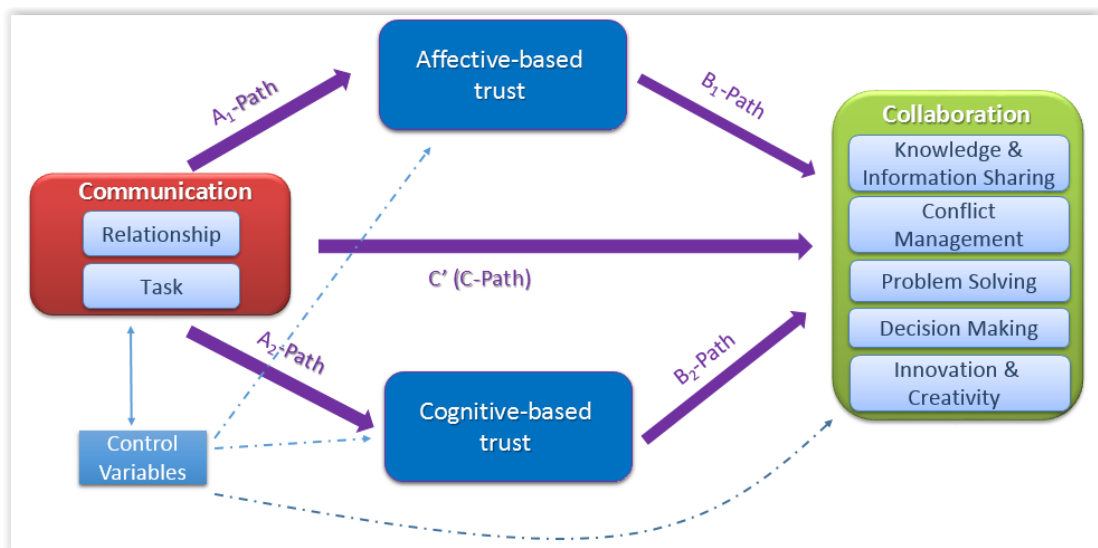
Further, based on the arguments that trust is a moderator and that communication, trust and collaboration are all linked [Roth, 2010]: communication is linked to collaboration [Mattessich, et al., 2001; Qureshi, et al., 2006; Hosley, 2010], trust to collaboration [Trainer, 2012; Martínez-Miranda & Pavón, 2012] and communication to trust [Roth, 2010; Thomas & Bostrom, 2008]. The study model which is based on this framework assumed that the two types of trust (both cognitive- and affective-based oriented) act as mediator factors between both task- and relationship-oriented communication and the five collaboration processes defined in this study.

Chapter 4 - Theoretical Model and Hypotheses

4.1 Research Model

The models, theories and research that have been raised in the framework chapter allow the presentation of a conceptual model to define the antecedents of collaboration and to help team leaders to improve virtual team collaboration through communication and trust (Figure 5).

Figure 5 - Research model



The model proposes that team leaders, by mentoring their virtual teams in the use of the right ICT channels and ways of communicating as well as by facilitating trust within their teams, can consequently improve the level of team collaboration. In order to accomplish it in the most effective way, team leaders will have to take multiple factors into consideration.

Firstly, the study claimed that a difference regarding the level of trust, communication and collaboration exists depending of the type of virtual team, the team leaders manage. The levels will be lower in temporary teams due to the fact that team members do not technically have the time and/or even the desire to develop trust, communication and collaboration with the other teammates. Consequently, team leaders will have to act and invest differently depending on the type of team. In temporary virtual teams they will have to find ways to

overcome this lack of time and desire. In ongoing virtual teams, they will have to invest in developing these factors over time.

Regarding trust, they will have to find the right balance in the development of team trust building between cognitive- and affective based trust. Cognitive trust, which is based on rational reasons for trusting another person, has been the subject of research into developing trust among temporary virtual teams. The principal theory based on cognitive trust is known as the "swift trust" theory. This theory, however, cannot properly address trust development in ongoing virtual teams. These teams, whose development is even more recent than that of temporary virtual teams, require more than swift trust alone—as would any long-term relationship. Swift trust alone is fragile and cannot be sustained over time. When working with ongoing teams, therefore, "emotional bonds" must be developed in order to build trust. These emotional bonds must be based not only on cognitive-based trust, but also on affective-based trust. Both types of trust must be fostered in an ongoing team if it is to maintain trust levels over time.

Regarding communication, team leaders will need to use the proper ICT channels and chose the right dosage of communication type (Task- and Relationship-oriented). As temporary teams do not have the time and/or desire to invest in interpersonal relationships, task-oriented communication is essential to accomplishing the job whereas relationship-oriented communication is less so. Moreover, as cognitive-based trust (and "swift trust") is based on rational roots, task-oriented communication is more dominant in its development. On the other hand, ongoing teams which are based on long-term relationships, in addition to the task-oriented communication to "do the job", will also need relationship-oriented communication to develop social bonds within the team. ICTs can facilitate both task-based and relationship-based communication. Of the large range of ICT channels, some are more suitable for task-oriented and some for relationship-oriented communication. Over the past few years, the developments of Web 2.0 technologies have added new communication capabilities. By understanding the different ICT channels, team leaders will be able to use them efficiently. They will be able to use the right channel at the right moment, depending on the message they seek to convey, and whether this message is

task-oriented or relationship-oriented.

For collaboration, due to the fact that differences in the levels of trust and communication are expected depending on the type of team, differences in the level of collaboration are also expected. Team leaders have to be aware that the level of collaboration in temporary virtual teams is expected to be lower. This could have an impact on the way team leaders choose to develop collaboration processes in general. And more particularly, it will depend on which processes of collaboration (i.e. knowledge and information sharing, conflict management, problem solving, decision making, innovation and creativity) they intend to develop for the success of their tasks or projects.

Secondly, the model claimed that a mediation relationship exists between these factors where trust is mediating the relationship between communication and collaboration. Through this mediation analysis, also including correlation analysis, the team leaders will be able to understand the relationship that exists between all these factors and therefore they will be able to choose the factors which should be developed, depending on the result to which they aspire. For example, if they need to develop affective-based trust, do they need to invest in the same way in task- and relationship-oriented communication or is one of them more dominant? This example, for instance, is related to correlation analysis. A second example, which is based on mediation analysis, could be that when team leaders need to develop the sharing of knowledge within the team to increase performance, they need to know which communication type is more dominant and which type of trust is better for mediating the relationship. The model is intended to help the team leaders make the optimal choice and the right decision about the time and method by which they will invest in each of these factors. Furthermore, the study claimed that the right dosage of factors to reach the desired result is also dependent on the type of team.

4.2 Hypotheses

Based on the current state of knowledge, preliminary research and what has been described above, the research hypotheses have been divided into three different groups.

The first group of hypotheses tries to define whether there are some significant differences between temporary virtual teams and ongoing ones related to the framework of this study. Thus, the first group of hypotheses required mean analysis of the different variables used in the present research. This set of hypotheses was divided into sub-sets according to the types of variables. The first sub-set dealt with trust variables (affective- and cognitive-based), the second with communication variables (relationship- and task-oriented) and the third and last with collaboration variables (problem solving, innovation and creativity, knowledge sharing, decision making, conflict management). Therefore, the following set of hypotheses was put forward.

For trust variables:

H1a: the level of affective-based trust is significantly higher in ongoing virtual teams than in temporary ones

H1b: the level of cognitive-based trust is significantly higher in ongoing virtual teams than in temporary ones

For communication variables:

H2a: the level of relationship-oriented communication is significantly higher in ongoing virtual teams than in temporary ones

H2b: the level of task-oriented communication is significantly higher in ongoing virtual teams than in temporary ones

For collaboration variables:

H3a: the level of problem solving is significantly higher in ongoing virtual teams than in temporary ones

H3b: the level of innovation and creativity is significantly higher in ongoing virtual teams than in temporary ones

H3c: the level of knowledge sharing trust is significantly higher in ongoing virtual teams than in temporary ones

H3d: the level of decision making trust is significantly higher in ongoing virtual teams than in temporary ones

H3e: the level of conflict management trust is significantly higher in ongoing

virtual teams than in temporary ones

The second set of hypotheses were proposed to get a better understanding of the effects of both affective-based and cognitive-based trusts on the relationship between relationship-oriented communication and each of the five processes of collaboration as defined in the study framework. They were also aimed at a better understanding of the trust effects (affective- and cognitive-based) between task-oriented communication and each of the five processes of collaboration. Based on the conceptual framework of the present study, it has been assumed that trust has a mediation effect between communication and collaboration. Hence, the following set of hypotheses was split into two sub-sets. The first one relates to relationship-oriented communication and the second one relates to task-oriented communication. The next stated set of hypotheses was:

For relationship-oriented communication:

H4a: cognitive- and affective-based trust mediates the relationship between relationship-oriented communication and problem solving.

H4b: cognitive- and affective-based trust mediates the relationship between relationship-oriented communication and innovation/creativity.

H4c: cognitive- and affective-based trust mediates the relationship between relationship-oriented communication and decision making.

H4d: cognitive- and affective-based trust mediates the relationship between relationship-oriented communication and conflict management.

H4e: cognitive- and affective-based trust mediates the relationship between relationship-oriented communication and knowledge sharing.

For task-oriented communication:

H5a: cognitive- and affective-based trust mediates the relationship between task-oriented communication and problem solving

H5b: cognitive- and affective-based trust mediates the relationship between task-oriented communication and innovation/creativity

H5c: cognitive- and affective-based trust mediates the relationship between task-oriented communication and decision making

H5d: cognitive- and affective-based trust mediates the relationship between task-oriented communication and conflict management

H5e: cognitive- and affective-based trust mediates the relationship between task-oriented communication and knowledge sharing

The last set of hypotheses proposed that the effect of cognitive-based trust and affective-based trust as a mediator between communication and collaboration is different depending on the type of team. Therefore, the last stated hypotheses were:

H6a: the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and solving problem.

H6b: the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and innovation/creativity.

H6c: the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and decision making.

H6d: the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and conflict management.

H6e: the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and knowledge sharing.

Chapter 5 – Methodology

5.1 Research Design: a mixed method sequential explanatory study

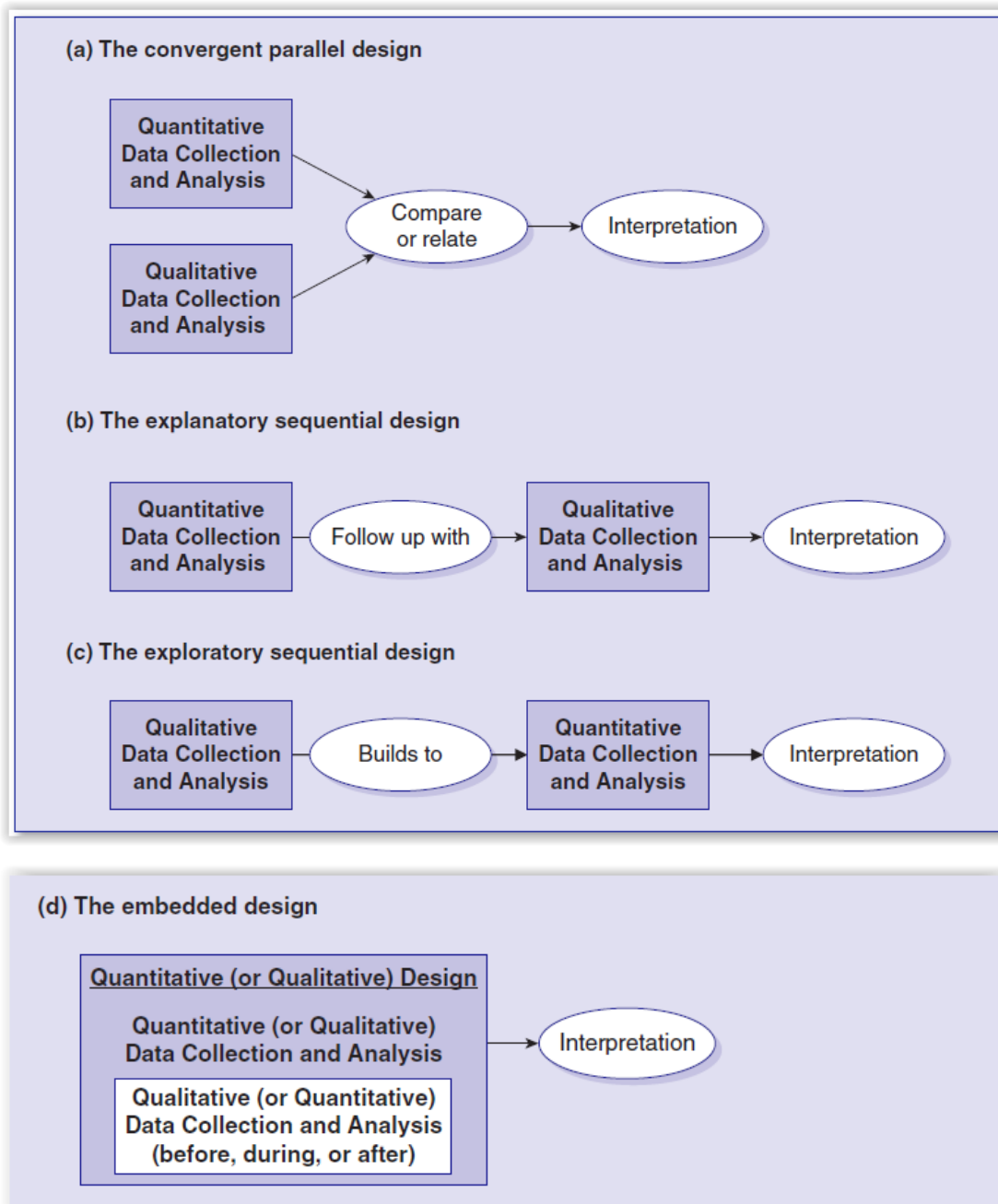
5.1.1 Introduction to Mixed research

The research employed the mixed method based on Creswell's research. This method improves understanding when quantitative (numbers, trends, generalizability) and qualitative (words, context, meaning) approaches offset the different weakness of the two approaches [Brewer & Hunter, 1989]. Hanson, Creswell, Plano-Clark, Petska, and Creswell [2005] maintain that both forms of data allow researchers to simultaneously generalize results from a sample to a population in order to gain a deeper understanding of the phenomenon of interest. If we are examining the same phenomenon using multiple perspectives that represent different but complementary views, then we are more likely to gain a better, more complete understanding [Hesse Biber & Leavy, 2008].

There are multiple types of mixed method research. Four of the major mixed method research designs described by Creswell and Plano Clark [2011] are: the convergent parallel design, the explanatory sequential design, the exploratory sequential design and the embedded design (Figure 6). Each of them can be appropriate depending on the aim of the research.

- The convergent parallel design's purpose is to get a more complete understanding of a topic or to validate/corroborate quantitative scales
- The explanatory sequential design's purpose is to explain quantitative results
- The exploratory sequential design's purpose is to test or measure qualitative explorative findings
- The embedded design's purpose, depending on the method used to conduct the research, is to conduct a preliminary exploration before an experimental trial or to get a more complete understanding of an experimental design or to follow-up explanations after an experimental trial.

Figure 6 - Mix method research designs [Creswell & Plano Clark, 2011]



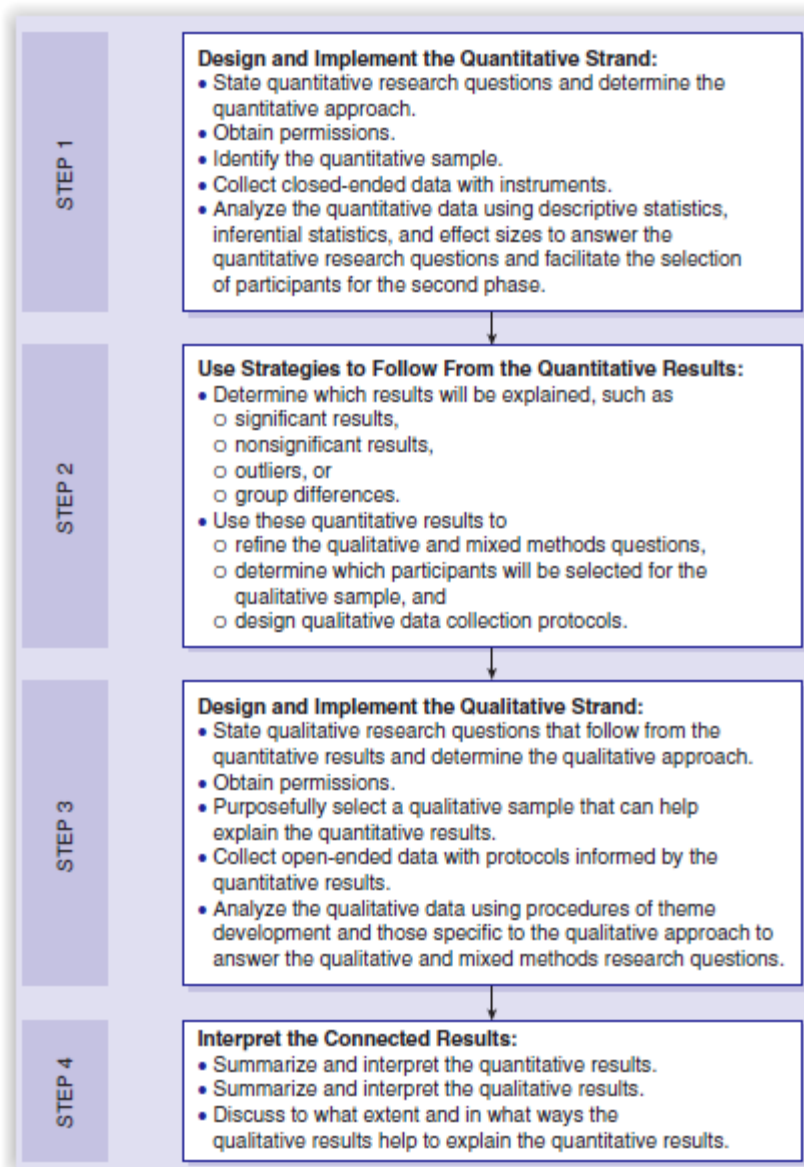
5.1.2 The explanatory sequential design

The explanatory sequential design is appropriate when the study needs qualitative data to explain significant (or insignificant) quantitative results, outlier results or surprising results [Morse, 1991]. "This design is most useful when the researcher wants to assess trends and relationships with quantitative data but also be able to explain the mechanism or reasons behind the resultant trends."

[Creswell & Plano Clark, 2011]. The design should be used when the research problems are more quantitatively oriented, when the important variables are identified and when quantitative instruments for measuring the relationship between the variables are available [Creswell & Plano Clark, 2011]. The first step is to design and implement a quantitative strand. This quantitative strand includes collecting and analyzing the quantitative data. Then, by identifying specific quantitative results, the researcher defines the findings that call for additional explanation. This step is the point of interface for mixing. These findings will provide a guideline to the development of the qualitative strand. From there, new qualitative questions will emerge and sampling procedures and data collection protocols will be defined. The qualitative phase is the result of the quantitative analysis. Finally, the qualitative data will then be interpreted for a deeper understanding of the quantitative findings (Figure 7).

The conceptual framework of this study is based on several empirical quantitative analyses and findings, such as a mean analysis of temporary virtual teams and ongoing virtual teams related to the three main factors (trust, communication and collaboration), the presence of correlation between these three factors and on the idea that trust can act as a mediating factor between variables. Therefore, the study started with quantitative research and analysis to highlight the difference between the two types of team and to highlight the relationship between the three factors based on the theoretical model. Then, essential unexpected results and significant results were identified. Through qualitative research, the study aimed to understand and explain the reasons for these results. Thus, the research questions are more quantitative oriented and the relevant variables have been identified. In addition, there are well known statistical and quantitative instruments to measure the relationship between the variables. Therefore the most suitable design for this study is the "explanatory sequential design".

Figure 7 - Explanatory Design Basic Procedures [Creswell & Plano Clark, 2011]



5.2 Data analysis methods

5.2.1 Quantitative Method

5.2.1.1 Likert Data

Since the development of the Likert scale [Likert, 1932], instruments to measure particular attributes or traits of individuals or groups have been developed by many researchers. The instruments usually ask respondents to give their level of agreement or disagreement, which can range from 1 to 5, to statements or questions relating to the attribute/trait being measured. One of the

controversies concerning the Likert scale is the type of analysis to be used – parametric or non-parametric. On the one hand, some researchers claim that only a non-parametric method is suitable because the Likert scale generates ordinal data. Likert scale data thus needs to be analyzed using rank based statistical procedures [Gardner & Martin, 2007]. On the other hand, some other researchers argue that even if Likert scale data is ordinal, parametric statistical procedures such as Pearson correlation coefficients and linear regression can be used with no fear of “coming to the wrong conclusion” [Norman, 2010]. This issue is critical because if the wrong statistical technique is used, the researcher increases the chance of coming to the wrong conclusion about the significance (or otherwise) of his research [Jamieson, 2004]. For this reason, during the preliminary quantitative tests described in the next chapter, the data was tested for parametric compliance, to see if it was possible to run parametric instruments such as linear regressions.

5.2.1.2 Mean and t-test Analysis

To validate the firsts hypotheses (H1 to H3), a comparison of the data between the two groups (temporary and ongoing teams) has been made. This allowed the author to find out whether there was a significant difference between these two groups. The t-test was used to discover whether there were statistically significant differences between the means of two groups using parametric data. Given that the two groups are unrelated to each other, the t-test appropriate to this analysis is the "independent sample t-test" [Cohen, et al., 2007]. In this test, one variable is categorical (temporary or ongoing) and the second one is a continuous variable (level of trust, communication and collaboration). The formula used calculates a statistic based on:

$$t = \frac{\text{Sample one mean} - \text{Sample two mean}}{\text{Standard error of the difference in means}}$$

First the test provides the average (mean) of the continuous variable for each of the groups. Then a significant statistical difference must be observed in

order to validate the hypotheses [Cohen, et al., 2007]. Given that the hypotheses assume not only that there is a difference but also that the mean of one group (the ongoing team) is higher than the other one (the temporary team), a one-tailed test was conducted [Field, 2009].

Beyond the fact that there is a significant difference between the means, there is another finding that is essential when studying the difference between two groups. This finding is the magnitude of the difference that can be expressed by the effect size of the mean difference [Coe, 2002]. To do that, we need to calculate the standardized mean difference between two groups by subtracting the mean of one group from the other ($M_1 - M_2$) and dividing the result by the standard deviation (SD) of the population from which the groups were sampled [Ellis, 2010]. There are different ways to calculate this and in the present study, Cohen's d effect size indexes were used [Cohen, 1988]. In order to calculate this, the formulas are:

$$\text{Cohen's } d = \frac{M_1 - M_2}{SD_{pooled}}$$

$M_1 = \text{Sample one mean}, M_2 = \text{Sample two mean}$

Where:

$$SD_{pooled} = \sqrt{\frac{(SD_1^2 + SD_2^2)}{2}}$$

$SD_1 = \text{Sample one Standard deviation}, SD_2 = \text{Sample two Standard deviation}$

5.2.1.3 Mediation Analysis

Many studies in the field of behavioral science aim to understand the relationship between independent variables and dependent variables. Defining the correlation between these variables is important but not always sufficient for understanding the real nature of the relationship [Preacher & Hayes, 2008]. Understanding the process by which independent variables influence dependent

variables in the social domain has been of interest to many researchers. Different approaches have been employed to help understand the psychological mechanisms which link these variables. The moderation approach is one of them but mediation is typically the standard for testing theories concerning processes [Rucker, et al., 2011]. The present study tries to provide a better understanding of the collaboration process within the virtual team, and the mediation model has been chosen to test the relationship between the different variables (trust, communication and collaboration).

Mediational hypotheses are hypotheses where it is assumed that the impact that an independent variable has on a dependent variable is mediated by the process of a mediating variable.

There are two types of mediation. The first is a full mediation of a variable on a relationship. In this case, if the mediating variable is non-existent between the independent and dependent variable, the relationship becomes insignificant. In other words, the relationship between the independent variables and the dependent variable exists only because the mediating variable is also present. The second type of mediation is partial. In this case, the mediating variable helps (or hinders) in the relationship between the independent variable and the dependent variable. The partial mediating variable allows a strengthening of the relationship. But if the partial mediating variable is non-existent in the relationship, there will still be a significant relationship between the independent variable and the dependent variable.

Baron and Kenny's [1985] procedures describe the analyses which are required for testing various mediational hypotheses.

The first step involved in Baron and Kenny's [1985] procedures is for the researcher to show that the independent variable correlates with the dependent variable. Thus, the first step in Baron and Kenny's [1985] procedures is to test for a significant relationship between the variables which may be mediated.

The second step described in Baron and Kenny's [1985] procedures is that the researcher must show that the independent variable is also correlated with the mediating variable.

The third step in Baron and Kenny's [1985] procedures is to show the

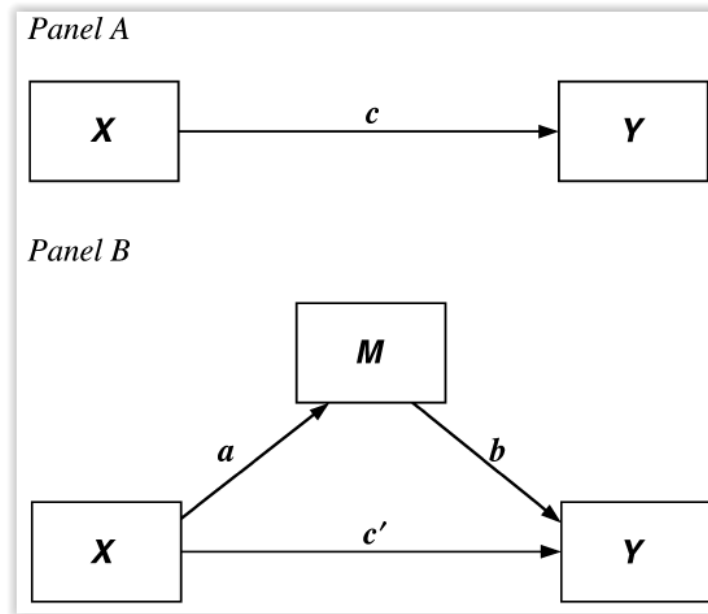
existence of a correlation between the mediating variable and the dependent variable. Thus, in Baron and Kenny's [1985] procedures, the independent variable must correlate with both the dependent variable and the mediating variable.

The last step for mediation analysis is conducted only if the first three steps have been validated. Then, the next step in Baron and Kenny's [1985] procedures is to regress the dependent variable on both the mediating variable and independent variable. In other words, confirm that the mediating variable is a significant predictor of the dependent variable, while controlling for the independent variable. In order to confirm that a mediating relationship could exist, a simple linear regression is also calculated between the independent variable and the dependent variable. If the coefficient of the independent variable is lower in the multiple linear regression of the dependent variable on both the mediating variable and independent variable than in the simple linear regression of the dependent variable on the independent variable, then a mediation relationship is assumed. To verify whether the assumed mediation is a full or a partial one, the researcher needs to check if the significance of the coefficient of the independent variable in the multiple linear regression is still significant ($r < .05$). If this is the case, the mediation is only a partial one and if it is not, then it is a full mediation.

The following example will illustrate the mediation model in a clear and simple way. X is an independent variable, Y is a dependent variable and M is suspected to be mediating the relationship between X and Y.

The first step is to show that the relationship between X and Y is significant, as in path c in Figure 8. The second step is to show that the relationship between X and M is significant, as in path a in Figure 8. The third step is to show that the relationship between M and Y is significant, as in path b in Figure 8. Finally, if after running a multiple linear regression of Y on both X and M, path c' is weaker than path c, then a mediation relationship is assumed. If path c' is still significant then mediation is partial. If path c' is not significant then full mediation is assumed.

Figure 8 - Mediation model from Hayes [2004]



Having tested the variables and having found that they meet Baron and Kenny's criteria for establishing mediation, a Sobel test is usually conducted to attest the validity of the conclusions reached. However, according to Hayes [2009], the Sobel test has a major flaw. The test assumes that the sampling distribution of the indirect effect is normal. Therefore, he advocates the use of a test such as the bootstrapping test that does not assume the normality of the sampling distribution. The SPSS macro [Hayes, 2014] employed in the present study uses the bootstrapping test which, in turn, uses re-sampling methodology. He also recommends a value of at least 5000 for re-sampling, which was the case in this study.

5.2.1.4 Correlation analysis

As was mentioned before, in order to test the mediation relationship between variables, the first stage is to test the correlation between them [Baron & Kenny, 1986]. Thus, for the next set of hypotheses (H4 and H5), a statistical technique for measuring the relationship between variables must be used. When a relationship exists between two variables, once one variable deviates from its mean then the other variable also has to deviate from its mean in either the same direction or the opposite one [Field, 2009]. A way of checking whether the

variables are associated is to check whether they *covary*:

$$cov(x, y) = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{N - 1}$$

$x =$ Variable one, $y =$ Variable two, $N =$ number of observation

Covariance allows one to assess whether two variables are related to each other. If the covariance is positive, then when one of the variables deviates from the mean, the other variable also deviates from the mean in the same direction. If the covariance is negative, then when one of the variables deviates from the mean, the other variable deviates from the mean in the opposite direction. But the covariance does not deal with one huge problem; it depends upon the scales of measurement used. Therefore, there must be standardization of the measures. To overcome the problem of dependence on the measurement scale, we need to convert the covariance into a standard set of units [Field, 2009]. The standardized covariance is known as a correlation coefficient and is defined by the following equation:

$$r = \frac{cov(x, y)}{S_x S_y}$$

$S_x =$ Variable one Standard deviation, $S_y =$ Variable two Standard deviation

This coefficient is known as the *Pearson correlation coefficient*. Statistical correlation techniques aim to answer three questions about the relationship between two variables [Cohen, et al., 2007]. The first question is "Does such a relationship exist between these variables?". If the answer is yes, the next question that needs to be answered is the direction of this relationship. That is, to find out whether the variables have a positive or negative impact one on another. And the last question that needs to be answered is what the strength of this relationship is, how much the variables influence one another. In the present study, the *Pearson correlation coefficient* r was used to measure the relationship between the variables.

5.2.1.5 Simple and Multiple Linear regression analysis

The second stage of mediation analysis, after testing the variables for correlation, is to test them with linear regression analysis. Correlation analysis measures the relationship between variables whereas regression analysis is a widely used statistical technique for predicting and forecasting the relationships between variables. Simple linear regression analysis is a powerful technique used for predicting an outcome variable from a predictor variable. Multiple linear regression analysis is a way of predicting a variable outcome from several predictor variables [Field, 2009].

More precisely, if X and Y are two related variables, then simple linear regression analysis helps to predict the value of Y for a given value of X or vice versa. Simple linear regression is based on models with just one independent and one dependent variable. The variable whose value is to be predicted is known as the dependent variable and the one whose known value is used for prediction is known as the independent variable. The line of regression of Y on X is given as $Y = i + aX$ where i and a are unknown constants known as the intercept and slope of the equation. This is used to predict the unknown value of variable Y when the value of variable X is known:

$$Y = i + aX$$

The coefficient of X in the line of regression of Y on X is called the regression coefficient of Y on X. It represents a change in the value of dependent variable Y corresponding to a unit change in the value of independent variable X. Once a line of regression has been constructed, one can check how good it is (in terms of predictive ability) by examining the coefficient of determination (R^2), also called the proportion of variance. R^2 always lies between 0 and 1. The closer R^2 is to 1, the better the model and its predictions.

In multiple linear regression, the principle is similar but the regression of the dependent variable is on several independent variables, therefore, the equation will be:

$$Y = i + a_1X_1 + a_2X_2 + \dots + a_nX_n$$

Regarding mediation analysis and according to Baron and Kenny's [1985] methodology, here are the simple and multiple linear regression equations where X is the independent variable, Y the dependent variable and M the mediation as shown in Figure 8 in the case of simple mediation analysis.

Where X significantly predicts Y:

$$Y = i_1 + cX$$

Where X significantly predicts M:

$$M = i_2 + aX$$

M significantly predicts Y controlling for X

$$Y = i_3 + c'X + bM$$

Where a, b, c and c' are the coefficients of the variables and are shown in Figure 8 as the path between the variables.

In cases of multiple mediation models, as in this study, where two variables are suspected of mediation, the multiple regression equation is simply:

$$Y = i_3 + c'X + bM_1 + eM_2$$

Where M₁ is one mediating variable and M₂ is the second one.

For the quantitative analysis, this study used a Likert scale as an ordinal method of collecting the data. Several statistical methods were used for validation of the hypotheses. For the hypotheses based on the study of the means, a T-test of two independent groups was conducted. For the hypotheses based on mediation analysis, Pearson's correlation analysis as well as simple and multiple linear regressions were conducted. The methodology used for the mediation analysis was based on Baron and Kenny's [1985] procedures.

5.2.2 Qualitative Method

The qualitative method used in the present qualitative study is thematic analysis. This method is a widely used means of analysis in qualitative research. Braun and Clarke [2006] defined thematic analysis as: "A method for identifying, analyzing and reporting patterns within data." (p. 79). Thematic analysis is a flexible method that can be used with any theory the researcher chooses. Through this flexibility, thematic analysis allows for rich, detailed and complex description of the data. This methodology has the advantage of providing core skills to researchers that will be useful for conducting many other forms of qualitative analysis. Qualitative methods are highly varied, complicated and nuanced [Hollway & Jefferson, 2000]. Therefore, thematic analysis, because of its flexibility and the benefit of providing core skills in the qualitative analysis world, should be seen as a foundational method for qualitative analysis [Braun & Clarke, 2006].

After becoming familiar with the data, researchers generate codes than define themes or patterns. There are two primary ways of identifying these themes or patterns within the data. The first is inductive, and this approach means that the themes are identified directly through the data itself and is not driven by theoretical interest in the area or topic. The second primary way is theoretical which, in contrast with the inductive way, tends to be driven by the researchers' theoretical or analytical interest in the area [Attride-Stirling, 2001; Braun & Clarke, 2006]. Because this study is an explanatory one, where the aim of the qualitative phase is to understand more deeply some results of the quantitative phase, the theoretical way was chosen as the thematic analysis approach for the identification of themes.

Braun and Clarke [2006] defined six clear steps for ensuring clarity and rigor in the process of thematic analysis. The six steps are:

1. Familiarizing yourself with your data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

This study used these six steps as an analysis methodology for the qualitative analysis and results phase. This followed a more detailed review of the methodology.

5.2.2.1 Step 1 - Familiarizing yourself with your data

This stage is about becoming very familiar with the data. It is crucial to become familiar with the depth and breadth of the content. Reading the data several times is the common way of becoming familiar with it. The reading has to be done in an active way where the researchers are already trying to search for meanings, patterns and so on. At this stage, it is recommended to take notes for initial ideas but not to start coding. In verbal data, the transcription implies close attention that may facilitate the close reading and interpretative skills needed to analyze the data [Lapadat & Lindsay, 2003]. However, in the present study, the data was collated as will be described later on, with a web survey. Therefore, no transcription was needed so it was imperative to spend time reading the data several times.

5.2.2.2 Step 2 – Generating initial codes

Only after having read and become familiar with the data, and having developed a preliminary list of ideas about the content of the data, can researchers produce initial codes.

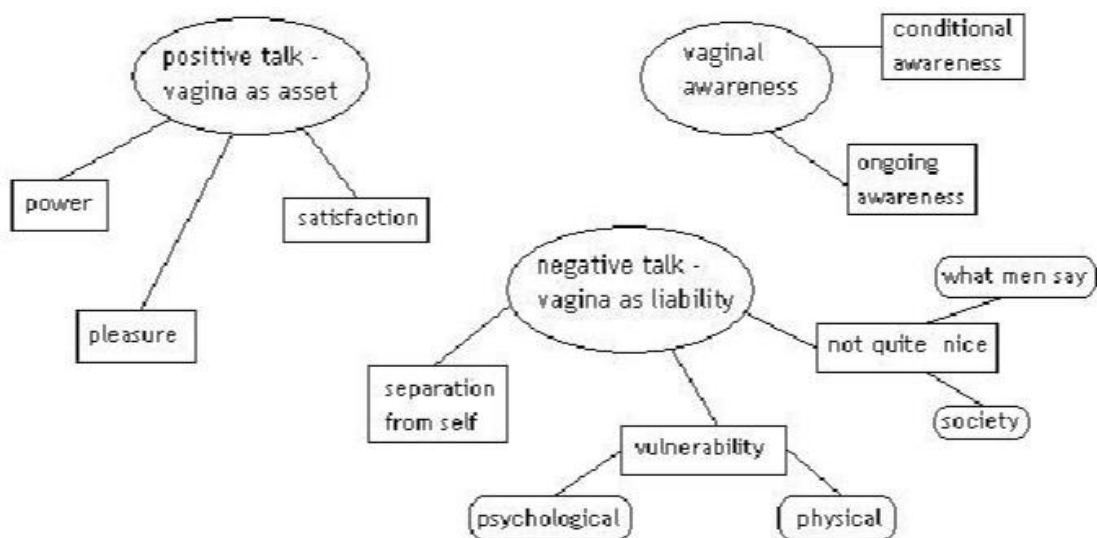
Coding is about identifying distinctive attributes or aspects that appear interesting to the study: "A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" [Saldana, 2009]. The codes refer to the most basic elements of information which can be assessed meaningfully as a phenomenon [Boyatzis, 1998]. Coding can either be done manually or through software. In this study, manual coding was used to analyze the data. The data was coded by writing notes on the texts and by using highlighters to indicate potential patterns [Braun & Clarke, 2006]. The act of coding requires filtering of the data through analytics lens [Saldana, 2009]. The framework of this study was used as an analytics lens where concepts like time,

distance, trust, communication, task and type of collaboration were analyzed. And finally, after all the data had been coded, the codes were collated.

5.2.2.3 Step 3 - Searching for themes

After completing the coding phase, collecting and combining them in proper order, the different codes were sorted into potential themes. The codes were then analyzed and the author considered how different codes may combine to form an overarching theme. In order to accomplish this step, Edraw mind map software [2015] was used to make visual representations which helped in sorting the different codes into themes. The software makes it easier to create mind maps, to visualize, to arrange and organize the codes. An example of thematic analysis using a mind map can be seen in Figure 9. At this stage and with the help of the software, the relationships between codes, between themes, and between different levels of themes (e.g. main overarching themes and sub-themes within them) were created. The author ended this stage with a collection of candidate themes and sub-themes along with all extracts of data that had been coded in relation to them. However, it was still unclear whether all the themes were to be held as they were, or whether some needed to be combined, refined and separated, or discarded. This analysis was conducted during the next phase.

Figure 9 - Thematic map showing three main themes [Braun & Wilkinson, 2003]



5.2.2.4 Step 4 – *Reviewing themes*

After devising a set of candidate themes, the refinement of those themes was necessary. During this stage, some candidate themes were eliminated due to the fact that there was not enough data to support them. Others were collapsed into each other and after that, seemingly separate themes were identified as one theme. And finally, others were broken down into separate themes. To achieve this stage, two levels of reviewing and refining of themes were involved. The first level involved reviewing the coded data extracts. Thus, all the collated extracts for each theme were re-checked and it was considered whether they appear to form a coherent pattern. Where the candidate themes did not fit, or the theme itself was problematic, or some of the data extracts within it simply did not fit there, it was necessary to rework the themes, creating new themes, finding a home for those extracts that did not currently work in an already-existing theme, or discarding them from the analysis. Once the candidate themes appeared to form a coherent pattern and a candidate "thematic map" was designed, the study moved on to the second level. Level two involved a similar process, but in relation to the entire data set. At this level, the study considered the validity of individual themes in relation to the data set, but also whether the candidate thematic map accurately reflected the meanings evident in the data set as a whole. Once the thematic map was in accordance with the theoretical and analytic approach of this study, the thematic map was considered as accurately representing the data set. The study could move to the next step.

5.2.2.5 Step 5 - *Defining and naming themes*

At this stage, once the thematic map had been deemed satisfactory, the themes were further defined and refined to identify the "essence" of what each theme was about (as well as the overall themes), and to determine what aspect of the data each theme captured [Braun & Clarke, 2006]. The aim of this step was to identify what was interesting about the data and why. As part of the refinement, the study identified whether or not a theme contained any sub-themes. This allowed the thematic map to be more accurate and to give a better understanding of the structure and hierarchy of the data. At the end of this stage, themes and

sub-themes were clearly defined as well as the relationship and hierarchy between them.

5.2.2.6 Step 6 - Producing the report

The last step was to do the final analysis and to write-up the report. The report was written in a manner so as to provide concise, coherent, logical and interesting answers to the questions that emerged from the quantitative analysis. The goal of these qualitative thematic analyses, as part of an explanatory analysis, was to provide a better understanding of the quantitative results.

Chapter 6 – Quantitative Phase

6.1 Data Collection

6.1.1 Data collection method

One of the popular methods of data collection in the social and behavioral sciences in both quantitative and qualitative research, has been and remains the survey. It is especially useful when the study requires the gathering of information from very large groups. With the development of internet technology, new methods of conducting surveys have appeared, with the two most common being the Email survey and the Web survey [Bajpai, 2011]. Being able to collect an individual's thoughts, interests, opinions, behaviors and attitudes in this format has advantages and disadvantages. The advantages include quick response times, elimination of interviewer bias, the lower cost of collecting data for international studies, easy follow-up and a better sense of anonymity for those responding [Weber & Bradley, 2006; Bajpai, 2011]. One of the most pronounced limitations applies to sampling bias, and concerns the lack of representation of certain subgroups or populations, specifically those who does not have access to computers. Because in this study the target population was working in a virtual environment, this limitation of web surveys was not applicable as virtual team members have access to computers as part of the communication means. Moreover, the advantages of electronic surveys have been shown to counterbalance the disadvantages and encourage the move from pencil-and-paper surveys to modern methods [Weber & Bradley, 2006]. The web survey site used in this study was Gizmo Survey (<http://www.surveygizmo.com/>) where closed-ended questions were developed, as describe below, for the quantitative phase.

6.1.2 Sample design

Most of the research on Virtual Teams has employed the convenience sample, where the researcher has selected a group of individuals [Thomas, 2010; Ustun & Pazos, 2012; Olson & Olson, 2012] or has chosen several virtual teams [Roth, 2010; Moore, 2007; Nemiro, 2001; Pangil & Chan, 2014] to survey.

Therefore, the results are limited to the specific group or team selected by the researcher. The convenience sample often suffers from a number of biases but also, since the sample is not chosen at random, the sampling is unlikely to be representative of the population being studied. This undermines the ability to make generalizations from the sample to the population studied. Instead of non-probability sampling techniques, a purposive sampling technique was chosen to focus on particular characteristics of a population that are of interest.

Therefore, the goal of the study was to have a maximum variation sample from several industrial sectors and not to be limited to specific groups and virtual teams. The basic principle behind maximum variation sampling is to gain greater insights into a phenomenon by looking at it from all angles.

In order to get a maximum variation sample and to collect data from team leaders and team members from different companies and industries working in a virtual environment, a method similar to that of McAllister [1995] was used. McAllister enrolled 194 managers and professionals, including men and women from various industries, at an executive Master's of Business (EMBA) program of a major university in Southern California. He also asked each individual to nominate peers from their workplaces to participate. To obtain a maximum variation sample, a self-selection sample was employed by publicizing the research via the researcher's Facebook and LinkedIn profiles and by asking the researcher's contacts who work in a virtual environment to complete the survey. The contacts were also asked to send the survey as a snowball sample to peers or friends working in a similar environment.

A total of 350 questionnaires were collected. 91 of them were discarded due to incomplete or erroneous responses. The final sample consisted of 259 completed questionnaires for the study from all over the world, except Africa (106 from North America, 3 from South America, 68 from Europe, 72 from Asia and 10 from Australasia). Most of the respondents worked in High-tech companies (about 85%) but some of them were also from Finance, Pharmaceutical and Health care, Marketing, Government, and several types of services industries. The High-tech companies' respondents worked in several High-tech sectors such as electronics, software, communication, hardware and services.

The survey included questions designed to obtain a description of the survey population. Four descriptive parameters were used: gender, team role and two choices of team type: temporary versus ongoing and local versus global. 34.7% of the respondents were women and 65.3% men. Team roles were split into Team Leaders or Managers, Team Members, and both. The result was 39% Team Leaders or Managers, 49% Team Members and 12% defined themselves as both. The next descriptive parameter was the type of virtual team, based on the distinction between temporary and ongoing virtual teams. The results revealed that 17% of the respondents worked in temporary virtual teams, 73.7% in ongoing virtual teams and 9.3% defined their teams as both temporary and ongoing. The final descriptive parameter was the distinction between global and local virtual teams. 20.8% of the respondents defined themselves as belonging to a local virtual team, 36.7% to a global virtual team, and the rest defined themselves as belonging to both kinds of virtual team (Table 5).

Table 5 - Group descriptive

		Frequency	Percent
Valid	Female	90	34.7
	Male	199	65.3
Total		259	100.0
Valid	Team Member	127	49.0
	Team Leader	101	39.0
	Both	31	12.0
Total		259	100.0
Valid	Temporary Team	44	17.0
	Ongoing Team	191	73.7
	Both	24	9.3
Total		259	100.0
Valid	Local Team	54	20.8
	Global Team	95	36.7
	Both	110	42.5
Total		259	100.0

6.1.3 Sample size

Statistical power analysis depends on the relationship between four variables: (1) the sample size is the number of observations used for calculating

estimates of a given population; (2) the probability level at which we will accept an effect as being statistically significant (the α -level); (3) the ability of a test to detect an effect of that size, that is, the statistical power (i.e. $1-\beta$); and (4) the effect size, which is a simple way of quantifying the difference between two groups. Thus, to evaluate the sample size for the study, the researcher needs first to determine the three other variables: that is, the significance criterion α , the power level $1-\beta$ and the desired effect size. Determination of an acceptable significance level for rejecting the null hypothesis, (i.e. the probability of committing a Type I error), is important. The standard values for the significance level are set at .1, .05 and .01 [Aczel & Sounderpandian, 2006]. The typical α -level used in psychology, social and behavior studies is .05 [Field, 2009; Lakens, 2013]. An α 's value of .05 corresponds to a 95% [$(1 - \alpha) = 0.95$] confidence level to reject H_0 [Aczel & Sounderpandian, 2006]. The power of the significance test ($1 - \beta$) is the probability of rejecting the null hypothesis when the null hypothesis is false. An acceptable level of power for psychology, social and behavior studies is 0.80 [Field, 2009; Lakens, 2013], making the Type II error four times as likely as the Type I error. Because it is typically more serious to make a false positive claim than it is to make a false negative claim, .80 is an acceptable level [Cohen, 1992]. However, a power of .80 is the recommended minimum, and a higher power such as .95 is more desirable, as long as it is practically feasible [Lakens, 2013].

. "Effect sizes are the most important outcome of empirical studies. Most articles on effect sizes highlight their importance to communicate the practical significance of results." [Lakens, 2013]. Effect size is a helpful way of evincing the importance of research findings and the magnitude of the effect [Field, 2009].

Cohen [1992] proposed effect size scales with three different indexes as conventions: small, medium and large. When choosing an effect size, researchers must decide how small a difference they are willing to accept while still finding the results worthwhile. To allow a very small effect size, a large sample is required, and to allow a large effect size, a small sample is required. The power of a test is proportionate to the sample size, with greater power from a larger effect size. A different value for effect size has been defined depending on the type of statistical test.

For the mean difference between groups Cohen [1988] defined a parameter named Cohen's *d*. For a value of .20, the effect size is small, for .50 it is medium and for .80 it is large [Cohen, 1992]. According to Cohen [1992], effect sizes for Pearson's *r* correlation is small at a value of .10, medium at .30, and large at .50. For multiple linear regression analysis, Cohen [1988] also defined a parameter named Cohen's *f*². According to him, if *f*² is equal to .02 the effect size is small, equal to .15 it is medium and equal to .35 large [Cohen, 1992]. All these values are gathered in Table 6.

Table 6 - Cohen's Effect Size measurement guidelines

Effect Size	Small	Medium	Large
Cohen's <i>d</i>	0.20	0.50	0.80
Pearson's <i>r</i>	0.10	0.30	0.50
Cohen's <i>f</i> ²	0.02	0.15	0.35

For the purposes of the present study, the level $\alpha = .05$, the most commonly designated value in social science research for this parameter, was used for the analysis of all the hypotheses. For the power level $1-\beta$, a value of .80 was used for hypotheses which compare two different types of groups (temporary and ongoing teams) (H1 & H6) and a value of .95 was used for the rest of the hypotheses. The reason was that for comparison between types of team, the sample was split at least in two (and therefore, the number of observations per group was smaller), thus the level was settled as recommended by Cohen [1992] and Field [2006] with a value of .80. However for the other hypotheses, the number of observations not being split into groups, the power level of confidence was settled at a level of .95 [Lakens, 2013].

Given that the value of α and β is known, effect size can be used to estimate how many participants we would need to detect that effect (based on the values of α and β that we chose). The effect size which this present study aimed to accomplish was at least a medium effect size, therefore, the effect size values used to evaluate the necessary sample size were as according Table 6. In order to compute the sample size required for this study, computer software named G*Power 3.1 was used. G*Power [Erdfelder, et al., 1996] was designed as a general stand-alone power analysis program for statistical tests commonly used

in social and behavioral research. Over the years, the software has improved with better effect size calculators and other capabilities. The software allows one to conduct statistical power analyses based on the four parameters: (1) the power level $(1-\beta)$ (i.e. Type II error probability), (2) the significance level α (i.e. Type I error probability), (3) the sample size and (4) the effect size [Faul, et al., 2007]. They used Cohen's definitions of small, medium and large effects as guidelines for effect size in the software. G*power 3.1 has five different statistical power analyses: (1) A priori analysis, (2) Compromise analysis, (3) Criterion analysis, (4) Post hoc analysis, (5) Sensitivity analysis [Faul, et al., 2009]. The detail of each type of analysis is reported in Figure 10.

Figure 10 - G*power statistical power analyses

1. *A priori analysis* (see Bredenkamp, 1969; Cohen, 1988). The necessary sample size is computed as a function of user-specified values for the required significance level α , the desired statistical power $1-\beta$, and the to-be-detected population effect size.

2. *Compromise analysis* (see Erdfelder, 1984). The statistical decision criterion ("critical value") and the associated α and β values are computed as a function of the desired error probability ratio β/α , the sample size, and the population effect size.

3. *Criterion analysis* (see Cohen, 1988; Faul et al., 2007). The required significance level α is computed as a function of power, sample size, and population effect size.

4. *Post hoc analysis* (see Cohen, 1988). Statistical power $1-\beta$ is computed as a function of significance level α , sample size, and population effect size.

5. *Sensitivity analysis* (see Cohen, 1988; Erdfelder, Faul, & Buchner, 2005). The required population effect size is computed as a function of significance level α , statistical power $1-\beta$, and sample size.

Two of these methods were used in the study. The first was "A priori analysis" to define the necessary sample size (Table 7), and it was used at this stage of the research. The second one is "Post hoc analysis" to determine the statistical power (1-β) of the final results, and it was used after the statistical data analysis of the quantitative data.

For the independent-samples t-tests that were conducted for the first set of hypotheses, α was set to .05, 1-β to .80 and the side effect to .5. The minimum sample size required according to G*power was: 64 for each group with a total of 128.

Then, for the rest of the hypotheses, correlation as well as simple and multiple linear regression analysis were conducted. For the correlation and simple linear regression analysis, α was set to .05, 1-β to .95 and the side effect to .3. The minimum sample size required according to G*power was: 115.

And finally, for the multiple linear regression analysis α was set to .05, 1-β to .95 and the side effect to .15. The minimum sample size required according to G*power was: 119 for a maximum of 3 predictors (one independent variable and two mediating variables). Tabachnick and Fidell [2007] also suggested a method for calculating the sample size where n should ideally be 50 + 8(k) for testing a full regression model or 104 + k when testing individual predictors (where k is the number of IVs).

The present research sample of 259 was well above all these requirements. However, for the two independent group t-test, the final power analysis was calculated with "Post hoc analysis" by entering the exact size of each group.

Table 7 - A priori analysis: sample size

Statistical test	Significance level α	Power Level 1-β	Effect size	Necessary Sample size
Two independent group t-test	.05	.80	.5	128 (64 +64)
Correlation and SLR*	.05	.95	.3	115
MLR**	.05	.95	.15	119

* Simple Linear Regression, ** Multiple Linear Regression

6.1.4 Preliminary tests

So that the different variables of the study could be measured, a scale built on several items for each variable was used. The number of items for each of the variables is detailed in Table 11.

The method used to build this scale is described in the next sub-section (Section 6.1.5). In order to assure a high level of reliability of the scale, the variables were preferably defined with items that had been previously used and tested in other research. Then some adaptations were made for the present study. However, two of the variables: Task- and Relationship-oriented communication were defined with a scale whose reliability had not been tested before. The items were mostly developed from a content analysis study [Kauffmann & Carmi, 2014] exploring how communication could improve trust among virtual teams to increase collaboration.

6.1.4.1 Question testing

In order to validate the quantitative survey, the first step was to send it to a test sample of five persons including both genders (male and female), from different industrial sectors and including native speakers and non-native speakers of English. Five persons from the researcher's close entourage were chosen. The link to the web-survey was sent to them and they were asked to answer the questions and provide comments (including grammatical and spelling corrections if needed). As a result of the comments, improvements in the formulation of questions as well as grammatical changes were made.

6.1.4.2 Likert data test for parametric variables

To be able to define whether trust acts as a mediator between communication and collaboration, Pearson Correlation analysis and Simple/Multiple Linear Regression analysis were used [Baron & Kenny, 1986; Preacher & Hayes, 2008]. This implies that Likert data were used as parametric variables. Therefore, it is essential for the present study to be able to determine with a high level of confidence that the use of parametric techniques is suitable. Murray [2013] conducted a study with the objective of determining whether the

type of statistical tests conducted on Likert scale data affects the conclusions. Parametric and non-parametric correlation techniques, such as Pearson and Spearman rho analysis, were used to test whether similar results are observed. The study showed very similar results in both the level of significance and the strength of the relationship. Thus, Murray's study was consistent with Norman's [2010] findings that parametric tests can be conducted on Likert scale data without drawing incorrect conclusions, but inconsistent with the claims of Gardner and Martin [2007]. In the present study, in order to have a high level of confidence that a parametric technique could be used and to avoid the risks of reaching incorrect conclusions, similar statistical tests were conducted on Likert scale data. For mediation analysis, the first stage being to check whether significant correlation is found between the different variables, both Pearson (as a parametric analysis) and Spearman rho (as a non-parametric analysis) tests were conducted. The findings were in agreement with the findings of Murray's study. The level of significance as well as the strength of the relationship between the variables were very similar. The correlation between all Communication variables and all Collaboration variables was highly significant ($p < .001$) for both Pearson and Spearman rho tests. The effect sizes were also very similar for each pair of variables with a maximum deviation for the Task-oriented communication and Problem solving variables where Pearson's $r = .618$ and Spearman rho = $.555$ (Table 8). The effect sizes in both tests are still considered as large ($r > .5$). The correlation between all Communication variables and all Trust variables was also highly significant ($p < .001$) for both Pearson and Spearman rho tests. The effect sizes were also very similar for each pair of variables with a maximum deviation for the Task-oriented communication and Affective-based Trust variables where Pearson's $r = .436$ and Spearman rho = $.374$ (Table 9). The effect sizes in both tests are still considered as medium ($r > .3$). The correlation between all Collaboration variables and all Trust variables was also highly significant ($p < .001$) for both Pearson and Spearman rho tests. The effect sizes were also very similar for each pair of variables with a maximum deviation for the Problem solving-and Affective-based Trust variables where Pearson's $r = .608$ and Spearman rho = $.557$ (Table 10). The effect sizes in both tests are still considered as large ($r > .5$).

According to these results, parametric techniques were used for the data analysis of the Likert scale data in the present study with no fear of reaching incorrect conclusions due to the use of these techniques.

Table 8 - Collaboration and Communication correlation comparison between parametric and non-parametric tests

N = 259		Statistical Tests	Communication	
			Relationship-oriented	Task-oriented
Collaboration	Problem solving	Pearson	.553***	.618***
		Spearman rho	.514***	.555***
	Innovation and Creativity	Pearson	.517***	.492***
		Spearman rho	.476***	.456***
	Knowledge sharing	Pearson	.438***	.505***
		Spearman rho	.418***	.471***
	Decision making	Pearson	.499***	.460***
		Spearman rho	.495***	.444***
	Conflict management	Pearson	.516***	.536***
		Spearman rho	.513***	.523***

*p < .05, **p < .01, ***p < .001

Table 9 - Trust and Communication correlation comparison between parametric and non-parametric tests

N = 259		Statistical Tests	Communication	
			Relationship-oriented	Task-oriented
Trust	Affective-based	Pearson	.667***	.436***
		Spearman rho	.669***	.374***
	Cognitive-based	Pearson	.489***	.455***
		Spearman rho	.458***	.405***

*p < .05, **p < .01, ***p < .001

Table 10 - Collaboration and Trust correlation comparison between parametric and non-parametric tests

N = 259		Statistical Tests	Trust	
			Affective-based	Cognitive-based
Collaboration	Problem solving	Pearson	.608***	.615***
		Spearman rho	.557***	.568***
	Innovation and Creativity	Pearson	.496***	.458***
		Spearman rho	.471***	.408***
	Knowledge sharing	Pearson	.424***	.516***
		Spearman rho	.387***	.504***
	Decision making	Pearson	.561***	.625***
		Spearman rho	.541***	.582***
	Conflict management	Pearson	.560***	.571***
		Spearman rho	.548***	.562***

*p < .05, **p < .01, ***p < .001

6.1.4.3 Cronbach's Alpha test

In order to estimate the reliability of a questionnaire scale, Cronbach (1951) came up with a measure that is loosely equivalent to splitting data in two in every possible way and computing the correlation coefficient for each split. The average of these values is equivalent to Cronbach's α . Different levels of reliability are required, depending on the nature and purpose of the scale, and a minimum level of .7 is usually recommended [Nunnally, 1978]. For example, the generally accepted value of .8 is appropriate for cognitive tests such as intelligence tests, while for ability tests a cut-off point of .7 is more suitable, and even values below .7 are acceptable when dealing with psychological constructs [Kline, 1999]. Such guidelines need to be followed with caution because the value of α depends on the number of items on the scale [Cortina, 1993]. Cortina [1993] explains that the more the number of items on the scale increases, the more α will increase, too. Low values under .7 are common in short scales (less than 10 items), moreover, α 's value tends to grow with the expansion of the samples. Therefore, during the preliminary test, a value below .7 was acceptable.

All items were tested with Cronbach's Alpha analysis for the measurement of the internal consistency of these variables (Table 11). The Cronbach's Alpha analysis was conducted at two different points of time. The first was after getting back 25 completed questionnaires in order to determine if changes were required.

And the second point was after collecting all the questionnaires to get the final Cronbach's Alpha analysis. Following the results of the preliminary Cronbach's Alpha analysis, the final Cronbach's analysis is developed further in the "measurement" section (Section 6.1.5).

6.1.4.4 *Preliminary Cronbach's alpha*

Trust items

Trust items were divided into two different variables in order to measure two different aspects of trust [McAllister, 1995]. The preliminary Cronbach's Alpha was calculated on each of these two constructs independently. After collecting the 25th first questionnaire, the α 's value for affective-based trust was .746. Therefore, the items for this construct seemed to be reliable. The α 's value for the cognitive-based trust was still higher than .6 but under .7 ($\alpha = .622$). However, since this construct had been previously tested, and since Cronbach's alpha values were dependent on the number of items in the scale, it was decided to retain these items for defining the variable, especially as the α 's value was expected to grow with the expansion of the sample.

Communication items

Because no previous scale was found in the literature that fitted the study's needs, it was decided to try to use a communication method for qualitative analysis and adapt it for quantitative measurement. The method is called the "Bales interaction process analysis (IPA) method" [Bales, 1951]. It consists of a content analysis coding scheme for task oriented and socio-relationship oriented messages. Based on this method, five items were developed for the task-oriented communication variables and five items for the relationship-oriented communication variables. The Cronbach's alpha values calculated after gathering 25 questionnaires were very low, respectively .514 and .499 for relationship-oriented and task-oriented communication. Therefore, it was decided to drop this scale and work on a new one. This time, a content analysis method from a study by Kauffmann and Carmi [2014] was also used. Five items were also developed for each of the communication aspects (relationship and task). Four of the

relationship-oriented items were inspired by Kauffmann and Carmi's [2014] study and one from the IPA method. For the Task-oriented items, all came from Kauffmann and Carmi's [2014] study. The α 's values calculated after 25 questionnaires were .779 and .808 respectively for relationship-oriented and task-oriented communication. This shows that the items were reliable, thus it was decided to retain these constructs for this study.

Collaboration items

Collaboration items were divided into five processes and each process comprised of four items. The preliminary Cronbach's Alpha was calculated on each of these five constructs independently. After collecting the 25th first questionnaire, one of the constructs was above .8, two were above .7 and two above .6 (Table 11). The three constructs above .7 (Innovation and Creativity, Knowledge Sharing and Conflict Management) were retained without hesitation based on Nunnally [1978] and Kline [1999]. For the two others (Problem Solving, Decision making), because they were close enough to the value of .7, because the construct had been previously tested, and because Cronbach's alpha values were dependent on the number of items in the scale and as the α 's value was expected to grow with the expansion of the sample, they were also retained.

Table 11 - Cronbach's Alpha reliability test

	Number of Items	Cronbach's Alpha with 25 respondents	Final Cronbach's Alpha
Trust Items			
Affective Trust	5	.746	.816
Cognitive Trust	5	.622	.834
Communication Items			
Relationship Communication	5	.779	.782
Task Communication	5	.808	.846
Collaboration Items			
Problem Solving	4	.668	.868
Innovation and Creativity	4	.748	.863
Knowledge Sharing	3(4*)	.769	.887(.865**)
Decision making	4	.696	.832
Conflict Management	4	.844	.873

* Knowledge sharing items were reduce from 4 to 3 as a result of the factor analysis

** Cronbach's α before reduction to 3 items

6.1.5 Measurement

In order to measure the variables in this study, several items based on previous research were developed. Five items were defined for each of the trust variables: Cognitive-based trust and Affective-based trust. Five items were also defined for each of the communication variables: Task-oriented communication and Relationship-oriented communication. For the collaboration variables, four items were defined for each of them (knowledge and information sharing, conflict management, problem solving, decision making, innovation and creativity). The values of the items were assets with Likert scale questions. Likert scales are commonly used to measure attitude, providing a range of responses to a given question or statement [Jamieson, 2004]. Typically, there are 5 categories of response, from (for example) 1 = strongly disagree to 5 = strongly agree, although there are arguments in favor of scales with 7 or with an even number of response categories [Cohen, et al., 2007]. Colman, Norris and Preston [1997] compare the rating scales of different lengths from 5 points to 7 points. The results of their study show a very high correlation between them ($r = .921$, $p < .001$) even though they conclude that the 7 point scale seems to be a little more accurate. Because of the large number of items in this study (40 questions) and because no real significant difference was found between 5 point scales and 7 point scales [Colman , et al., 1997], it was decided to use a 5-point scale so the questions would be less loaded and for it to be easier for the respondents to answer them.

6.1.5.1 Trust measure

For this study, cognitive-based trust and affective-based trust were assessed utilizing modified survey items originally developed by McAllister [1995]. This landmark study not only measured a variety of interpersonal trust variables but was the first to measure cognitive and affective-based trust factors. McAllister created eleven survey items (Figure 35) designed to assess levels of affective-based and cognitive-based trust, five for affective-based and six for cognitive based trust. Respondents were asked to rank their responses on a scale from 1 (strongly disagree) to 7 (strongly agree). This scale was used by several other studies, for example, studies conducted by Costigan et al. [2006]. They examined

the effects of an employee’s affective-based and cognitive—based trust of the supervisor on that employee’s enterprising behavior. For affective-based trust measurement, they took four items from the five that McAllister [1995] had developed and for cognitive-based trust measurement, they took five items from the six (Figure 36). They also changed the Likert scale from 7-point to 5-point. The Cronbach's Alpha value was for the affective-based trust items and for the cognitive-based trust items respectively, $\alpha=.88$ and $\alpha=.89$. In the present study, each type of trust was defined by five items (Table 12), where the reliability estimates (Cronbach's alpha) for cognitive-based trust measures was .834 and for affective-based was .816 (Table 11).

Table 12 - Affective and Cognitive trust items

Affective-based trust Items	
Q1	The team has a sharing relationship. We can freely share our ideas, feeling and hopes.
Q2	I can talk freely to a team member about difficulties I am having at work and know that s(he) is willing to listen.
Q3	Team members would feel a sense of loss if one of them was transferred and could no longer work with the team.
Q4	If I share my problems with a team member, I know (s)he would respond constructively and caringly.
Q5	I can say that the team members made considerable emotional investments in the team working relationship.
Cognitive-based trust items	
Q6	The team members approach their job with professionalism and dedication.
Q7	I have no reason to doubt the team members' competence and preparation for the job.
Q8	I can rely on the team members not to make my job more difficult by careless work.
Q9	Generally, team members, even if they are not close friends, trust and respect each other as coworkers.
Q10	Other employees who are not part of the team and who interact with it consider my team members to be trustworthy.

6.1.5.2 Communication measure

Unlike all other variables that were defined with scales tested in former studies to increase the chances of high reliability, a scale for Relationship- and Task-oriented communication that was fit for the purposes of the present study

could not be found in the literature. Therefore, in order to define the different aspects of Relationship-oriented and Task-oriented Communication, a former study [Kauffmann & Carmi, 2014] based on a literature review and content analysis was used. The study presented a list of factors which are essential for relationship-oriented communication on an affective/emotional basis (Figure 38) and for task-oriented communication on a cognitive basis (Figure 39). Four essential items were identified that define relationship-oriented communication and five for task-oriented communication according to the study. A fifth item was added for relationship-oriented communication from the "Bales interaction process analysis (IPA) method" (Figure 37). In all, five items were defined for relationship-oriented communication and five for task-oriented communication. The final reliability estimates (Cronbach's alpha) for Relationship-oriented communication measures was .782 and for Task-oriented communication .846 (Table 11).

Table 13 – Task and Relationship communication items

Relationship-oriented Communication items	
Q11	The team members show solidarity, give help or rewards to one another.
Q12	Team members are willing to share personal interests and information.
Q13	Team members take time to get to know each other as individuals and show interest in each others' personal lives.
Q14	Team members use communication channels for social interactions.
Q15	During meetings via electronic channels such as call & video conferencing, team members engage in small talk (phatic communication) with each other.
Task-oriented Communication items	
Q16	Team members report the progress of their work and give updates of the status of scheduled tasks.
Q17	Team members give suggestions, propose solutions or provide technical assistance.
Q18	Team members discuss common tasks and goals.
Q19	Team members coordinate tasks and activities.
Q20	Team members are apprised of the responsibilities, roles, competencies and skills of the other team members.

6.1.5.3 Collaboration measure

Problem solving items were taken from a revised and updated version of the Dutch Test for Conflict Handling (DUTCH) (Figure 40) designed by Van de Vliert

[1997]. Even though this test was developed by Dutch scholars, it is not necessarily applicable only to Dutch culture and can be generalized to other cultures [De Dreu, et al., 2001]. This test defines four items for problem solving measurement (Table 14). These items were used to assess the levels of collaboration in the working relationships between members of project teams in other studies. A study on conflict management's influences on individual wellbeing, group performance and organizational performance, used these four items with a 5-point scale. The Cronbach's alpha value found in this study was .81 [De Dreu, et al., 2001]. Another study also used these items but this time with a 7-point scale (Figure 41). The focus of this research was to study virtual team effectiveness and the Cronbach's Alpha value for these items was .91 [Peters, 2003]. The final reliability estimate (Cronbach's alpha) in this study for problem solving was .868 (Table 11).

The Innovation and Creativity items that were used to assess the variables were taken from Peters' [2003] study of virtual team effectiveness. The items (Figure 43) were developed from a study exploring the relationships between some of the various concepts and scales that have been used to characterize innovative attitudes and behaviors in organizations [Ettlie & O'Keefe, 1982]. Then, in 1999, Tierney, Farmer and Graen adapted four of the innovation and creativity items (Figure 42) from Ettlie and O'Keefe's study (1982) for their study on leadership and employee creativity. They use a 6 point Likert scale while Peters [2003] used a continuous scale (0 to 100). As mentioned before, the present study used a 5 point Likert Scale for all the items' variables. These four items (Table 14) were used in Peters' [2003] study and the alpha reliability for her study of these four items was .77. In the present study, the final alpha reliability value was .863 (Table 11).

Knowledge Sharing items are based on a study dealing with the process of knowledge sharing within virtual teams through group support systems [Samarah, 2007]. In order to determine his knowledge sharing items (Figure 44), Samarah [2007] used research on the use of collaborative electronic media (electronic mail, World Wide Web, list serves, and other collaborative systems) for sharing information in a large state university in Australia [Jarvenpaa & Staples, 2000].

He defined seven items, five of which were taken from his analysis of Jarvenpaa and Staples' [2000] study. Four of these five items (Table 14) which were the most appropriate to the study were taken and a 5-point Likert scale was used. After the extraction of one of his seven items, the Cronbach's Alpha was .873. The final reliability estimates (Cronbach's alpha) in this study of Knowledge sharing was .865 (Table 11).

Decision Making items were also taken from Samarah's study [2007]. Based on a former study [Paul, et al., 2004] (Figure 45), he identified four items while a fifth one was included for validity checks only (Figure 46). He got a value of .865 for the Cronbach's Alpha test of the first four items. The present study also used the first four items for the decision making variable (Table 14) while the final alpha reliability value was .832 (Table 11).

Conflict management items were taken from a study that suggests that managing conflict cooperatively facilitates effective problem solving for individuals [Tjosvold, et al., 2003]. In this study, conflict management was divided into two variables: cooperative and competitive approaches. The cooperative approach's variable was scaled with five items and the competitive approach with four (Figure 47). These items were developed from a series of experimental studies [Tjosvold, 1985] and from a questionnaire study on project managers [Alper, et al., 2000; Barker, et al., 1988]. The five items of the cooperative approach were found to be the most suitable for the study (Table 14). Tjosvold et al. [2003] defined this approach in the following way: "The five cooperative approach items measured the emphasis on mutual goals, understanding everyone's views, orientation toward joint benefit, and incorporating several positions to find a solution good for all". They used a 5-point scale to collect the respondents' answers, and the same scale was also used in the present research. The Cronbach's Alpha estimated for their study was .70, while in the present study, the final value was .873.

Table 14 - Collaboration items

Problem Solving items	
Q21	Team members examine issues until a solution is found that really satisfies all members
Q22	Each team member stands up for his or her own and the other members' goals and interests
Q23	Team members examine ideas from all sides to find a mutually optimal solution
Q24	Team members work out solutions that serve my own as well as the other members' interests as good as possible
Innovation and Creativity items	
Q25	My team demonstrates originality in its work
Q26	My team has found new uses for existing methods or equipment
Q27	My team has solved problems that have caused others difficulty
Q28	My team has tried out new ideas and approaches to problems
Knowledge sharing	
Q29	Team members are willing to share notes which they might have made during meetings (such as video or call meeting but also face-to-face meeting if applicable)
Q30	Team members are willing to explain to others certain aspect of team's tasks
Q31	Team members are willing to share what they know about the team's tasks
Q32	Team members are willing to share their knowledge to the benefit of the team
Decisions making	
Q33	The decisions made by my team are fair
Q34	The decisions made by my team are practical
Q35	I am confident that the final decision made by my team was the best decision
Q36	I feel that the quality of the group's decision would have positive effects on our team tasks/assignment
Conflict Management	
Q37	Team members encourage a "we are in it together" attitude
Q38	Team members seek a solution that will be good for all of us
Q39	Team members treat conflict as a mutual problem to solve
Q40	We work so that to every extent possible we all get what we really want

6.1.6 Parametric Assumptions

Many statistical tests are based on assumptions about the variables used in the analysis. Nevertheless, several researchers have tended to regard assumptions as rather tedious things about which no one really needs to worry. There are good reasons for taking assumptions seriously because when these assumptions are not considered the results may not be accurate, resulting in a Type I or Type II error, or the over- or under-estimation of significance or effect size [Field, 2009]. Osborne, Christensen, and Gunter [2001] argued that only a few studies have reliable conclusions after having tested the assumptions of statistical tests. Therefore, the validity of many results, conclusions and assertions in social science can be doubtful as we have no idea whether the assumptions of the statistical tests were considered [Osborne & Waters, 2002]. In the present study, two major types of parametric statistical methods have been used. The first is an independent-samples T-test and the second relies on simple and multiple linear regression. The Likert data has already been tested for reliability (Cronbach's α) and for parametric compatibility (based on Murray's methodology). The following sections present the tests that were conducted on the data for parametric assumptions depending on the type of statistical test used. describes which test was used according the assumptions and the statistical tests. This list of tests is based on several academic papers [Field, 2009; Osborne, et al., 2001; Osborne & Waters, 2002; Osborne & Overbay, 2004; Williams, et al., 2013; Cohen, et al., 2007]. A lot time was invested in the study to check whether the assumptions were complied with as well as data correction in the case of non-compliance detection. The reason why these tests were conducted was for the results and the conclusions of this study to be as much as possible accurate and trustworthy.

Table 15 - Assumption test for parametric analyses

Assumption	Independent samples T-test	Regression/Mediation
Normal distribution	Skew and Kurtosis analysis (Z-scores) Visual graph analysis: Histogram of the data with normal curve Q-Q plot of the data	Skew and Kurtosis analysis (values) Visual graph analysis: Histogram of the data with normal curve Q-Q plot of the data
No significant Outliers	Boxplot graph analysis Standardized values (Z-scores)	Boxplot graph analysis Standardized values (Z-scores) Standardized Residual
Homogeneity of Variance'	Levene's test	Scatterplot of Standardized Residual
Linearity	----	Scatterplot of Standardized Residual
Normally Distributed Errors	----	Histogram of the Standardized residual with normal curve graph analysis P-P plot of Standardized Residual
Multicollinearity	----	Tolerance and Variance inflation variance (VIF)
Independent errors	----	Durbin-Watson test
Non-zero variance	----	Variance descriptive box

6.1.6.1 Normal distribution

Some of the statistical procedures are parametric tests based on normal distribution. For the data to be parametric, some assumptions must be true. If the data are not parametric then the results are likely to be inaccurate. Normal distribution is a critical assumption that must be verified and tested. In order to be able to define whether the sample is normally distributed, the variable has to be tested for two aspects: Skewness and Kurtosis. These two aspects are ways in which a distribution can deviate from the norm: (1) lack of symmetry (called skew) and (2) pointiness (called kurtosis). There are two common ways of testing the variables for normal distribution [Field, 2009]. One of the ways is quantitative, where values of Skew and Kurtosis can be found with the help of software like IBM SPSS version 22.0 [IBM Corp, 2013] which was used in this study. The second method is to check normality visually. The quantitative method depends on the size of the sample. If the size is relatively small or medium, The Z-scores

for the two aspects are calculated where the recommended value for a Z-score is 1.96 (P=.05), for a large sample a value of 2.58 is recommended [Cramer, 1998; Doane & Seward, 2011; Field, 2009].

$$Z_{skewness} = \frac{S - 0}{SE_{skewness}} \quad Z_{kurtosis} = \frac{K - 0}{SE_{kurtosis}}$$

$Z_{skewness}$ = z-score of Skewness, S = Skewness, $SE_{skewness}$ = Standard deviation of Skewness

$Z_{kurtosis}$ = z-score of Kurtosis, K = Kurtosis, $SE_{kurtosis}$ = Standard deviation of Kurtosis

If the sample size is very large (over 200) it is more important to look at the Skew and Kurtosis values themselves rather than calculate their significance. It is recommended that the value of Skewness be between -1 and +1 (when values between -.5 and +.5 are considered as symmetric) and for the value of Kurtosis to be between -2 and +2 (when a range between -1 to +1 is preferable) [Bulmer, 1979; George & Mallery, 2010].

The normality of the distribution can also be approximately tested through visual inspection of graphs. The first graph is the histogram of the data with a normal curve and the second one is the Q-Q plot of the data. The histogram gives an approximate view of the distribution of the data. If the data is distributed symmetrically around the center, it can be assumed that the data has a normal distribution. The normal curve helps to analyze the histogram visually. The Q-Q plot graph plots the cumulative probability of a variable against the cumulative probability of a particular distribution. Hence, if values fall on the diagonal of the plot then the data is normally distributed, while deviations from the diagonal show deviations from normality.

In this study, the normality distribution test was conducted once as a Small/Medium sample size for the sets of hypotheses H1, H2, H3 and H6. The test was conducted a second time with a very large sample for the remaining hypotheses (that is the sets of hypotheses H4 and H5).

The first test was conducted with a sample of under 200 observations. For comparisons between temporary virtual teams and ongoing ones, the samples size were respectively 44 and 191. Thus, these hypotheses were firstly tested for

Z-scores of Skew and Kurtosis. According to the test, several variables had Skew and Kurtosis Z-scores of above 1.96 in both temporary virtual team groups and ongoing virtual team groups (Table 16, Table 17).

Table 16 - Skewness and Kurtosis test on Temporary Group before data correction

n=44	Affective-based Trust	Cognitive-based Trust	Relationship-oriented com.	Task-oriented com.	Problem Solving	Innovation and Creativity	Decision Making	Conflict mng.	Knowledge Sharing
Skewness	-.223	-.254	-.027	-.760	-.844	-.752	-.451	-.510	-1.123
SE Skewness	.357	.357	.357	.357	.357	.357	.357	.357	.357
Kurtosis	-.109	.411	-.807	1.251	1.240	.402	.511	.376	1.989
SE Kurtosis	.702	.702	.702	.702	.702	.702	.702	.702	.702

Table 17 - Skewness and Kurtosis test on Ongoing Group before data correction

n=191	Affective-based Trust	Cognitive-based Trust	Relationship-oriented com.	Task-oriented com.	Problem Solving	Innovation and Creativity	Decision Making	Conflict mng.	Knowledge Sharing
Skewness	-.444	-.733	-.207	-.596	-.551	-.400	-.064	-.221	-.406
SE Skewness	.176	.176	.176	.176	.176	.176	.176	.176	.176
Kurtosis	.584	1.113	.542	.756	.839	.971	-.133	-.103	.503
SE Kurtosis	.350	.350	.350	.350	.350	.350	.350	.350	.350

A significant violation of the assumption of normality can seriously increase the chances of the researcher committing either a Type I or Type II error. There are different options for correcting the problem [Field, 2009]. The first option proposed by Field [2009] is to remove some observations that contribute to results of over 1.96. But this should only be done if there is a good reason to believe that these observations are not from the population the study is researching. This was not the case in the present study, therefore the observations were not removed. The second option is to transform the data with the help of an arithmetic method like Log10. Data transformation methods are widely used in statistics to solve the problem of non-normally distributed data [Osborne, 2002]. The transformation did not help to lower the Z-score values to under 1.96, however. The third option is to change the value of some observations that contributed to the results of over 1.96. The presence of outliers which have extreme values relative to the rest of the sample is a common reason for non-normality. There is a great debate in the literature about whether outliers should be removed or not. However, many

researchers agree with Judd and McClelland's [1989] argument that outlier removal is desirable, honest and important [Osborne, 2002; Field, 2009]. Field [2009] argues that even if changing the data may seem like cheating, not changing the value of an outlying observation could be very unrepresentative and bias the statistical model. Therefore, and still according to field [2009], it is preferable to change the value. This option was used to correct the problem where a maximum of four observations per variable were corrected. These changes were minor relative to the quantity of data and only bring a few observation scores closer to the mean. These very few scores are considered to be a deviation from the rest of the sample and do not represent the population [Field, 2009]. This can be caused by an exaggeration of the respondent, for example. The method used to change the value of some observations and correct them was the mean plus/minus two standard deviations.

After the data correction, all the Skew and Kurtosis Z-scores dropped under 1.96 and fulfilled the requirements. The two following tables show the Skew and Kurtosis values with their respective standard deviations which were used to calculate their Z-scores after data correction. Table 18 shows the values for the temporary virtual teams and Table 19, the values for ongoing virtual teams.

Table 18 - Skewness and Kurtosis for Temporary team group

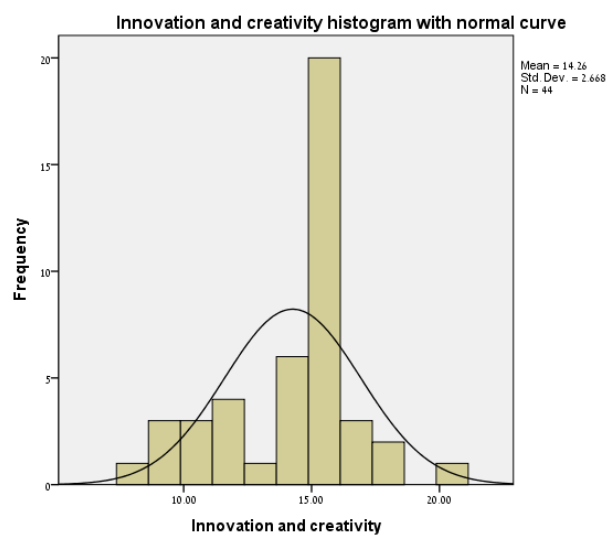
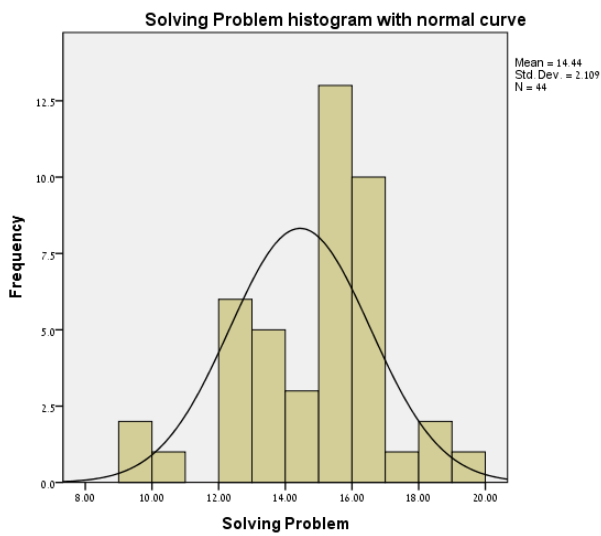
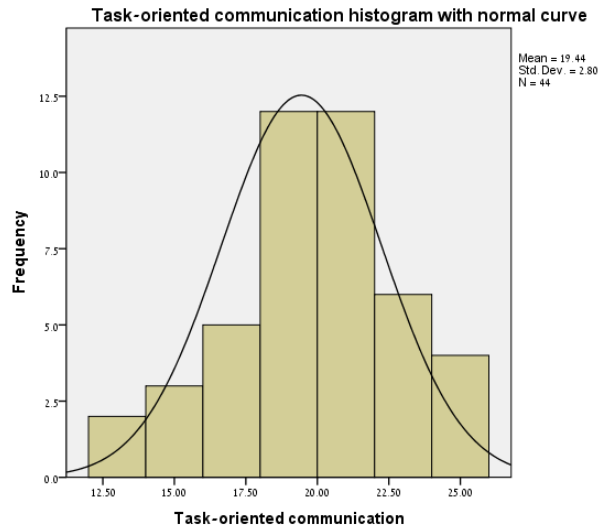
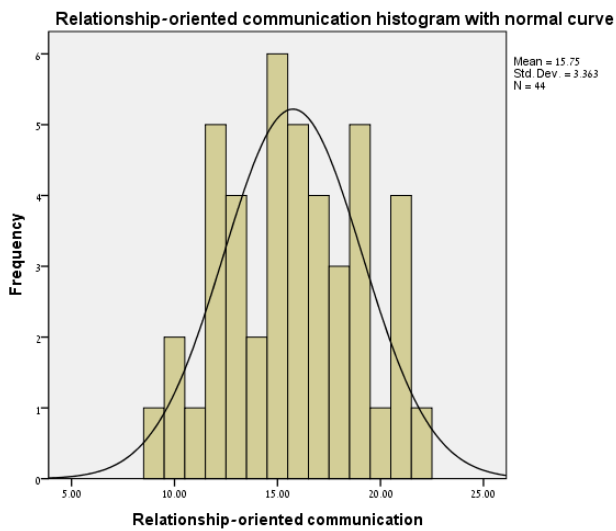
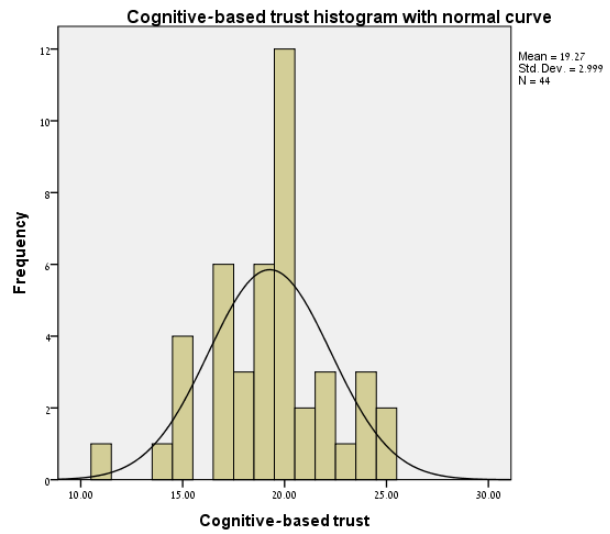
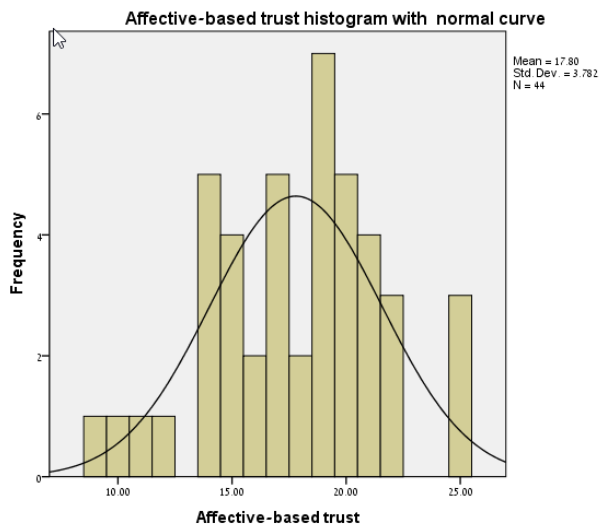
N = 44	Affective-based Trust	Cognitive-based Trust	Relationship-oriented com.	Task-oriented com.	Problem Solving	Innovation and Creativity	Decision Making	Conflict mng.	Knowledge Sharing
Skewness	-.223	-.254	-.027	-.275	-.402	-.660	-.451	-.510	-.571
SE Skewness	.357	.357	.357	.357	.357	.357	.357	.357	.357
Kurtosis	-.109	.411	-.807	-.124	.078	.230	.551	.376	.452
SE Kurtosis	.702	.702	.702	.702	.702	.702	.702	.702	.702

Table 19 - Skewness and Kurtosis for Ongoing team group

N = 191	Affective-based Trust	Cognitive-based Trust	Relationship-oriented com.	Task-oriented com.	Problem Solving	Innovation and Creativity	Decision Making	Conflict mng.	Knowledge Sharing
Skewness	-.117	-.290	-.207	-.274	-.300	-.060	-.064	-.221	-.196
SE Skewness	.176	.176	.176	.176	.176	.176	.176	.176	.176
Kurtosis	-.507	-.295	.542	-.246	.288	-.423	-.133	-.103	-.254
SE Kurtosis	.350	.350	.350	.350	.350	.350	.350	.350	.350

Then, a final visual inspection of the histograms with normal curves and normal Q-Q plots showed that the variables' data was approximately normally distributed for all the variables. The two graphs were generated for each of the variables for both temporary virtual teams (Figure 11 & Figure 12) and ongoing virtual teams (Figure 13 & Figure 14).

Figure 11 - Distribution histograms with Normal Curve for temporary teams



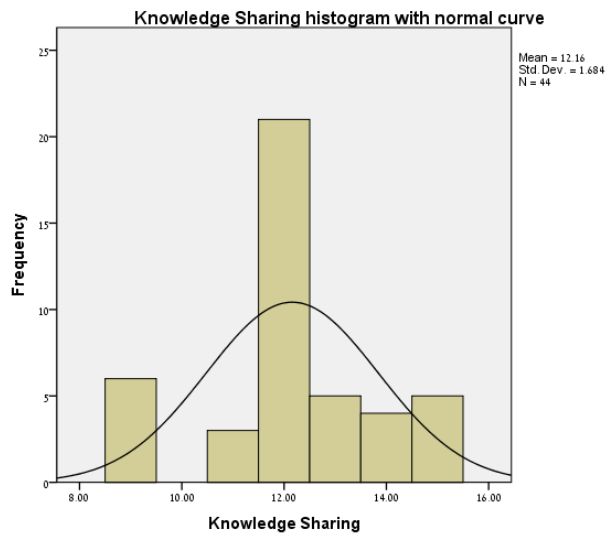
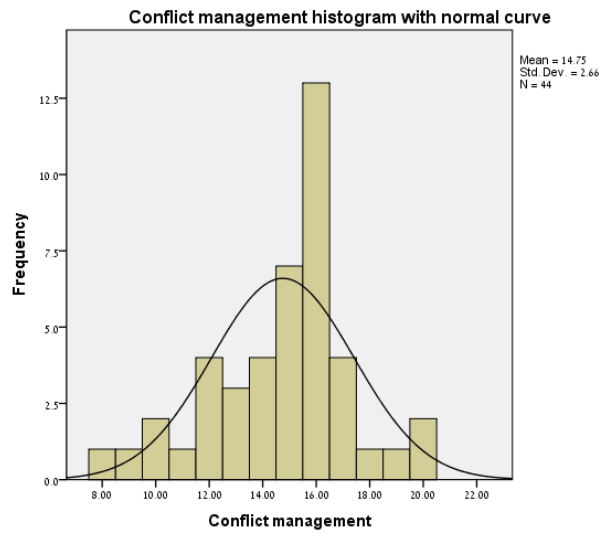
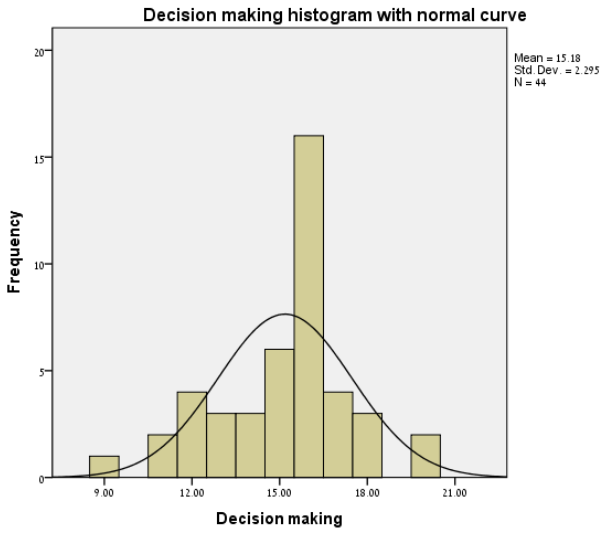
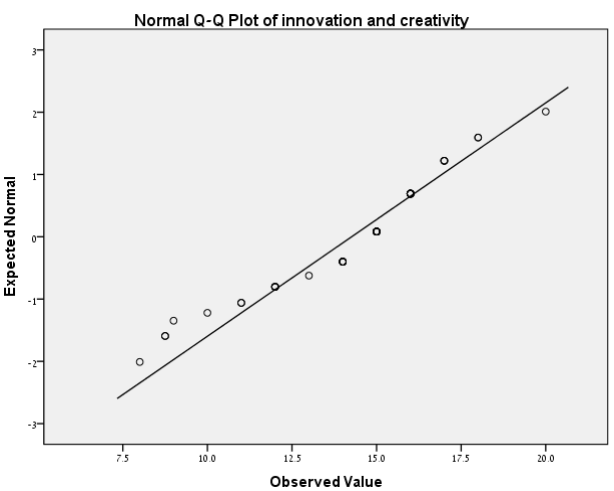
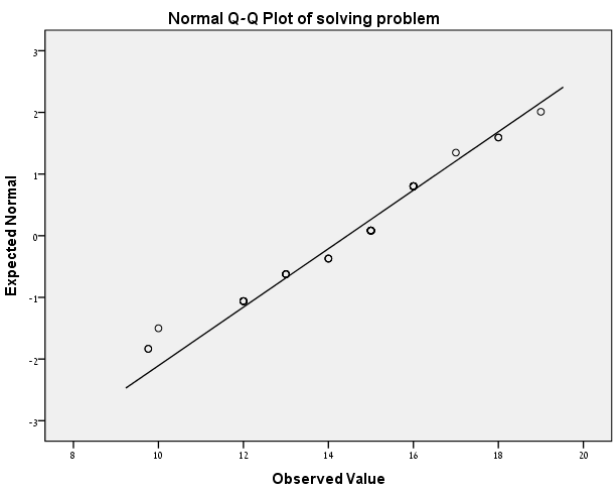
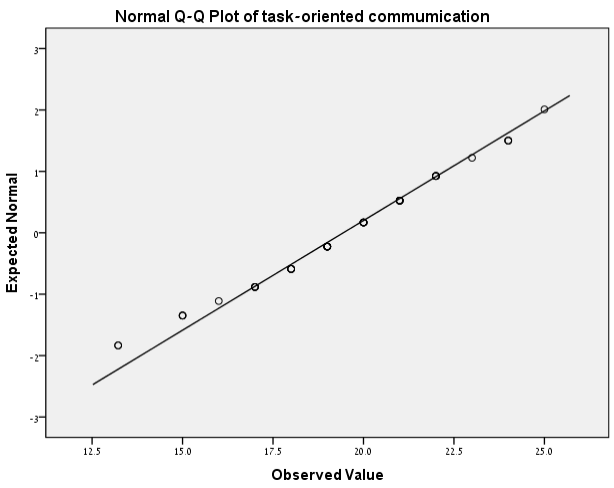
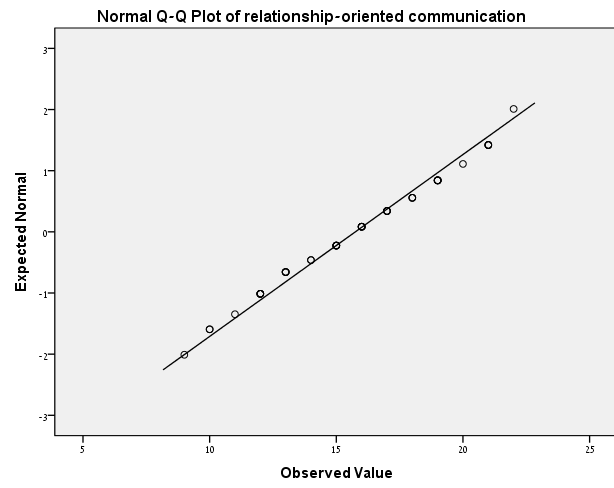
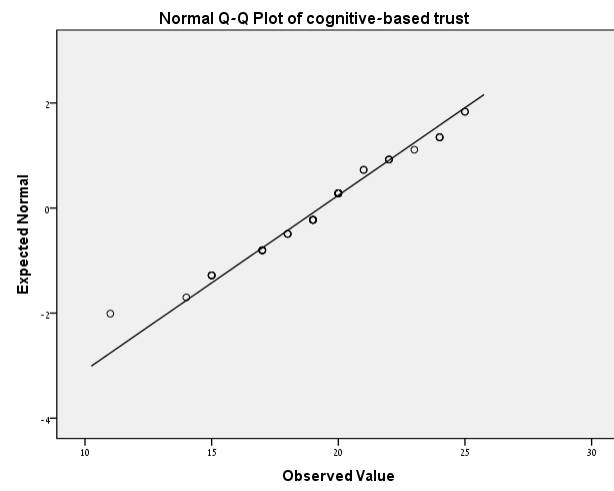
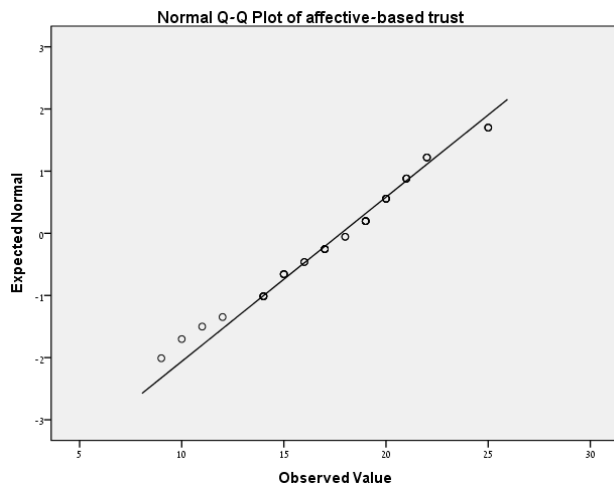


Figure 12 - Normal Q-Q plot graphs for temporary teams



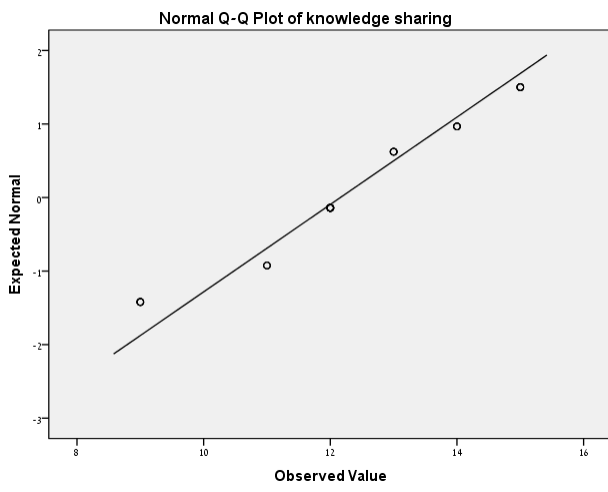
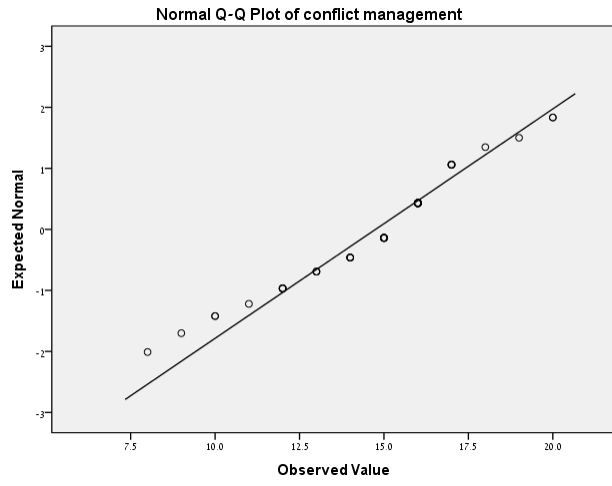
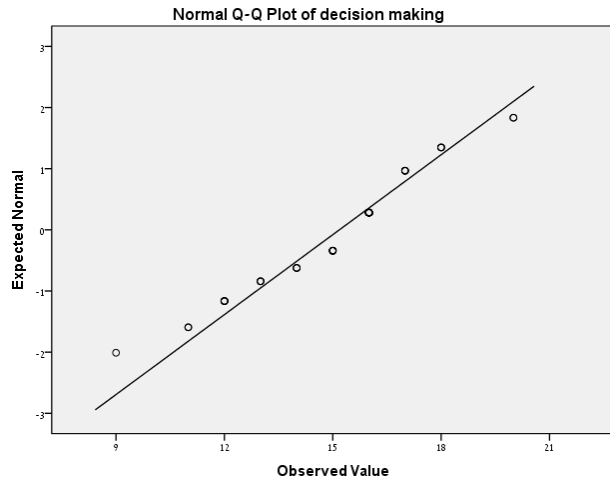
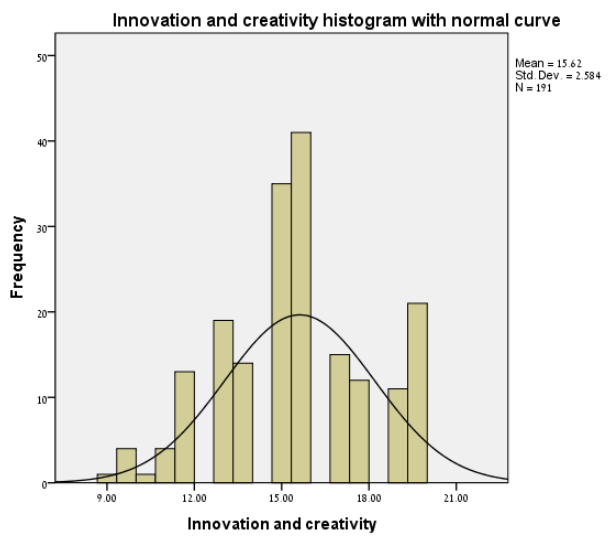
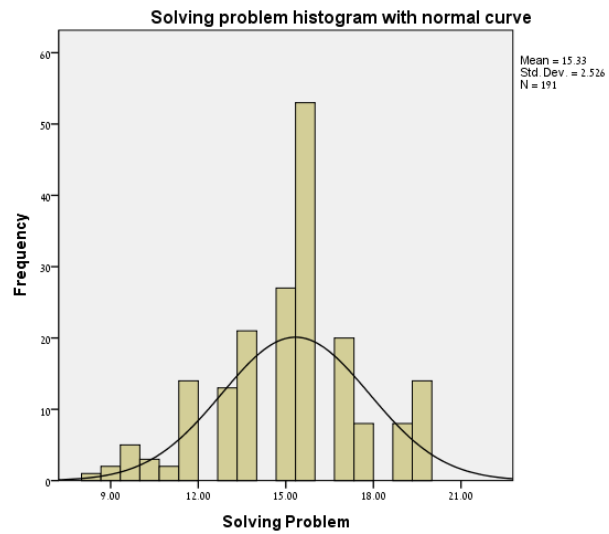
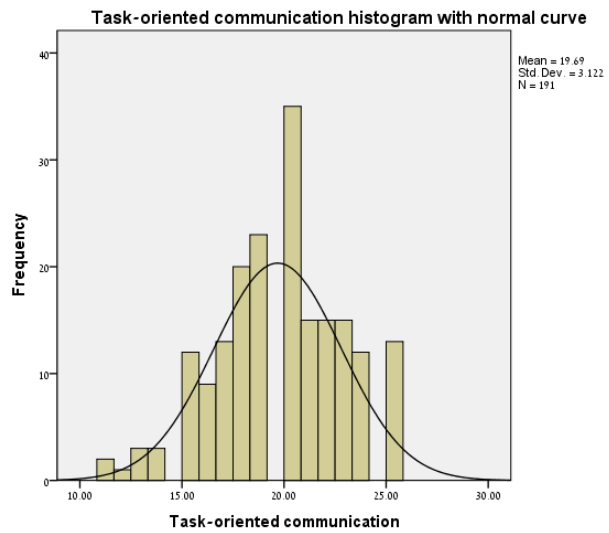
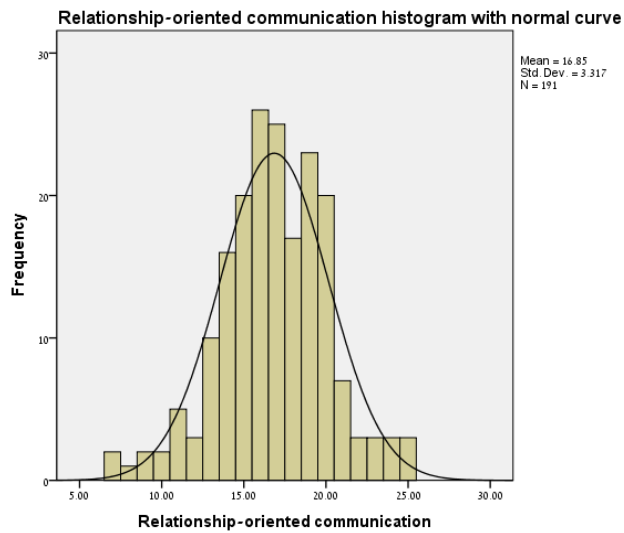
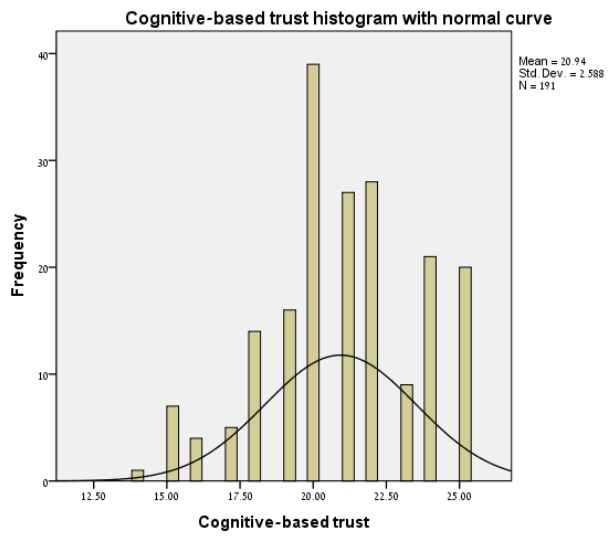
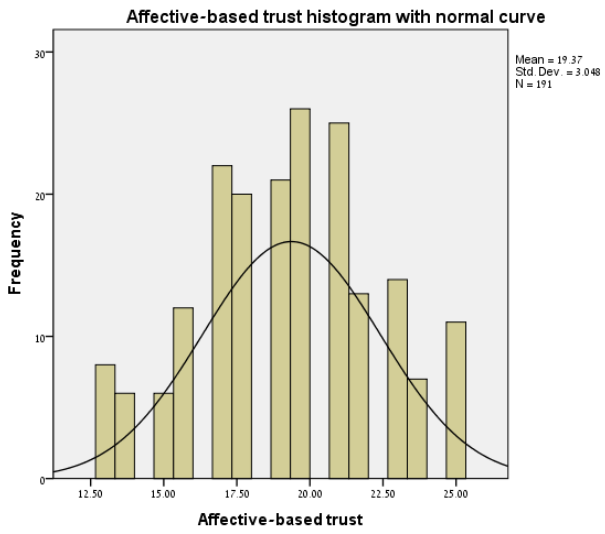


Figure 13 - Distribution histograms with Normal Curve for ongoing teams



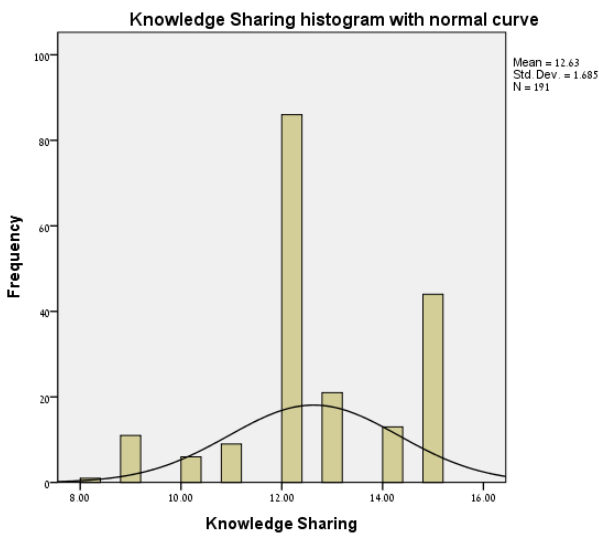
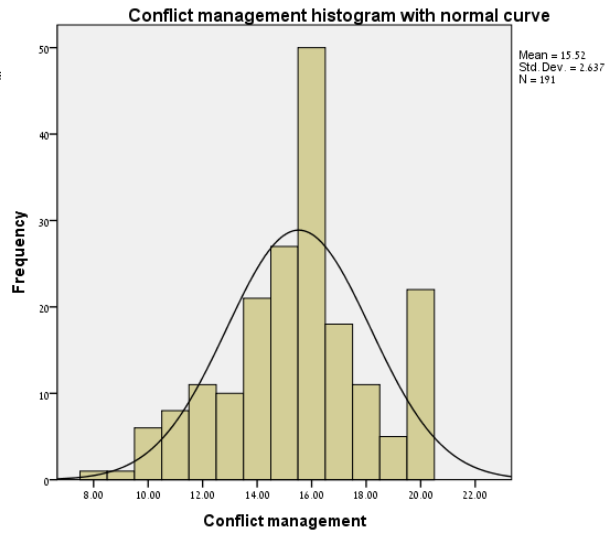
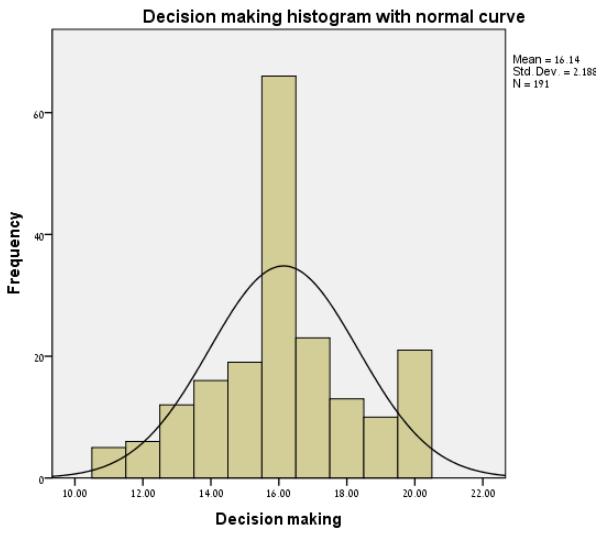
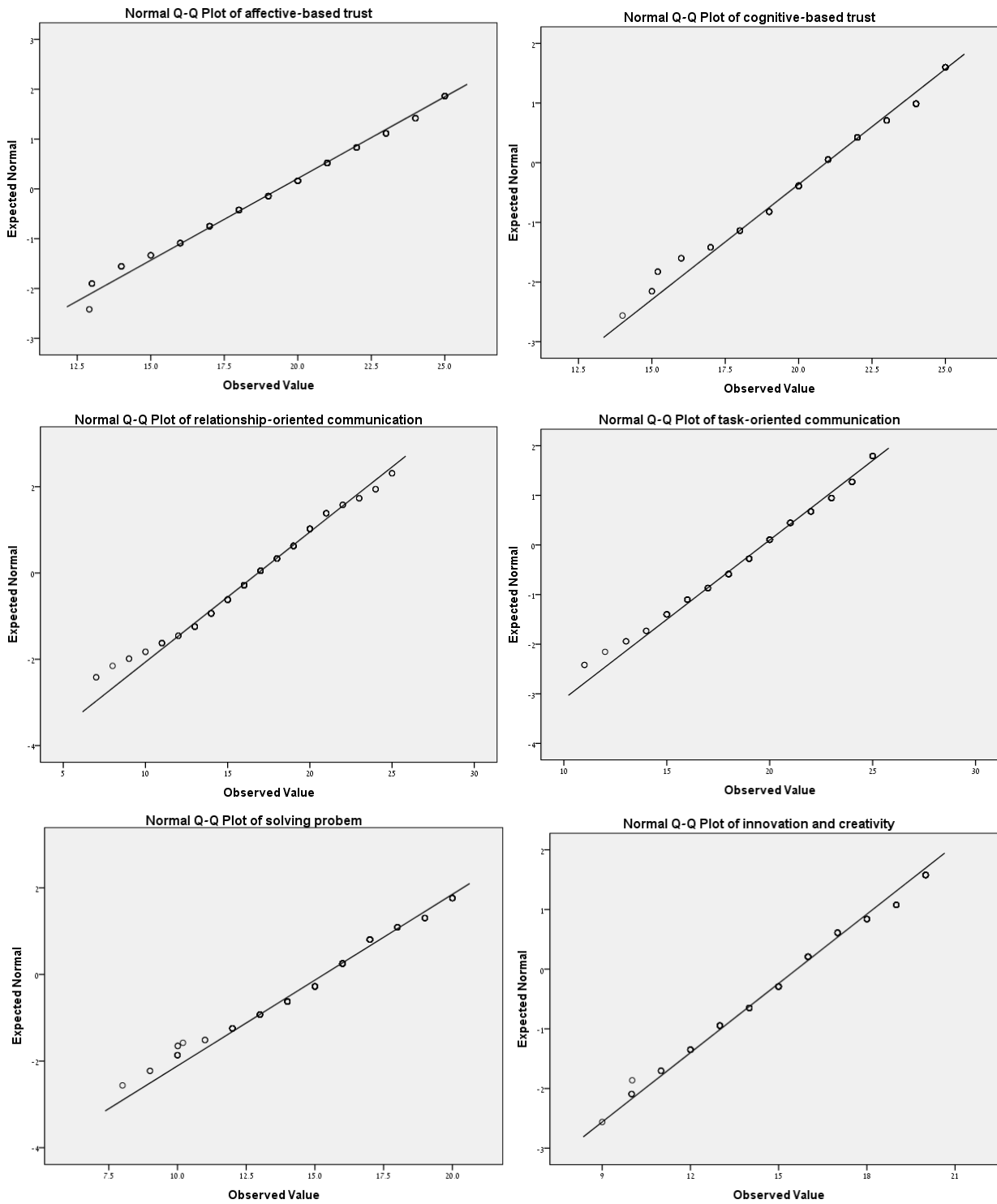
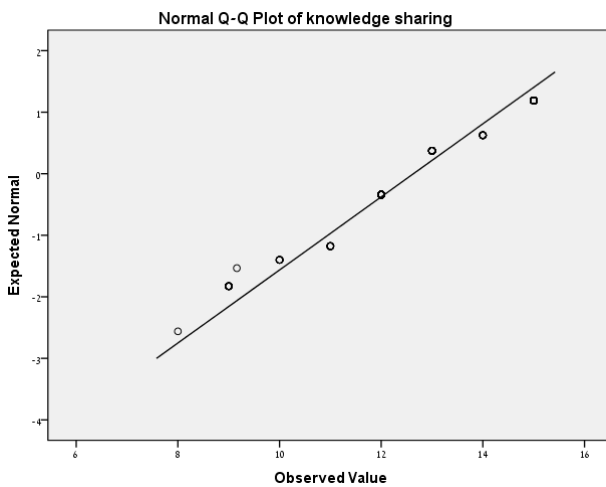
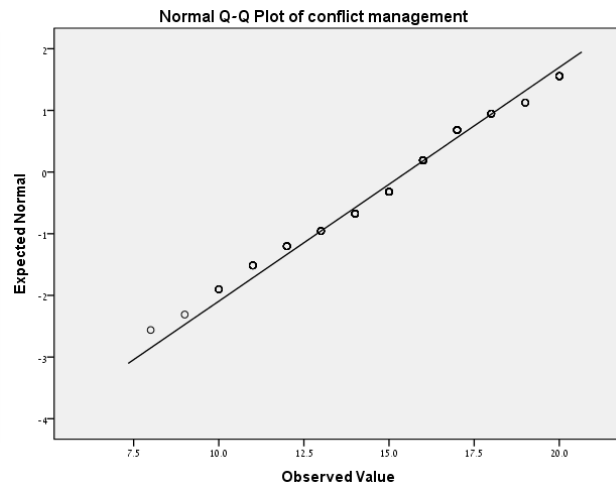
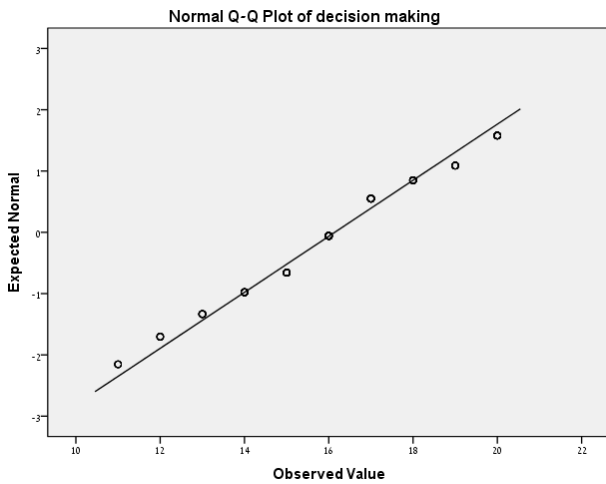


Figure 14 - Normal Q-Q plot graphs for ongoing teams





Given that after data correction, all Skew and Kurtosis Z-scores were between -1.96 and +1.96., and given that the visual inspection of the graphs also supported the idea that all the variables were almost normally distributed, the assumption of normality of distribution is validated and the parametric test can be run on this data.

The second test for normality distribution was run on the whole sample of 259 observations for multiple mediation analyses (after the data correction had already been carried out on temporary and ongoing virtual team group observations). Even if Williams, Grajales and Kurkiewicz [2013] claim that the assumption of normal distribution for Independent Variables is not a must in linear regression, several researchers still argue that it is essential [Field, 2009;

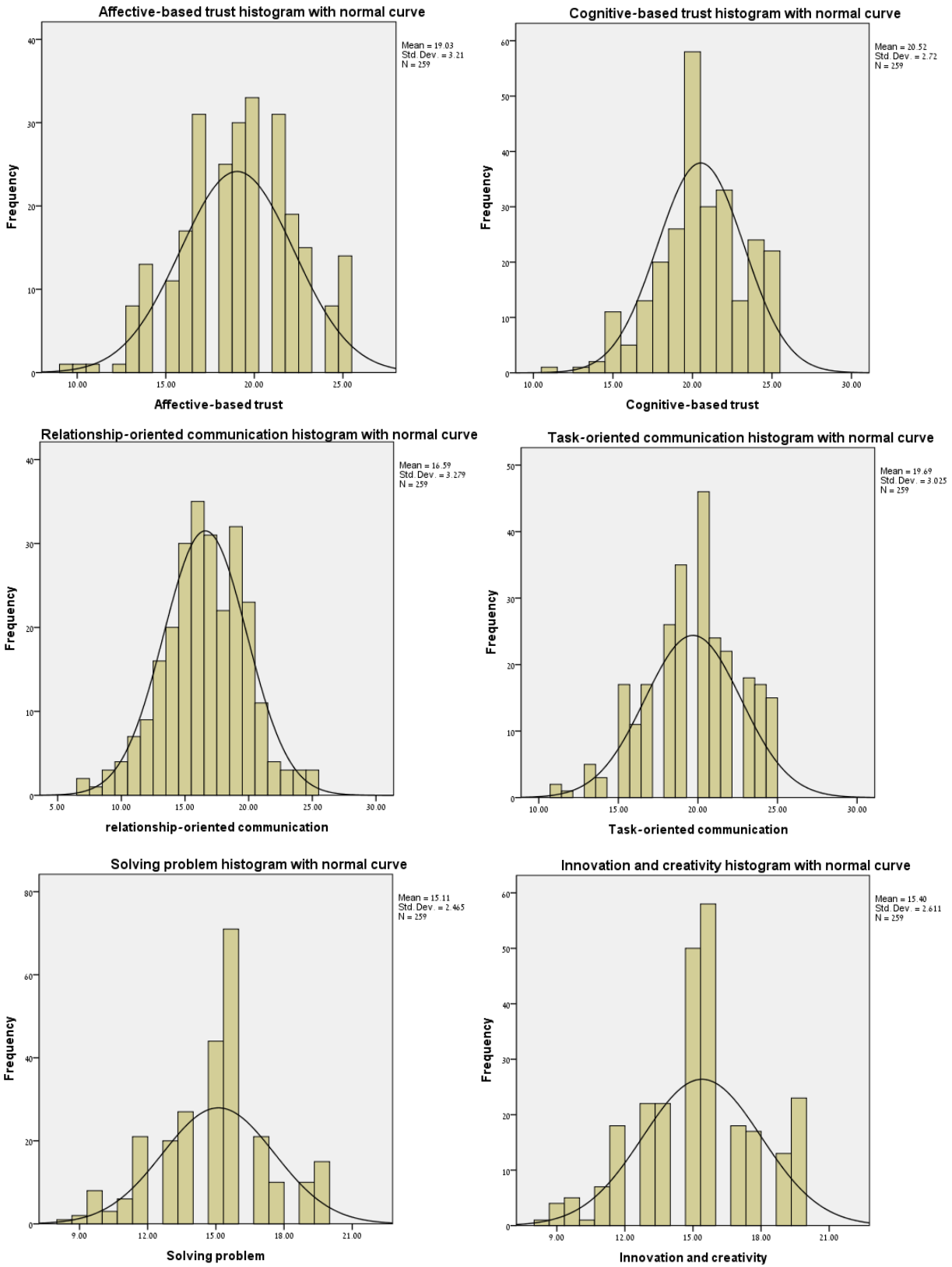
Osborne & Waters, 2002]. Thus, beyond the visual inspection of the graphs, the values for Skewness and Kurtosis were checked according to the recommendations for sample size of over 200 observations [Bulmer, 1979; George & Mallery, 2010; Field, 2009]. This time, to meet these recommendations, there was no necessity to remove other observations than the ones that had already been removed in the previous data correction. All the Skewness values were under +/- .5 and all the Kurtosis values were under +/- 1 (Table 20).

Table 20 - Skewness and Kurtosis for Mediation analyses

N = 259	Affective-based Trust	Cognitive-based Trust	Relationship-oriented com.	Task-oriented com.	Problem Solving	Innovation and Creativity	Decision Making	Conflict mng.	Knowledge Sharing
Skewness	-.215	-.338	-.156	-.273	-.216	-.193	-.125	-.240	-.256
SE Skewness	.151	.151	.151	.151	.151	.151	.151	.151	.151
Kurtosis	-.209	.041	.239	-.216	.084	-.083	.045	-.102	-.137
SE Kurtosis	.302	.302	.302	.302	.302	.302	.302	.302	.302

Therefore, all Skew and Kurtosis values fulfilled the recommendations. Moreover, the visual inspection of the histograms with a normal curve (Figure 15) and normal Q-Q plots (Figure 16) supported these results as all the variables were almost normally distributed. Therefore, the assumption of normality of distribution is validated and a parametric test can be run on this data also.

Figure 15 - Distribution histograms with Normal Curve for entire sample



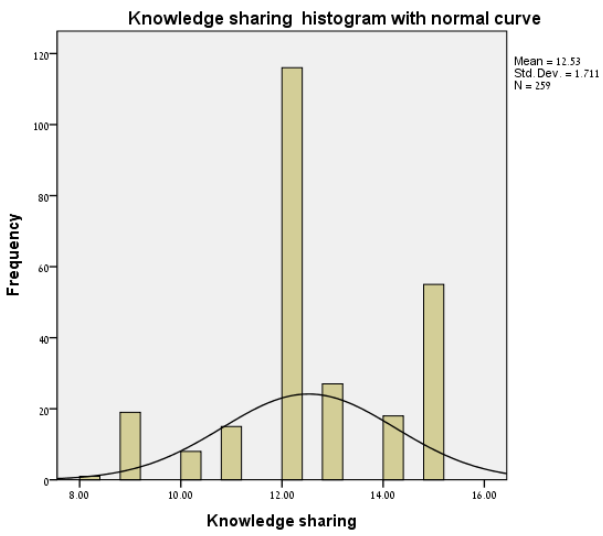
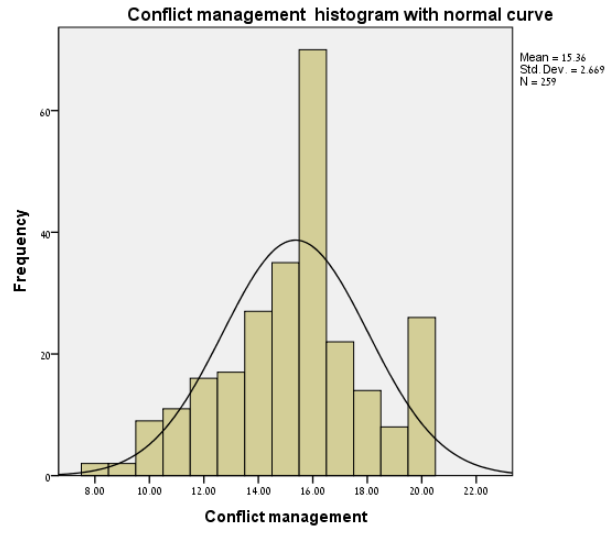
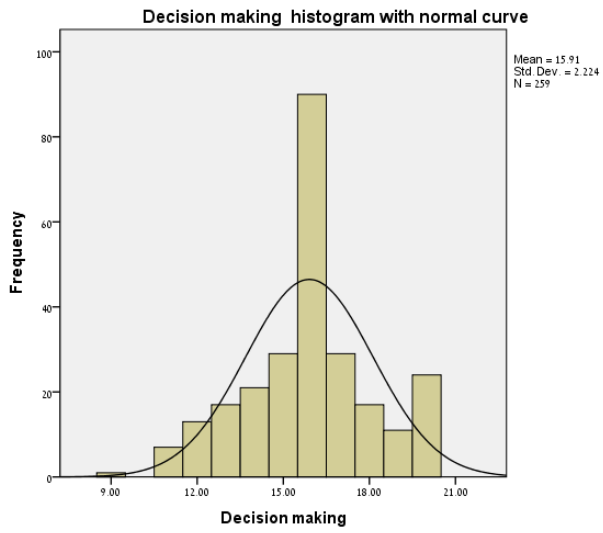
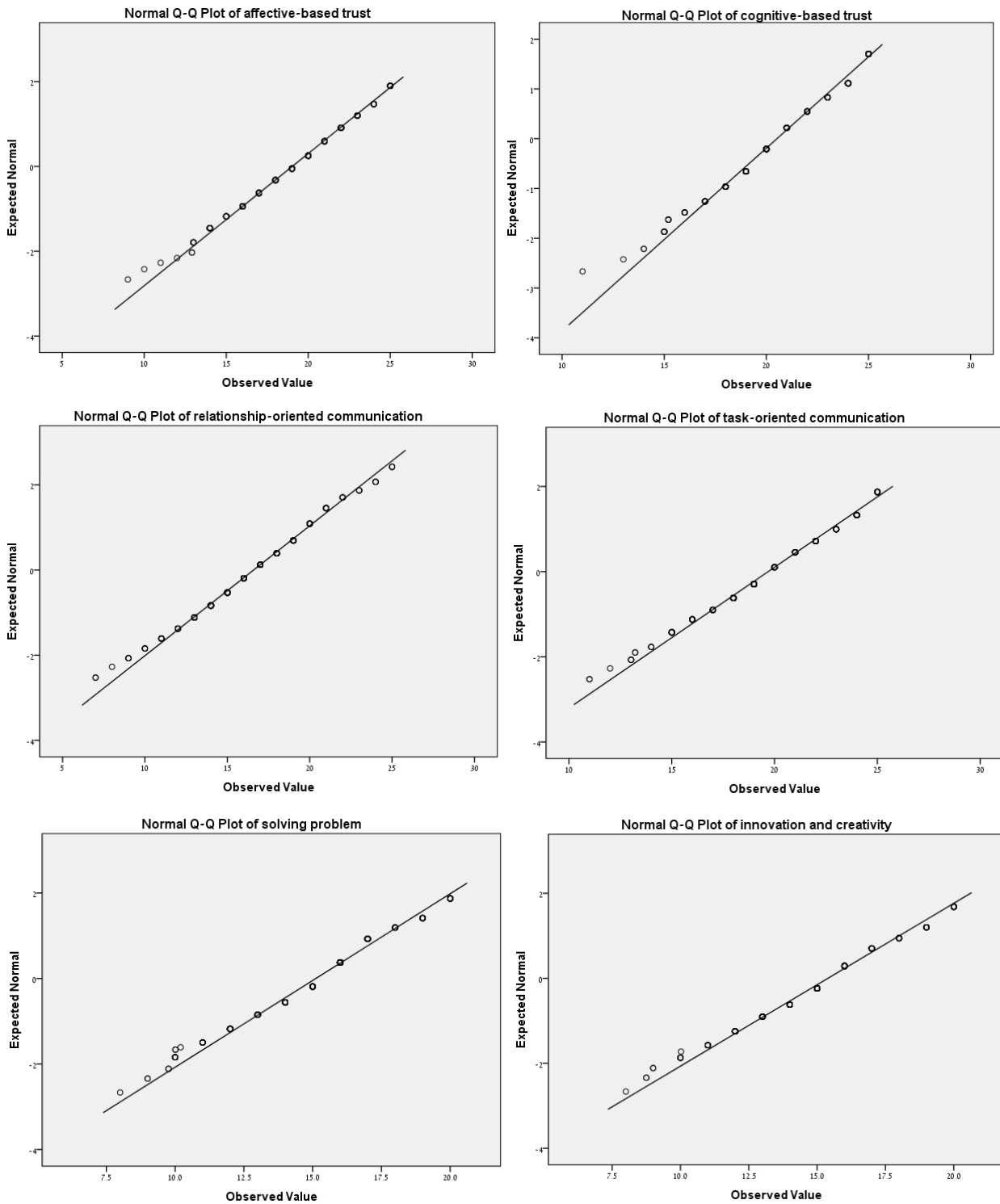
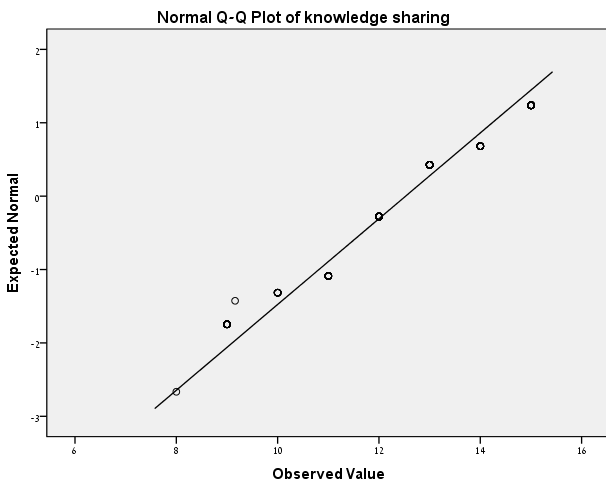
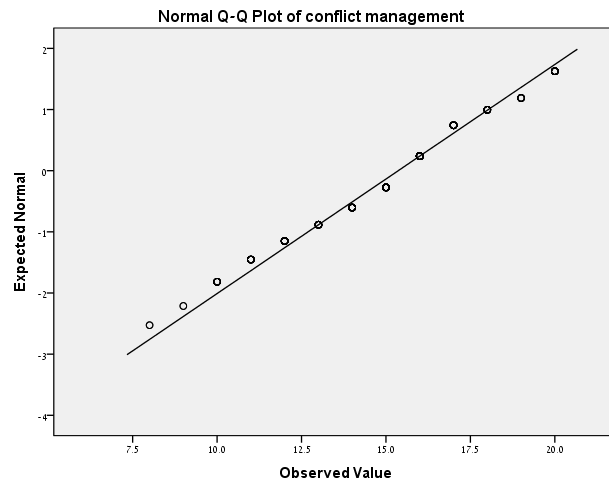
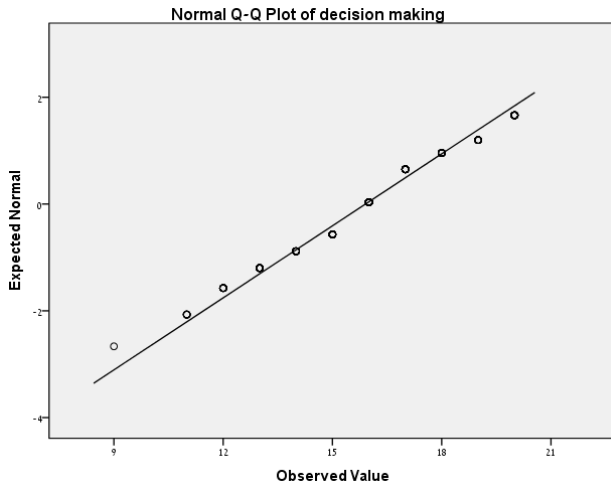


Figure 16 - Normal Q-Q plot graphs for entire sample





6.1.6.2 Significant Outliers

Once it was established that the data was almost normally distributed, an analysis of outliers was conducted. According to Osborne, Christiansen, and Gunter [2004], the literature suggests that researchers rarely report checking for outliers of any sort. This argument is supported by the empirical research they conducted [Osborne, et al., 2001]. This is quite alarming because analysis of outliers is crucial. The presence of outliers can lead to inflated error rates and substantial distortions of parameter and statistic estimates. Thus, in this study a deep analysis was conducted in order to avoid errors and distortions of the results as much as possible. A first analysis was performed with the help of a boxplot graph of temporary and ongoing virtual groups in order to find some extreme outliers that could have a large effect on the statistical results for the t-test. Only three extreme outliers were detected for the knowledge sharing variable of the

temporary group. These three cases could have had a large effect on the results, therefore, they were changed to the next highest score. This boxplot graph analysis was repeated for all cases to find out whether there are still distant outliers that could affect the mediation analysis. No extreme outlier was detected. A second, z-scores outliers' analysis, was also conducted. A cases was found with a z-score of over 3.29 for the cognitive-based trust variable. A z-score of over 3.29 is also considered as an outlier that could have a large effect on the results. Therefore, this case was also corrected to the next nearest score.

When using simple or multiple linear regressions, Field [2009] recommends, in addition to the outliers analysis that has already been conducted, running another test for a much more complete search for outliers. In linear regressions, outliers can cause the model to be biased because they affect the values of the estimated regression coefficients. In order to find other outliers that could have had a large effect on the results, residual analysis was conducted where residuals were defined as the differences between the values of the outcome predicted by the model and the values of the outcome observed in the sample. Standardized residuals (z-scores) were calculated for 10 different multiple linear regressions, one for each of the mediation hypotheses. The first five multiple regressions were run with relationship-oriented communication, affective- and cognitive-based trust as IVs and with each of the five collaboration processes as DVs (Table 21). Then the five other regressions were run, with task-oriented communication, affective- and cognitive-based trust as IVs and with each of the five collaboration processes as DVs (Table 22). Standardized residuals with an absolute value greater than 3.29 are a cause for concern. During the mediation analysis, all cases with an absolute value of greater than 3.29 were omitted. For the hypotheses with relationship-oriented communication as IV, and with decision making as DV, a significant outlier was identified (Std. Residual Min = -3.949, Std. Residual Max = 3.221). Therefore, case 72 was omitted during the mediation analysis of relationship-oriented communication and decision making. For the other DVs, no significant outliers were identified. For the hypotheses with task-oriented communication as IV, outliers for two of the DV variables were identified. For decision making (Std. Residual Min = -4.404, Std. Residual Max = 3.525), three

significant outliers were identified. Thus, cases 72,180 and 217 were omitted during the mediation analysis of task-oriented communication and decision making. For conflict management (Std. Residual Min = -3.177, Std. Residual Max = 3.432) one significant outlier was identified. Thus, case 43 was omitted during the mediation analysis of task-oriented communication and conflict management. For the other DVs, no significant outliers were identified.

Table 21 - standard residuals analysis for relationship-oriented communication

Collaboration	Std. residual		Case # to omit
	Min	max	
Problem solving	-3.085	2.781	
Innovation/Creativity	-2.527	2.715	
Decision making	-3.949	3.211	72
Conflict management	-3.272	2.674	
Knowledge sharing	-2.723	2.670	

Table 22 - standard residuals analysis for task-oriented communication

	Std. residual		Case # to omit
	Min	max	
Problem solving	-3.234	2.831	
Innovation/Creativity	-2.912	3.202	
Decision making	-4.404	3.525	72, 180, 217
Conflict management	-3.177	3.432	43
Knowledge sharing	-2.787	2.750	

6.1.6.3 Homogeneity of variance or Homoscedasticity

The homogeneity of variance means that as the researcher goes through levels of one variable, the variance of the other should not change. Otherwise, the variables have heterogeneity of variance and the results of the parametric methods used in the study could lead to false conclusions. In correlational analysis such as regression, graph analysis is usually conducted in order to check if the sample meets the assumption requirement. For the analysis of groups of data such as independent t-tests, a test called Levene's test is often used to check the validity of this assumption.

For the study's hypotheses that imply a means comparison between groups (temporary virtual teams and ongoing virtual teams), Levene's test was used to determine whether the study's samples complied with the assumption. All the variables were tested with non-significant Levene's test results (i.e $p > .05$). Therefore, the variances are roughly equal and the assumption is tenable for all the variables (Table 23)

Table 23 - Levene's test for Homogeneity of variance for group of data mean comparison

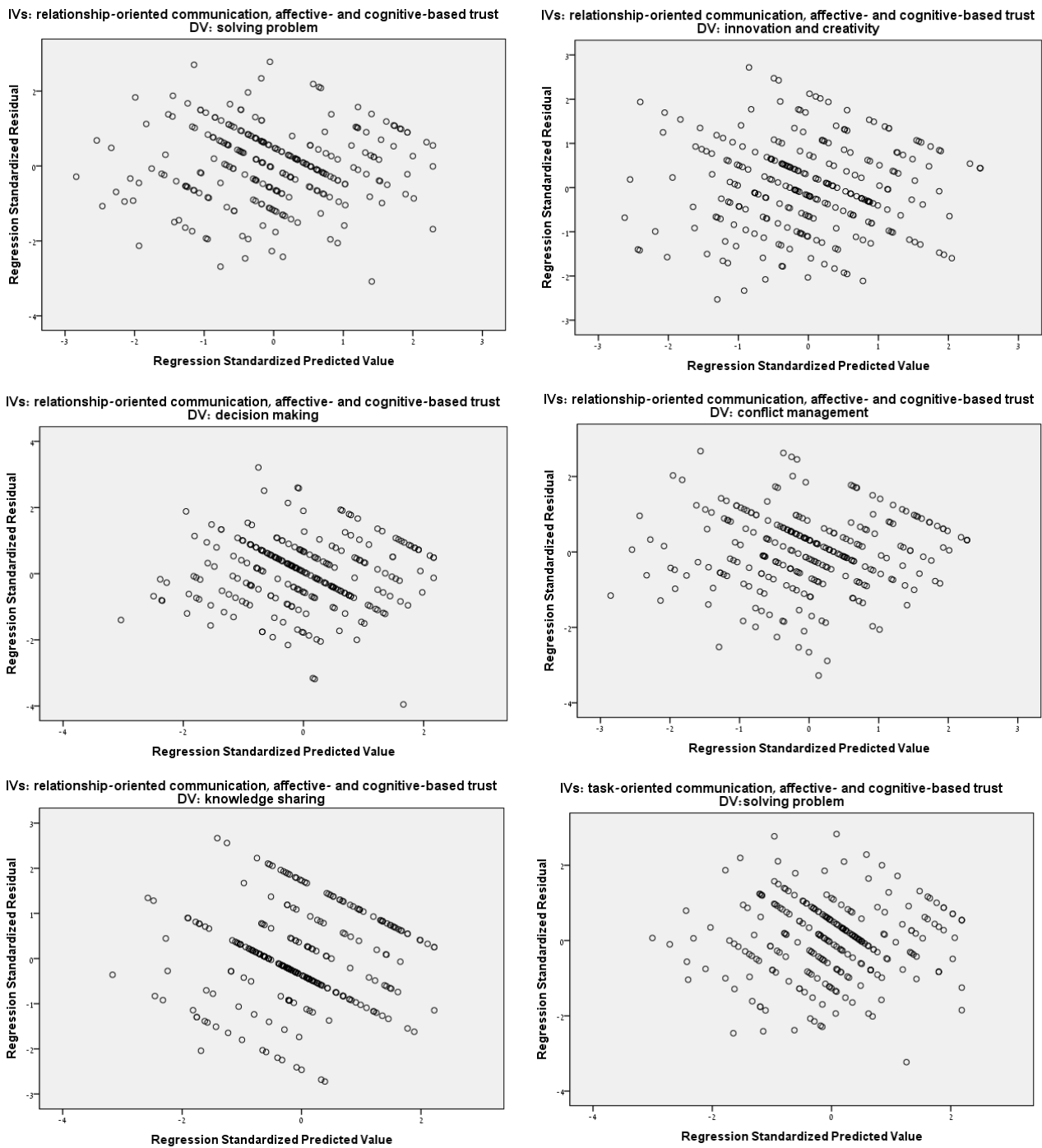
	Levene's Test for Equality of Variances	
	F	Sig.
Affective-based trust	3.284	.071
Cognitive-based trust	.470	.494
Relationship-oriented communication	.332	.565
Task-oriented communication	.783	.377
Problem solving	.951	.330
Innovation and Creativity	.006	.937
Decision making	.323	.570
Conflict management	.005	.945
Knowledge Sharing	1.140	.287

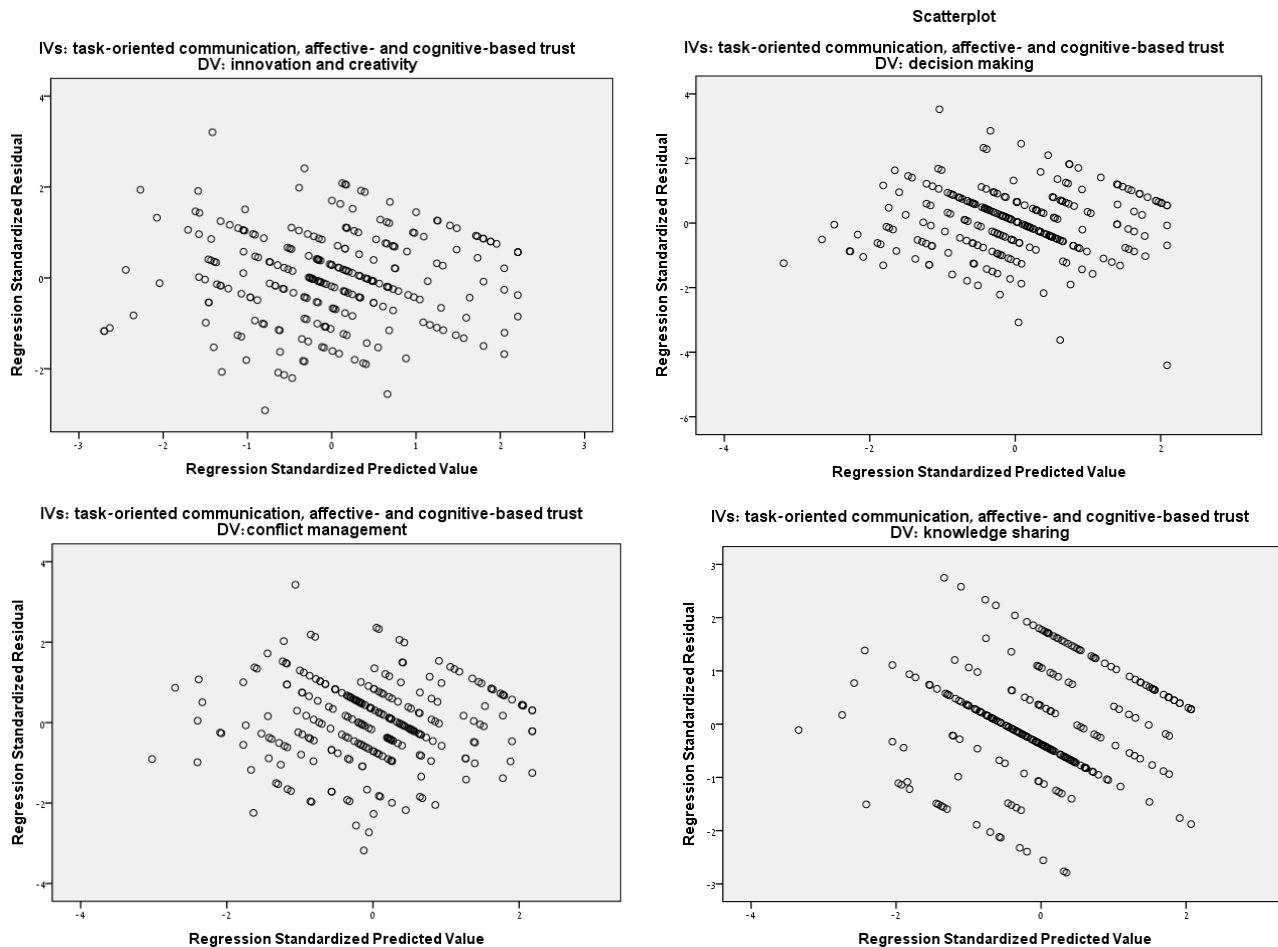
6.1.6.4 Homoscedasticity and Linearity

Homoscedasticity and linearity are important assumptions for linear regression. For the hypotheses which assumed a mediation effect of trust on communication and collaboration, linear regressions were used for analysis, and thus, scatterplots graph analysis was also conducted. This analysis allows one to check whether the data complies with the two assumptions; homoscedasticity (homogeneity of variance) and linearity (the linear relationship between the independent variable or variables, and the dependent variable) [Williams, et al., 2013; Field, 2009; Osborne & Waters, 2002]. Plots of standardized residuals against standardized predicted values was generated and ten multiple linear regressions were run to generate ten different scatterplots in order to check homoscedasticity and linearity for both relationship- and task-oriented communication (IVs) against each of the five collaboration processes (DVs) where

affective- and cognitive-based trust are part of the IVs. These scatterplots of standardized residuals showed that the data met the assumptions of linearity though there was a high level of suspicion that the data did not meet the homoscedasticity assumption (Figure 17).

Figure 17 - Scatterplot of standardized residuals





When the homoscedasticity assumption is violated, the estimator of the covariance matrix of the parameter estimates can be biased and inconsistent. Hence, heteroscedasticity can have an impact on the significance tests and confidence intervals results [Hayes & Cai, 2007]. Therefore, to confirm the suspicion, two tests for heteroscedasticity were run. The first was a Breusch-Pagan test [Breusch & Pagan, 1979] and the second was a Koenker test [Koenker & Bassett, 1982]. The two tests were run with the help of an SPSS macro [Garcia-Granero, 2002]. In the case of relationship-oriented communication, the Breusch-Pagan and Koenker tests showed that for three of the collaboration processes (innovation and creativity, decision making and conflict management), the homoscedasticity assumption was not complied with (Table 24). In the case of task-oriented communication, the Breusch-Pagan and Koenker tests showed that for two of the collaboration processes (innovation and creativity; and conflict management) the homoscedasticity assumption was not complied with (Table

24). For a third process (decision making) the Breusch-Pagan test was significant but the Koenker test was not.

Table 24 - Tests for homoscedasticity with relationship-oriented communication as IV

IV: Relationship-oriented com., Affective- and Cognitive-based trust

n=259, df=3 DV	Breusch-Pangan test		Koenker test	
	CHi-Square	Sig.	CHi-Square	Sig.
Problem solving	5.834	.120	5.253	.154
Innovation/creativity	8.990	.029*	10.431	.015*
Decision making	22.050	.000***	13.536	.004**
Conflict management	16.552	.001***	12.901	.005**
Knowledge sharing	4.247	.236	4.128	.247

* p<.05, ** p<.01, *** p<.001

Table 25 - Tests for homoscedasticity with task-oriented communication as IV

IV: Task-oriented com., Affective- and Cognitive-based trust

n=259, df=3 DV	Breusch-Pangan test		Koenker test	
	CHi-Square	Sig.	CHi-Square	Sig.
Problem solving	5.500	.139	4.735	.192
Innovation/creativity	9.532	.023*	9.443	.024*
Decision making	13.288	.004**	6.477	.091
Conflict management	15.285	.002**	11.972	.007**
Knowledge sharing	3.041	.385	2.847	.416

* p<.05, ** p<.01, *** p<.001

Long and Ervin [2000] propose the use of an alternative method to reduce the effect of heteroscedasticity. This method is based on a heteroscedasticity consistent covariance matrix (HCCM). Several estimator models have been developed based on HCCM over the years. MacKinnon and White [1985] presented three estimators adapted to small samples HC1, HC2 and HC3. Long and Ervin [2000] recommended the use of an HC3 estimator for samples of around 250 observations. The advantage of the HCCM method is that it employs a heteroscedasticity-consistent standard error (HCSE) estimator that does not assume heteroscedasticity for estimating the standard errors. Hayes and Cai [2007] developed an SPSS macro that implemented the HC3 estimator. This

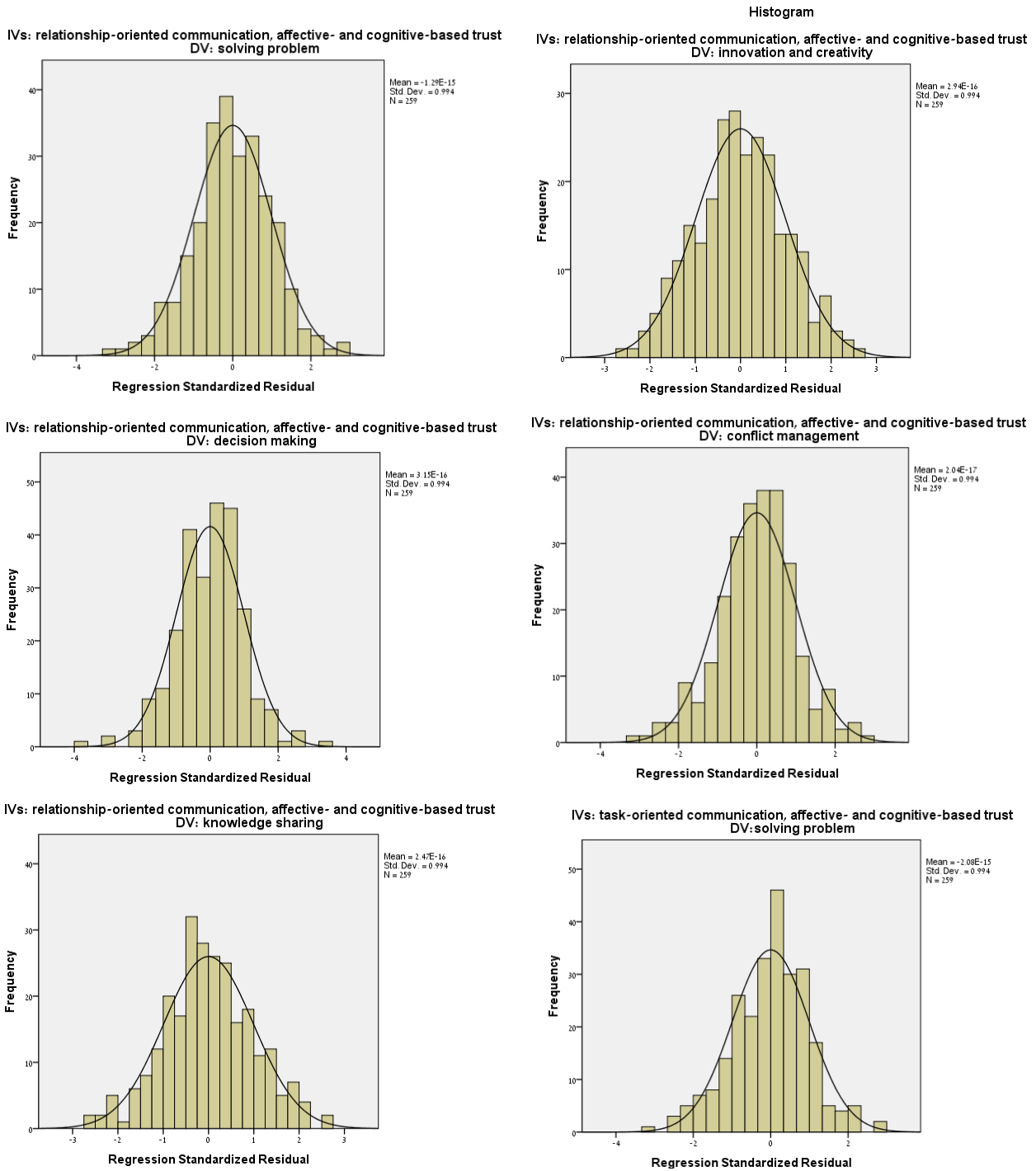
SPSS macro is used as an option in the PROCESS macro [Hayes, 2014] which was used in this study for multiple mediation analyses. Thus, the HC3 option was used during all the multiple analyses to overcome the lack of homoscedasticity. Moreover, the use of this estimator is recommended even when the homoscedasticity assumption is complied with [Hayes & Cai, 2007; Long & Ervin, 2000].

6.1.6.5 *Normally Distributed Errors*

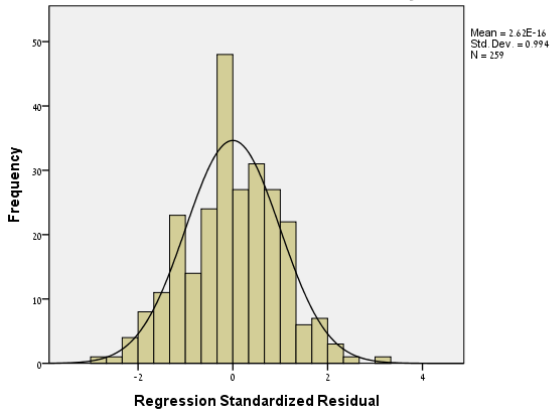
This assumption simply means that the differences between the model and the observed data are most frequently zero or very close to zero, and that differences much greater than zero happen only occasionally. One of the tests for normally distributed errors is a P-P plot (or Q-Q plot) of the standardized residuals and a histogram presenting them. This is a plot of the fractals of error distribution versus the fractals of a normal distribution having the same mean and variance [Williams, et al., 2013]. If the distribution is normal, the points on such a plot should fall close to the diagonal reference line. To carry out this test, 10 multiple linear regressions were run to generate 10 different histograms and P-P plots in order to check the normal distribution of the residuals for both relationship- and task-oriented communication (IVs) against each of the five collaboration processes (DVs) where affective- and cognitive-based trust are part of the IVs.

The histograms of the standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plots of standardized residuals, which showed points that were not exactly on the lines, but close (Figure 18). Therefore, the Normally Distributed Errors assumption is also complied with for all the mediation models.

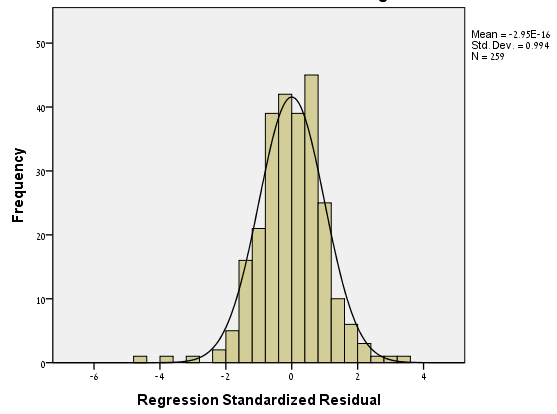
Figure 18 - The normal distribution of the residuals



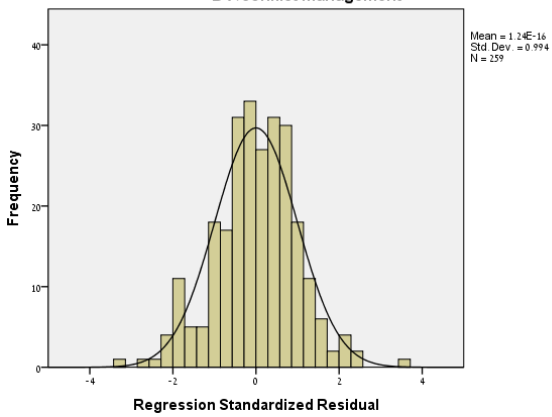
IVs: task-oriented communication, affective- and cognitive-based trust
DV: innovation and creativity



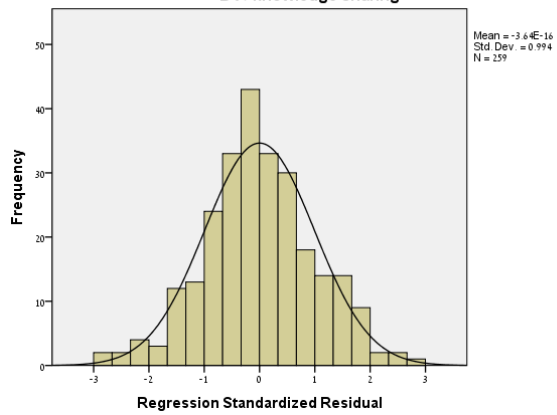
IVs: task-oriented communication, affective- and cognitive-based trust
DV: decision making



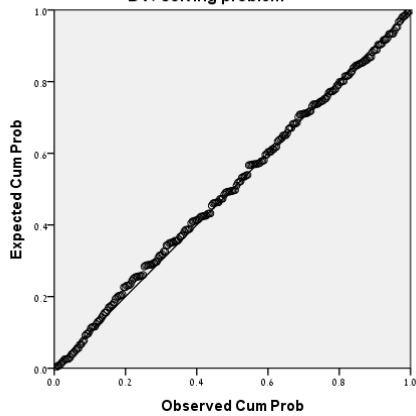
IVs: task-oriented communication, affective- and cognitive-based trust
DV: conflict management



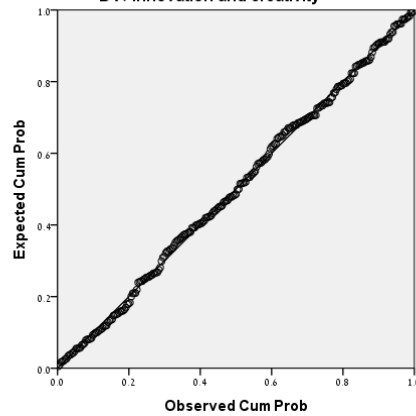
IVs: task-oriented communication, affective- and cognitive-based trust
DV: knowledge sharing



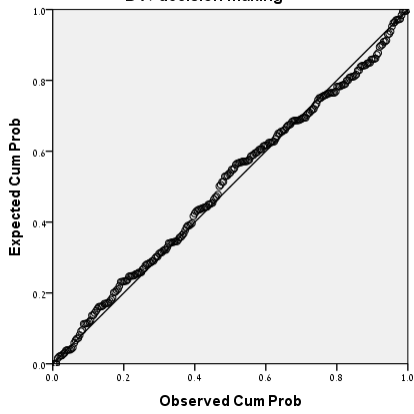
IVs: relationship-oriented communication, affective- and cognitive-based trust
DV: solving problem



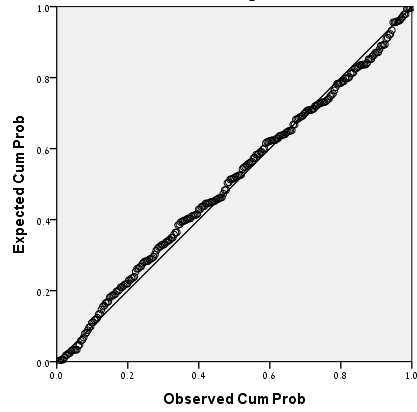
IVs: relationship-oriented communication, affective- and cognitive-based trust
DV: innovation and creativity



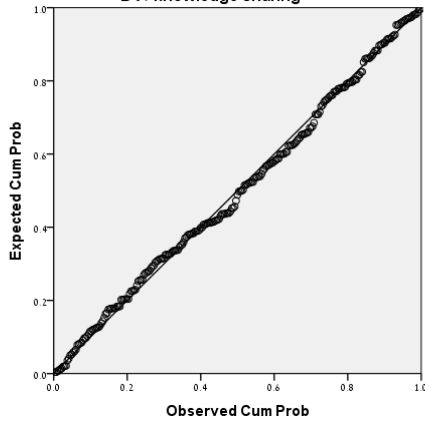
IVs: relationship-oriented communication, affective- and cognitive-based trust
DV: decision making



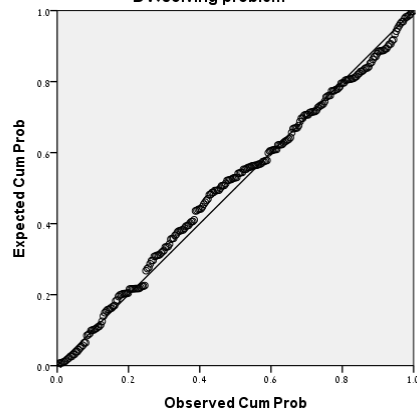
IVs: relationship-oriented communication, affective- and cognitive-based trust
DV: conflict management



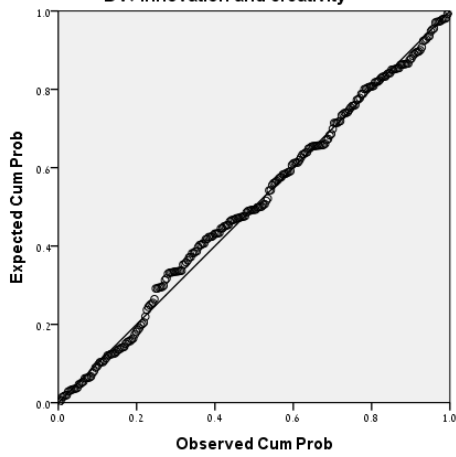
IVs: relationship-oriented communication, affective- and cognitive-based trust
DV: knowledge sharing



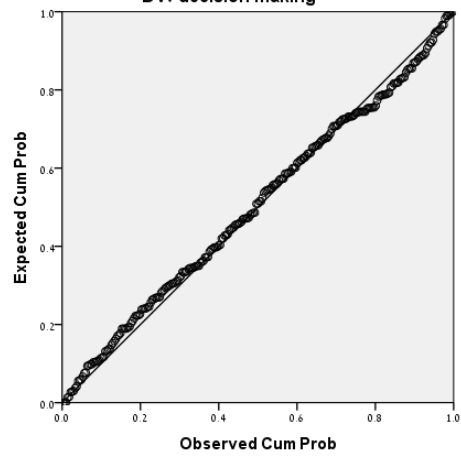
IVs: task-oriented communication, affective- and cognitive-based trust
DV: solving problem



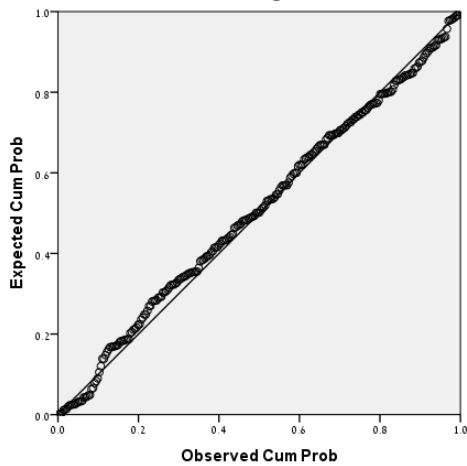
IVs: task-oriented communication, affective- and cognitive-based trust
DV: innovation and creativity



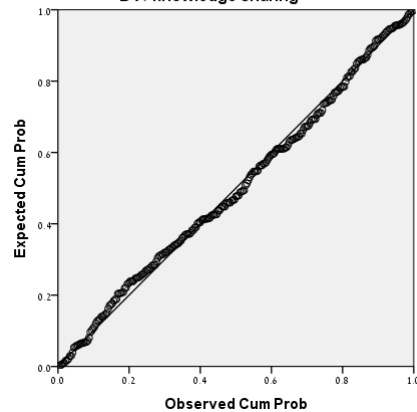
IVs: task-oriented communication, affective- and cognitive-based trust
DV: decision making



IVs: task-oriented communication, affective- and cognitive-based trust
DV: conflict management



IVs: task-oriented communication, affective- and cognitive-based trust
DV: knowledge sharing



6.1.6.6 Multicollinearity

Multicollinearity is reflected when two or more independent variables are strongly correlated in a regression model. Multicollinearity becomes a problem only in multiple regression models such as single mediation or multiple mediation models because simple regression requires only one independent variable. This problem may cause serious difficulty with the reliability of the estimates of the model parameters. The two parameters that could be affected by multicollinearity in a multiple regression model are the β coefficient and the size of R. If the β coefficient becomes untrustworthy, its standard errors could increase and its sign could be wrong. In addition, R, which measures the multiple correlation between the independent variables and the dependent variable, and R^2 , which indicates the variance in the dependent variable in the model, can also be badly affected by multicollinearity and reflect false results [Alin, 2010; Field, 2009; O'Brien, 2007].

Hence the need to check the existence of multicollinearity in the present study to assure the reliability of the results. Multicollinearity analysis is available in several statistics software programs. IBM SPSS Version 22.0 [IBM Corp, 2013] was used in this study where two parameters for multicollinearity were calculated: Variance inflation factors, known as VIF and Tolerance ($1/VIF$), were also analysed. Many researchers have identified a certain value of VIF as a sign of multicollinearity. The most common value reported as problematic is a value

above 10 but some also have suggested that a value above 5 is already a source for concern [Alin, 2010; Field, 2009; O'Brien, 2007].

In the context of the present study, the multicollinearity analysis was run twice. Firstly, where relationship-oriented communication is the independent variables and cognitive- and affective-based trust act as mediators to collaboration. And secondly, where task-oriented communication is the independent variable and cognitive- and affective-based trust act as mediators to collaboration.

According to the analyses, the data complied with the assumption of collinearity which indicated that multicollinearity was not a concern in both cases. In the case of relationship-oriented communication, the higher value for VIF was 2.083 (Table 26). In the case of trust-oriented communication, the higher value for VIF was 1.611 (Table 27).

Table 26 - Multicollinearity test for Relationship-oriented communication

Independent Variable	Collinearity Statistics	
	Tolerance	VIF
Affective-based trust	.480	2.083
Cognitive-based trust	.651	1.536
Relationship-oriented based trust	.541	1.849

Table 27 - Multicollinearity test for Task-oriented communication

Independent Variable	Collinearity Statistics	
	Tolerance	VIF
Affective-based trust	.648	1.544
Cognitive-based trust	.621	1.611
Task-oriented based trust	.779	1.283

6.1.6.7 Independent errors

Errors are assumed to be independent. The lack of compliance with this assumption could cause biased estimates of standard errors and significance, though the estimates of regression coefficients would remain unbiased, yet inefficient [Williams, et al., 2013]. To determine whether the errors were independent, Durbin-Watson tests were conducted for each of the 10 mediation hypotheses. Durbin-Watson tests allow one to detect whether there is the

presence of correlation in the residuals from a regression analysis [Durbin & Watson, 1950]. The statistical test values can vary between 0 and 4 with a value of 2, meaning that the residuals are uncorrelated. A value greater than 2 indicates a negative correlation between adjacent residuals, whereas a value below 2 indicates a positive correlation [Field, 2009]. All the Durbin-Watson values were very close to 2 (Table 28). Therefore, the data complied with the assumption of independent errors for each of the mediation hypotheses. The first set of tests for the mediation models were with relationship-oriented communication as the IV. The second set of tests for the mediation models were with task-oriented communication as the IV.

Table 28 - Durbin-Watson values for independent errors test

	Durbin-Watson	
	Relationship Com	Task Com
Problem Solving	1.899	1.971
Innovation/Creativity	2.180	2.210
Decision making	1.930	1.929
Conflict management	1.927	2.007
Knowledge sharing	1.924	1.966

6.1.6.8 Non-zero variance

The last assumption tested during this study was non-zero variance. For a regression model, the IVs should have some variation in value. In other words, values are not expected to have variance of 0 [Field, 2009]. Based on the mediation hypotheses of the study, there are four variables to check for non-zero variance which are affective-based trust (Variance = 10.306), cognitive-based trust (Variance = 7.427), relationship-oriented communication (Variance = 10.754) and finally, task-oriented communication (Variance = 9.151) (Table 33). Therefore, this assumption was also complied with.

6.1.6.9 Conclusion

It is essential for the data to comply with certain assumptions in parametric statistical tests for the results to be trustworthy and accurate. Such results can be

interpreted with confidence and this allows one to draw conclusions that are reliable. In the present study, several key assumptions were tested and after some data corrections, all the assumptions were met. The study's data can be considered with a high level of confidence as reliable for the parametric tests of this study.

6.1.7 Factor analysis

Two statistics were used to test whether the factor analysis was appropriate for the study [Hair, et al., 2009; Field, 2009]. First, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy [Kaiser, 1970; Kaiser, 1974] statistic was calculated (Table 29), resulting in a value of .941, which is a meritorious value according Kaiser [1974]. Furthermore, values above .9 were defined as superb by Hutcheson and Sofroniou [1999]. Since the KMO value was above 0.80, the variables were interrelated and shared common factors [Hair, et al., 2009; Field, 2009]. The high KMO value supported the use of factor analysis and suggested that the data could be grouped into a smaller set of underlying factors [Tabachnick & Fidell, 2007], as expected. Second, Bartlett's test of sphericity [Bartlett, 1954] was conducted (Table 29), yielding a significant χ^2 value ($\chi^2=6344.071$, $df=780$, $Sig.=.000$). Both tests indicated that the factor analysis was appropriate for the study.

Table 29 - KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.941
Bartlett's Test of Sphericity	Approx. Chi-Square	6344.071
	df	780
	Sig.	.000

In order to proceed to factor analysis, three statistical tests were conducted in IBM SPSS [Field, 2009]: Cronbach's Alpha If item deleted, Corrected Item-Total Correlation and Factor Loading. The *Cronbach's Alpha If item deleted* test calculates the values of the overall α if that item isn't included in the calculation. As such, they reflect the change in Cronbach's α that would be seen if a particular item were deleted. If the deletion of an item increases Cronbach's α then this means that the deletion of that item improves reliability [Field, 2009]. The

Corrected Item-Total Correlation test calculates the correlations between each item and the total score from the questionnaire. In a reliable scale all items should correlate with the total. Items that don't correlate with the overall score from the scale and with a value under about .3 may have to be dropped [Field, 2009]. And finally, when orthogonal rotation is used, the *Factor Loading* test calculates the correlation between the factor and the variable, but is also the regression coefficient. The Varimax method for orthogonal rotation in IBM SPSS version 22.0 was used because it is a good general approach that simplifies the interpretation of factors [Field, 2009]. Typically, several items with a factor loading greater than .3 may be grouped into a smaller set of underlying factors. However, the significance of factor loading will depend on the sample size. Stevens [2002] produced a table of critical values against which loadings can be compared. He recommended that for 200 observations, the value should be greater than 0.364 and for 300 observations, it should be greater than 0.298. As study sample size was 259, a greater value than approximately .32 met the recommendation.

6.1.7.1 *Trust items*

For the affective-based trust items, the lower value for the *Corrected Item-Total Correlation* parameter was .530 while the others items' value measured between .6 and .7. (Table 30). Thus, there was a good correlation between each items and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .816 (Table 11). Finally, all the values for the factor loading parameter were above .478 (Table 30), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The affective-based trust factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the cognitive-based trust Items, the lower value for the *Corrected Item-Total Correlation* parameter was .619 while the others item's value measured between .6 and .7. (Table 30). Thus, there was a good correlation between each

item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .834 (Table 11). Finally, all the values for the factor loading parameter were above .603 (Table 30), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The cognitive-based trust factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

Table 30 - Trust - Factor Loadings

Items	Cronbach's Alpha If item deleted	Corrected Item-Total Correlation	Factor Loading
affective-based trust Items			
Q1	.779	.613	.613
Q2	.770	.640	.713
Q3	.807	.530	.478
Q4	.763	.681	.640
Q5	.782	.602	.535
Cognitive-based trust items			
Q6	.808	.619	.633
Q7	.802	.640	.751
Q8	.803	.637	.716
Q9	.797	.649	.603
Q10	.794	.664	.624

6.1.7.2 Communication items

For the relationship-oriented communication items, the lower value for the *Corrected Item-Total Correlation* parameter was .437. Two other items' values were measured below .5 (.476 and .495). Another item's value was .676 and the last one .726 (Table 31). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009] All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .782 (Table 11). Finally, the lowest value for the factor loading parameter was .320 (Table 31).

Although this parameter was relatively low, it still met the requirement defined by Stevens [2002]. Moreover, the four other factor loading parameters for the rest of the items were above .418, indicating that all these items could have been regrouped into the same factor. The Relationship-oriented Communication factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the task-oriented communication items, the lower value for the *Corrected Item-Total Correlation* parameter was .547 while the four other items' values measured above .6 with the lowest value of .603 and the highest value of .729 (Table 31). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .846 (Table 11). Finally, all the values for the factor loading parameter were above .615 (Table 31), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The Task-oriented Communication factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

Table 31 - Communication - Factor Loadings

Items	Cronbach's Alpha If item deleted	Item-Total Correlation	Factor Loading
Relationship-oriented Communication			
Q11	.760	.495	.320
Q12	.702	.676	.610
Q13	.680	.726	.671
Q14	.772	.476	.809
Q15	.779	.437	.418
Task-oriented Communication			
Q16	.842	.547	.729
Q17	.803	.703	.684
Q18	.803	.697	.710
Q19	.794	.729	.779
Q20	.828	.603	.615

6.1.7.3 Collaboration items

For the problem solving items, the lower value for the *Corrected Item-Total Correlation* parameter was .699 while the three others items' values measured between .7 and the highest value of .747 (Table 32). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .868 (Table 11). Finally, the lowest value for the factor loading parameter was .360 (Table 32). Although this parameter was relatively low, it still met the requirement defined by Stevens [2002]. Moreover, the three other factor loading parameters for the rest of the items were above .431, indicating that all these items were able to be regrouped into the same factor. The Problem Solving factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the innovation and creativity items, the lower value for the *Corrected Item-Total Correlation* parameter was .649 while the three others items' values measured above .7 with values of .703, .721 and .779. (Table 32). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .863 (Table 11). Finally, all the values for the factor loading parameter were above .7 with a highest value of .763 (Table 32), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The Innovation and Creativity factors met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the knowledge sharing items, the lower value for the *Corrected Item-Total Correlation* parameter was .599 while the three others items' values measured, in increasing order, .689, .797 and .820 (Table 32). Thus, there was a good correlation between each item and the total score from the questionnaire,

well above the .3 bar [Field, 2009]. One of the values for *Cronbach's Alpha if Item is Deleted* parameter was higher ($\alpha = .887$) than the overall reliability of .865. This indicated that one of the items would increase the reliability if it were deleted (Table 11). Therefore the item was canceled for the construct and only three of the four items were retained. Finally, the three values for the factor loading parameter that were retained were above .688 (Table 32), well above the .32 bar [Stevens, 2002], indicating that all these retained items were able to be regrouped into the same factor. After canceling one of the items, the Knowledge Sharing factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the decision making items, the lower value for the *Corrected Item-Total Correlation* parameter was .587 while the three others items' values measured, in increasing order, .662, .680 and .723 (Table 32). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .832 (Table 11). Finally, all the values for the factor loading parameter were above .477 (Table 32), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The Decision Making factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

For the conflict management items, the lower value for the *Corrected Item-Total Correlation* parameter was .687 while the three others items' values measured above .7 with values of .743, .744 and .748 (Table 32). Thus, there was a good correlation between each item and the total score from the questionnaire, well above the .3 bar [Field, 2009]. All the values for the *Cronbach's Alpha if Item is Deleted* parameter indicated that none of the items would have increased the reliability if they had been deleted because all values were less than the overall final reliability of .873 (Table 11). Finally, all the values for the factor loading parameter were above .657 (Table 32), well above the .32 bar [Stevens, 2002], indicating that all these items were able to be regrouped into the same factor. The

Conflict management factor met all the factor analysis requirements that were defined above. Consequently, the scales criteria were validated.

Table 32 - Collaboration - Factor Loadings

Items	Cronbach's Alpha If item deleted	Item-Total Correlation	Factor Loading
Problem Solving items			
Q21	.839	.699	.519
Q22	.831	.721	.435
Q23	.819	.747	.431
Q24	.834	.709	.360
Innovation and Creativity items			
Q25	.822	.721	.707
Q26	.829	.703	.753
Q27	.851	.649	.763
Q28	.799	.779	.753
Knowledge Sharing items			
Q29	.887	.599	.508
Q30	.800	.797	.817
Q31	.789	.820	.796
Q32	.839	.689	.688
Decision Making items			
Q33	.821	.587	.477
Q34	.781	.680	.683
Q35	.759	.723	.729
Q36	.788	.662	.641
Conflict management items			
Q37	.833	.744	.672
Q38	.831	.748	.730
Q39	.832	.743	.702
Q40	.854	.687	.657

6.2 Data analysis and results

6.2.1 Variables descriptives

After correcting all the data to comply with the parametric test assumptions, final descriptive statistics of the mean and standard deviation of the variables were calculated (Table 33). The sample as a whole had a relatively high level of affective-based trust (M = 19.026, SD = 3.210) and cognitive-based trust (M = 20.517, SD = 2.725). The results correspond to an average of "agree" responses to the survey questions relative to the trust variables. It was also observed via a paired-samples t-test that cognitive-based trust is significantly higher than affective-based trust ($t = 8.620$, $p < .000$) with a mean difference m_{a-b} of 1.490

(Table 34). This can be explained by the fact that cognitive-based trust is developed first in a work environment [McAllister, 1995]. The sample as a whole had a relatively high level of task-oriented communication (M = 19.689, SD = 3.025) which corresponds to an average of "agree" responses to the survey questions. Yet the relationship-oriented communication had a medium level (M = 16.594, SD = 2.279) which corresponds to an average of "neutral" responses to the survey questions. It was also observed that the difference in the mean m_{a-b} of 3.095 for task-oriented communication relative to the relationship-oriented one is significant ($t = 15.267$, $p < .000$) (Table 34). This result can be explained by the fact that task-oriented communication is about planning and scheduling work, coordinating activities and tasks, and monitoring operations and performance which are some of the basic elements for a team to accomplish its tasks in an efficient and reliable way [Yukl, 2012]. All the five collaboration processes also got a relatively high score with an average of a little less than "agree" responses to the survey questions (Table 33).

Table 33 - General variables descriptives

n = 259	Minimum	Maximum	Mean	Std. Deviation	Variance
Affective-based trust	9.00	25.00	19.026	3.210	10.306
Cognitive-based trust	11.00	25.00	20.517	2.725	7.427
Relationship-oriented communication	7.00	25.00	16.594	3.279	10.754
Task-oriented communication	11.00	25.00	19.689	3.025	9.151
Problem solving	8.00	20.00	15.115	2.464	6.075
Innovation and Creativity	8.00	20.00	15.396	2.610	6.815
Decision making	9.00	20.00	15.907	2.223	4.945
Conflict management	8.00	20.00	15.363	2.669	7.124
Knowledge sharing	8.00	15.00	12.526	1.711	2.928

Table 34 - Paired-samples t-test for Trust and Communication variables

n = 259	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Cognitive-based trust	1.490	2.782	.173	1.150	1.831	8.620	258	.000***
Affective-based trust								
Task-oriented communication	3.094	3.262	.203	2.695	3.494	15.267	258	.000***
Relationship-oriented communication								

* $p < .05$, ** $p < .01$, *** $p < .001$

6.2.2 Independent-samples T-test Analysis

This set of tests was run to answer the first group of hypotheses (H1 to H3). The aim of these hypotheses was to clarify whether there are some differences in the level of trust, communication and collaboration between temporary virtual teams and ongoing ones. In order to validate (or not) the hypotheses, mean analyses were conducted between these two types of team where the final sample size for temporary virtual teams was $n = 44$ and for ongoing ones $n = 191$. All the Mean analyses were run with IBM SPSS version 22.0 using the "Independent-Samples t-test" Analyze option. Given that the Levene's test probability value was insignificant ($p > 0.05$) for all the trust, communication and collaboration items (Table 23), equal variances were assumed. Thus, the first row of the IBM SPSS version 22.0 results (equal variances assumed) were used as t-test results for all the tests. For the level of signification, a 1-tailed value was used. The reason was that trust, communication and collaboration were expected to develop over time. Therefore, the mean value of the different variables was expected to be higher for ongoing virtual teams than for temporary ones.

6.2.2.1 Affective-based trust

Ongoing virtual teams had a significantly higher level of affective-based trust ($M = 19.365$, $SD = 3.047$) than temporary ones ($M = 17.1795$, $SD = 3.782$), $t(233) = 2.938$, $p = .02$ (Table 35 & Table 36). The effect size of this mean difference was almost a medium one (Cohen's $d = .491$). According to this result, the first hypotheses H1a was supported.

Table 35 - Affective-based trust descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	19.365	3.047	.220
Temporary	44	17.795	3.782	.570

Table 36 - Affective-based trust Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
2.938	233	.02*	1.570	.534	.517	2.623

*p < .05, **p < .01, ***p < .001

Cohen's d = .491

6.2.2.2 Cognitive-based trust

Ongoing virtual teams had a significantly higher level of cognitive-based trust (M = 20.936, SD = 2.588) than temporary ones (M = 19.295, SD = 2.938), $t(233) = 3.694$, $p < .001$ (Table 37 & Table 38). The effect size of this mean difference was medium (Cohen's d = .618). According to this result, the hypothesis H1b was supported.

It might be noticed that the effect size of the mean difference for cognitive-based trust was much higher than the effect size for affective-based trust.

Table 37 - Cognitive-based trust descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	20.936	2.588	.187
Temporary	44	19.295	2.938	.443

Table 38 - Cognitive-based trust Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
3.694	233	.000***	1.641	.444	.765	2.516

*p < .05, **p < .01, ***p < .001

Cohen's d = .618

6.2.2.3 Relationship-oriented communication

Ongoing virtual teams had a significantly higher level of Relationship-oriented communication (M = 16.848, SD = 3.317) than temporary ones (M = 15.750, SD = 3.362), $t(233) = 1.975$, $p = .025$ (Table 39 & Table 40). The effect size of this mean difference was a small one (Cohen's d = .330). According to this result, the hypothesis H2a was supported.

Table 39 - Relationship-oriented communication descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	16.848	3.317	.240
Temporary	44	15.750	3.362	.507

Table 40 - Relationship-oriented communication Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
1.975	233	.025*	1.098	.556	.002	2.194

*p < .05, **p < .01, ***p < .001

Cohen's d = .330

6.2.2.4 Task-oriented communication

There was no-significant mean difference for task-oriented communication between ongoing virtual teams (M = 19.686, SD = 3.122) and temporary ones (M = 19.442, SD = 2.800), $t(233) = .477$, $p = .317$ (Table 41 & Table 42). According to this result, the hypothesis H2b was not supported.

It might be noticed that there was a fundamental difference between the two types of communication. Even with a small size effect, a significant level of relationship-oriented communication was found between the two types of team, unlike for task communication where no-significant difference in level was found.

Table 41 - Task-oriented communication descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	19.686	3.122	.226
Temporary	44	19.442	2.800	.422

Table 42 - Task-oriented communication Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
.477	233	.317	.244	.513	-.765	1.254

*p < .05, **p < .01, ***p < .001

Cohen's d = 0.080

6.2.2.5 Solving-problem

Ongoing virtual teams had a significantly higher value for the problem solving variable (M = 15.331, SD = 2.526) than temporary ones (M = 14.444, SD =2.109), $t(233) = 2.162$, $p = .016$ (Table 43 & Table 44). The effect size of this mean difference was a small one (Cohen's $d = .362$). According to this result, the hypothesis H3a was supported.

Table 43 - Problem solving descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	15.331	2.526	.182
Temporary	44	14.444	2.109	.318

Table 44 - Problem solving Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
2.162	233	.016*	.887	.410	.079	1.696

* $p < .05$, ** $p < .01$, *** $p < .001$

Cohen's $d = .362$

6.2.2.6 Innovation and creativity

Ongoing virtual teams had a significantly higher value for the Innovation and creativity variables (M = 15. 618, SD = 2. 584) than temporary ones (M = 14. 261, SD =2. 668), $t(233) = 3.120$, $p = .001$ (Table 45 & Table 46). The effect size of this mean difference was a medium one (Cohen's $d = .522$). According to this result, the hypothesis H3b was supported.

Table 45 - Innovation and creativity descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	15.618	2.584	.187
Temporary	44	14.261	2.668	.402

Table 46 - Innovation and creativity Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
3.120	233	.001**	1.356	.435	.500	2.213

*p < .05, **p < .01, ***p < .001

Cohen's d = .522

6.2.2.7 Decision making

Ongoing virtual teams had a significantly higher value for the Decision making variable (M = 16.141, SD = 2.187) than temporary ones (M = 15.182, SD = 2.295), $t(233) = 2.599$, $p = .005$ (Table 47 & Table 48). The effect size of this mean difference was a small one but close to medium (Cohen's d = .435). According to this result, the hypothesis H3c was supported.

Table 47 - Decision making descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	16.141	2.187	.158
Temporary	44	15.182	2.295	.346

Table 48 - Decision making Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
2.599	233	.005**	.959	.369	.232	1.687

*p < .05, **p < .01, ***p < .001

Cohen's d = .435

6.2.2.8 Conflict management

Ongoing virtual teams had a significantly higher value for conflict management (M = 15.524, SD = 2.637) than temporary ones (M = 14.750, SD = 2.660), $t(233) = 1.751$, $p = .04$ (Table 49 & Table 50). The effect size of this mean difference was a small one (Cohen's d = .293). According to this result, the hypothesis H3d was supported.

Table 49 - Conflict Management descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	15.524	2.637	.191
Temporary	44	14.750	2.660	.401

Table 50 - Conflict management Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
1.751	233	.04*	.773	.442	-.096	1.643

*p < .05, **p < .01, ***p < .001

Cohen's d = .293

6.2.2.9 Knowledge sharing

Ongoing virtual teams had a significantly higher value for knowledge sharing (M = 12.634, SD = 1.684) than temporary ones (M = 12.160, SD = 1.684), $t(233) = 1.687$, $p = .046$ (Table 51 & Table 52). The effect size of this mean difference was also a small one (Cohen's d = .282). According to this result, the hypothesis H3e was supported.

Table 51 - Knowledge sharing descriptives by team type

Team Type	N	Mean	Std. Deviation	Std. Error Mean
Ongoing	191	12.634	1.684	.122
Temporary	44	12.160	1.684	.254

Table 52 - Knowledge sharing Independent samples t-test by team type

t	df	Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
					Lower	Upper
1.687	233	.046*	.475	.281	-.080	1.030

*p < .05, **p < .01, ***p < .001

Cohen's d = .282

It can be noticed that three variables (problem solving, innovation and creativity, decision making) have convincing Cohen's d and significance values where the Cohen's d values are above .35 and p values under .02. However, there are two variables (conflict management, knowledge sharing) with weak values where Cohen's d values are under .3 and p values above .4.

6.2.2.10 Summary

All the hypotheses comparing the mean between the two types of virtual team were validated except one (Table 53). The only hypothesis that was not validated was H2b that assumed a significantly higher level of task-oriented communication in ongoing virtual teams than in temporary virtual teams. According to this study, the type of virtual team (ongoing or temporary) does not have an impact on task-oriented communication. Three interesting observations can be noticed. The first is that the effect size of the differences in the cognitive-based trust level (Cohen's $d = .491$) between the two types of team is considerably more important than the differences in affective-based trust (Cohen's $d = .618$). The second is that a significant difference in the relationship-oriented communication level between the two team types was observed but there was no difference in task-oriented communication. And the last one is that three of the collaboration processes (problem solving, innovation and creativity, decision making) had convincing values of significance but two others (conflict management, knowledge sharing) had weak ones.

Table 53 – Outcomes summary for mean comparison hypotheses

Hypothesis	Expected Effect	Observed Effect	Verification status
H1a	Significantly higher level in ongoing teams than temporary ones	Significantly higher level in ongoing teams than temporary ones	Supported
H1b			Supported
H2a			Supported
H2b		No significant level difference between the two groups	Not supported
H3a		Significantly higher level in ongoing teams than temporary ones	Supported
H3b			Supported
H3c			Supported
H3d			Supported
H3e			Supported

A post-hoc statistical power analysis was conducted for each of the hypotheses (Table 54). For five hypotheses the value was under .80. The H2b value was very low, nevertheless the result was not significant. For H3a and H3b the values were respectively .54 and .52. The Cohen's d value was also low.

Therefore, the results were not really conclusive. These two hypotheses were analyzed in more detail by qualitative analysis. Finally, the hypotheses H2a and H3a had values respectively of .63 and .70 which were under .80. Therefore, the results had limited reliability, the Type II error probability being high. The values were all calculated with G*Power 3.1 software.

Table 54 - Post-hoc statistical power analysis for Independent-sample t-test hypotheses with two groups

n of group 1 = 44, n of group 2 = 191 & $\alpha = .05$		
	Cohen's d	1- β (power)
H1a	.491	.90
H1b	.618	.98
H2a	.330	.63
H2b	.080	.12
H3a	.362	.70
H3b	.522	.93
H3c	.435	.83
H3d	.293	.54
H3e	.282	.52

6.2.3 Correlation Analysis

The next stage was to validate (or not) the next set of hypotheses that assume the existence of trust as a mediator between communication and collaboration. According to Baron and Kenny [1986], in order to identify a mediation relationship, researchers need to proceed in several stages as explained previously. The first stage required the existence of correlation between the IV and the DV, that is between communication and collaboration. The next stage is evidence of correlation between IV and the mediator(s), between communication and trust. And the last stage of correlation evidence is between the mediator(s) and the DV that is between trust and collaboration.

6.2.3.1 Correlation between Communication and Collaboration (path c)

Considering that the study hoped to verify the mediating effect of trust on both relationship-oriented and task-oriented communication as IVs, Pearson's correlation test was run between the two types of communication against each of the five collaboration processes. A total of ten tests were run in order to meet

Baron and Kenny's [1986] first condition (Table 55). For the tests with relationship-oriented communication as IV, three relationships were found with a strong effect size (Pearson's $r > .5$) and two with a medium effect size (Pearson's $r > .3$). Relationship-oriented communication was positively correlated with problem solving, Pearson's $r(257) = .547$, $p < .001$. Relationship-oriented communication was also positively correlated with innovation and creativity, Pearson's $r(257) = .504$, $p < .001$. It was also found positively correlated with knowledge sharing, Pearson's $r(257) = .418$, $p < .001$. The same result was found with decision making, Pearson's $r(257) = .499$, $p < .001$. And finally, it was also found to be positively correlated with conflict management, Pearson's $r(257) = .516$, $p < .001$. For the tests with task-oriented communication as IV, two relationships were found with a strong effect size (Pearson's $r > .5$) and three with a medium effect size (Pearson's $r > .3$). Task-oriented communication was positively correlated with problem solving, Pearson's $r(257) = .582$, $p < .001$. Relationship-oriented communication was also positively correlated with innovation and creativity, Pearson's $r(257) = .470$, $p < .001$. It was also found to be positively correlated with knowledge sharing, Pearson's $r(257) = .465$, $p < .001$. The same finding occurred with decision making, Pearson's $r(257) = .442$, $p < .001$. And finally, it was also found to be positively correlated with conflict management, Pearson's $r(257) = .531$, $p < .001$. It can be noticed that all the relationships were highly significant with $p < .001$ for all the Pearson's correlation tests. Moreover, it can be observed that the size effect of the two types of communication with each of the collaboration processes was quite similar. Yet there is a slight advantage for relationship-oriented communication with innovation/creativity and decision making and a slight advantage for task-oriented communication with problem solving, knowledge sharing and conflict management. Thus, the first condition proposed by Baron and Kenny [1986] was met for all the variables.

Table 55 - Communication and Collaboration correlation

Person coefficient <i>r</i> N = 259		Communication	
		Relationship-oriented	Task-oriented
Collaboration	Problem solving	.547***	.582***
	Innovation and Creativity	.504***	.470***
	Knowledge sharing	.418***	.465***
	Decision making	.499***	.442***
	Conflict management	.516***	.531***

* $p < .05$, ** $p < .01$, *** $p < .001$

6.2.3.2 Correlation between Communication and Trust (path a)

To meet the second condition proposed by Baron and Kenny [1986], correlation evidence must be found between the IV and the mediator(s). In the case of this study, two variables were tested for mediation effect, affective-based trust and cognitive-based trust. Hence, four of Pearson's correlation tests were run (Table 56). Two tests with relationship-oriented communication against affective- and cognitive-based trust and two with task-oriented communication against affective- and cognitive-based trust. For the four tests, positive correlations were found where one relationship was found with a very strong effect size and three relationships with a medium effect size. The results for relationship-oriented communication and affective-based trust were Pearson's $r(257) = .664$, $p < .001$; for relationship-oriented communication and cognitive-based trust, Pearson's $r(257) = .491$, $p < .001$. For task-oriented communication and affective-based trust, Pearson's $r(257) = .393$, $p < .001$; task-oriented communication and cognitive-based trust, Pearson's $r(257) = .437$, $p < .001$. It can be noticed that for affective-based trust, there was a very strong effect size with relationship-oriented communication while for task-oriented communication, it was the weakest of the four results. For cognitive-based trust the effect size was very close with a slight advantage for relationship-oriented communication on task-oriented communication. All the results were highly significant with $p < .001$. Thus, the second condition was met for all the variables.

Table 56 - Communication and Trust correlation

Person coefficient <i>r</i> N = 259		Communication	
		Relationship-oriented	Task-oriented
Trust	Affective-based	.664***	.393***
	Cognitive-based	.491***	.437***

* $p < .05$, ** $p < .01$, *** $p < .001$

6.2.3.3 Correlation between Trust and Collaboration (path b)

To meet the third and last correlation condition proposed by Baron and Kenny [1986], evidence of correlation must also be found between the mediator(s) and the DV. Considering that there were two assumed mediators and five different DVs, ten Pearson's correlations were tested (Table 57). For the tests with affective-based trust as one of the assumed mediators, three relationships were found with strong effect size (Pearson's $r > .5$) and two with medium effect size (Pearson's $r > .3$). Affective-based trust was positively correlated with problem solving, Pearson's $r(257) = .585$, $p < .001$. Affective-based trust was also positively correlated with innovation and creativity, Pearson's $r(257) = .497$, $p < .001$. It was also found to be positively correlated with knowledge sharing, Pearson's $r(257) = .389$, $p < .001$. It was also correlated with decision making, Pearson's $r(257) = .557$, $p < .001$. And finally, it was found to be positively correlated with conflict management, Pearson's $r(259) = .560$, $p < .001$. For the tests with cognitive-based trust as the second assumed mediator, four relationships were found with a strong effect size (Pearson's $r > .5$) and one with a medium effect size (Pearson's $r > .3$). Cognitive-based trust was positively correlated with problem solving, Pearson's $r(257) = .610$, $p < .001$. Cognitive-based trust was also positively correlated with innovation and creativity, Pearson's $r(257) = .443$, $p < .001$. It was also found to be positively correlated with knowledge sharing, Pearson's $r(257) = .524$, $p < .001$. It was positively correlated with decision making, Pearson's $r(257) = .634$, $p < .001$. And finally, it was also found to be positively correlated with conflict management, Pearson's $r(257) = .585$, $p < .001$. It can be noticed that beside knowledge sharing, which had a medium size effect with affective-based trust and a strong size effect with cognitive-based trust, the other components had quite similar size effects with

affective- and cognitive based-trust. However, for innovation and creativity, affective-based trust had a slight advantage over cognitive-based trust while for the others, cognitive-based trust had the advantage over affective-based trust. All the results were highly significant ($p < .001$). The third and last correlation condition was also met for all the variables. Because all the three correlation conditions were met for all variables, it was possible to run multiple linear regression for mediation analysis.

Table 57 - Trust and Collaboration correlation

Person coefficient r N = 259		Trust	
		Affective-based	Cognitive-based
Collaboration	Problem solving	.585***	.610***
	Innovation and Creativity	.497***	.443***
	Knowledge sharing	.389***	.524***
	Decision making	.557***	.634***
	Conflict management	.560***	.585***

* $p < .05$, ** $p < .01$, *** $p < .001$

6.2.4 Mediation effect analyses

Based on Baron and Kenny [1986], the second stage after finding correlation between the variables is to test statistically the existence of the mediation effect itself.

The fact that all previous correlation tests were significant and met all the Baron and Kenny [1986] requirements, allowed us to continue the analysis to determine whether affective-based trust and cognitive-based trust had a mediating effect between communication and collaboration. In order to test this mediation effect, the methodology developed by Preacher and Hayes [2004] was used for mediation testing that facilitated estimation of the indirect effect with a normal theory approach and a bootstrap approach to obtain confidence intervals. In the present study, a 95% confidence interval of the indirect effects was obtained with 5000 bootstrap resamples [Preacher & Hayes, 2008]. Because heteroscedasticity was observed in multiple cases (Table 24 & Table 25), the method of heteroscedasticity-consistent standard error estimators was used

during the multiple mediation analyses [Hayes & Cai, 2007]. In order to be able to compare the β strength between the results, standardized values (Z-scores) of the variables were used in the simple and multiple linear regressions. Four variables were entered as covariates at each of the linear regression analyses. These covariates (or controller variables) were the gender of the respondent, the position the respondent fulfills within the team i.e. team leader or regular team member, the type of virtual team based on time i.e. temporary or ongoing and the type of virtual team based on distance i.e. local or global. These variables were defined in the quantitative sample design section above (Section 6.1.2). They were also entered as controller variables to check whether they affected the multiple mediation models of this study.

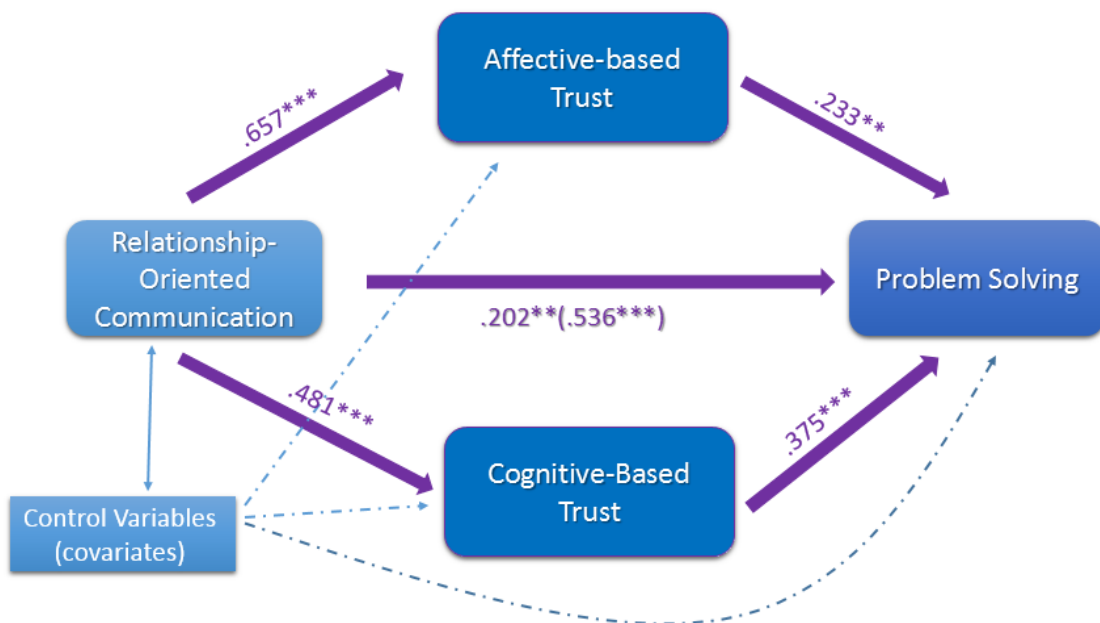
6.2.4.1 *Mediation analysis with problem solving as DV*

In this first mediation analysis (Table 58), the independent variable relationship-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .657$, $F(7, 251) = 13.846$, $p < .001$) and cognitive-based trust ($\beta = .536$, $F(7, 251) = 8.734$, $p < .001$). Relationship-oriented communication was also significantly related to the dependent variable problem solving ($\beta = .343$, $F(7, 251) = 9.330$, $p < .001$). Additionally, both proposed mediators were significantly related to problem solving where for affective-based trust; $\beta = .233$, $F(7, 251) = 3.067$, $p < .01$ and for cognitive-based trust; $\beta = .375$, $F(7, 251) = 6.252$, $p < .001$. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: relationship-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and problem solving as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of both affective-based Trust ($\beta=.153$, $CI=.063$ to $.269$) and cognitive-based Trust ($\beta=.181$, $CI=.118$ to $.255$), as none of them had the result of zero in the confidence interval. Furthermore, the relationship

between relationship-oriented communication and problem solving was weaker in this analysis ($\beta = .202$; $t = 2.842$, $p < .01$) compared to the direct relationship ($\beta = .202$). The direct effect between relationship-oriented communication and problem solving was still significant ($p = .005$), suggesting only a partial mediation. The covariates, Gender ($p = .634$), team leader/teammate role ($p = .345$), temporary/ongoing team ($p = .729$), local/global team ($p = .456$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-}R^2 = .482$, $F(7,251) = 33.233$, $p < .001$). The H4a hypothesis was fully supported where both affective- and cognitive-based trust were found to be partial mediators (

Figure 19).

Figure 19 - Multiple mediation model with relationship-oriented communication as IV, affective- and cognitive-based trust as mediators and problem solving as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 58 - Mediation analysis with relationship-oriented communication as IV and problem solving as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.657	13.846	.000***
Cognitive-based trust	.481	8.734	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.233	3.067	.002**
Cognitive-based trust	.375	6.252	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Relationship-oriented communication	.536	9.330	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Relationship-oriented communication	.202	2.842	.005**
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	-.046	-.477	.634
Team leader, Teammate or both role	.068	.946	.345
Temporary, Ongoing or both team	-.033	-.347	.729
Local, Global or both team	-.043	-.747	.456
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.482	33.233	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

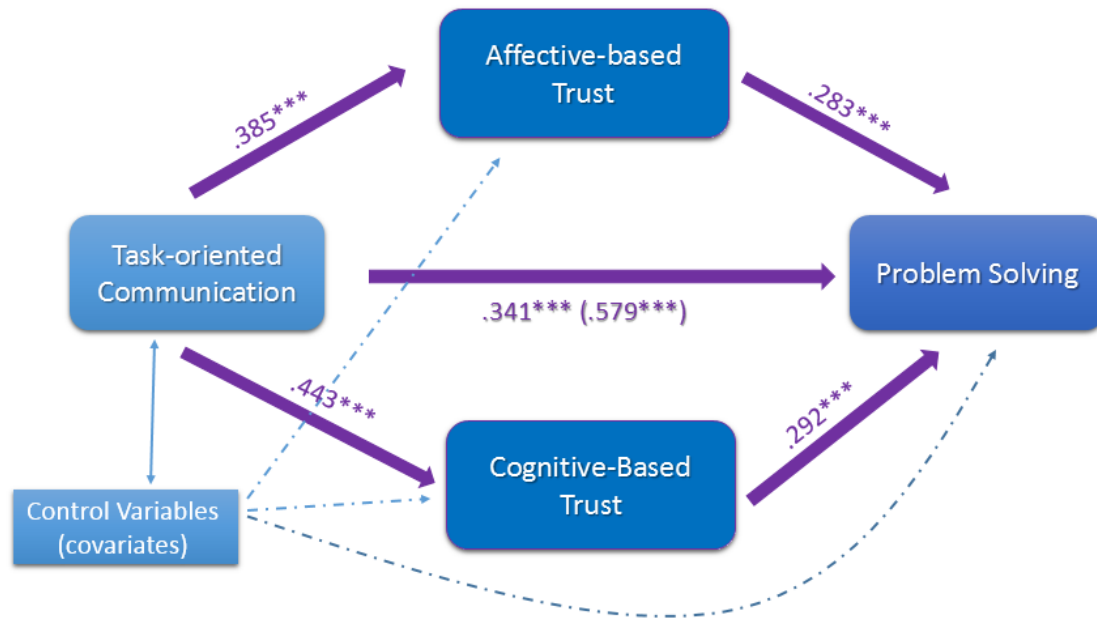
Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.334	.237	.455
Affective-based trust	.153	.063	.269
Cognitive-based trust	.181	.118	.255

* p<.05, **p<.01, ***p<.001

In the next mediation analysis (Table 59), the independent variable task-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .385$, $F(7, 251) = 5.969$, $p < .001$) and cognitive-based trust ($\beta = .443$, $F(7, 251) = 6.755$, $p < .001$). Task-oriented communication was also significantly related to the dependent variable problem solving ($\beta = .579$, $F(7, 251) = 10.874$, $p < .001$). Additionally, both proposed mediators were significantly related to problem solving where for affective-based trust; $\beta = .283$, $F(7, 251) = 4.697$, $p < .001$ and for cognitive-based trust; $\beta = .292$, $F(7, 251) = 5.169$, $p < .001$. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: task-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and problem solving as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. Results of the mediation analysis confirmed the mediating role of both Affective-based Trust ($\beta = .109$, $CI = .059$ to $.178$) and Cognitive-based Trust ($\beta = .129$, $CI = .077$ to $.198$) as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and problem solving was weaker in this analysis ($\beta = .341$; $t = 7.423$, $p < .001$) compared to the direct relationship ($\beta = .579$). The direct effect between relationship-oriented communication and problem solving was still significant ($p < .001$), suggesting only a partial mediation. The covariates, gender ($p = .903$), team leader/teammate ($p = .783$) role, temporary/ongoing team ($p = .476$) were found to be insignificant, thus they did not affect the mediation model. However, the covariate local/global team ($p = .011$) was found to be significant. Thus, the distance between the teammates at a physical or even cultural level seemed to have an impact on the mediation model involving task-oriented communication and problem solving. Further research needs to be conducted to understand this impact but this research was not a part of the framework of this study. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-}R^2 = .548$, $F(7, 351) = 44.559$, $p < .001$). The H5a

hypothesis was fully supported where both affective- and cognitive-based trust were found to be partial mediators (Figure 20).

Figure 20 - Multiple mediation model with task-oriented communication as IV, affective- and cognitive-based trust as mediators and problem solving as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 59 - Mediation analysis with task-oriented communication as IV and solving problem as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.385	5.969	.000***
Cognitive-based trust	.443	6.755	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.283	4.697	.000***
Cognitive-based trust	.292	5.169	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Task-oriented communication	.579	10.874	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Task-oriented communication	.341	7.423	.000***
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	.014	.122	.903
Team leader, Teammate or both role	-.022	-.275	.783
Temporary, Ongoing or both team	.074	.715	.476
Local, Global or both team	-.159	-2.551	.011*
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.548	44.559	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.238	.166	.324
Affective-based trust	.109	.059	.178
Cognitive-based trust	.129	.077	.198

* p<.05, **p<.01, ***p<.001

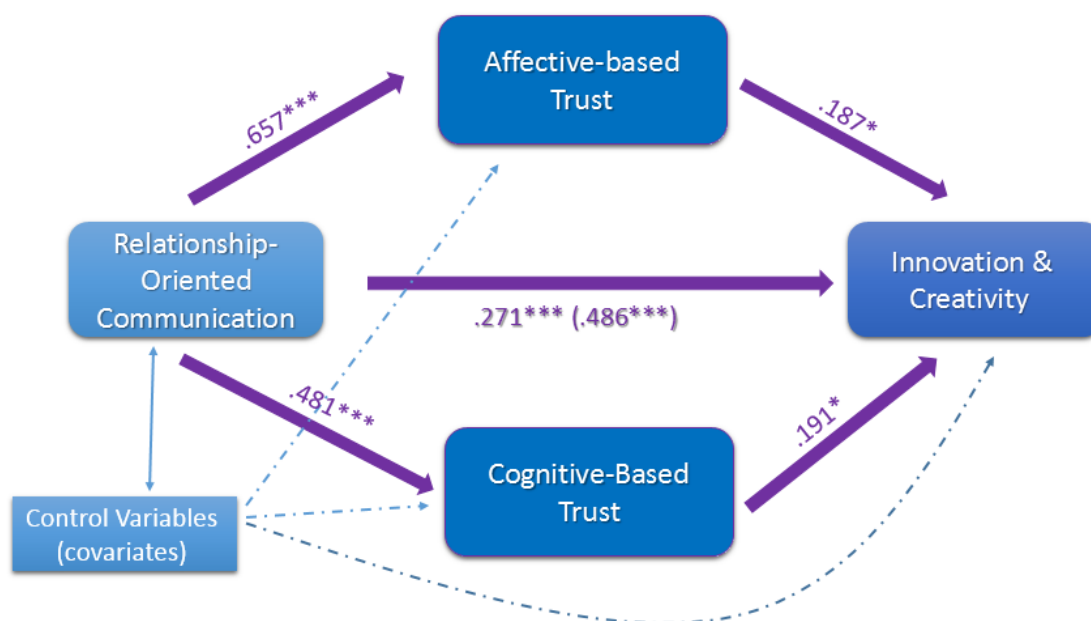
In conclusion, for the mediation analysis with problem solving as DV, it two observations could be noticed. The first was that in the cases of both relationship- and task-oriented communication, the two types of trust acted as partial mediators where cognitive-based trust seemed to have a slightly higher impact than affective-based trust. The β result for cognitive-based trust was .181 and for affective-based trust it was .153 in the model with relationship-oriented communication. The β result for cognitive-based trust was .129 and for affective-based trust it was .109 in the model with task-oriented communication. The second observation was that the covariate defining the type of the team that the respondent worked in e.g. local virtual team, global team or both seemed to have an impact on the model with task-oriented communication as IV. However, this last observation was not elaborated upon further since it was not a part of the study's framework.

6.2.4.2 Mediation analysis with innovation and creativity as DV

For the first innovation and creativity mediation analysis (Table 60), the independent variable relationship-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .657$, $F(7, 251) = 13.846$, $p < .001$) and cognitive-based trust ($\beta = .481$, $F(7, 251) = 8.734$, $p < .001$). Relationship-oriented communication was also significantly related to the dependent variable innovation and creativity ($\beta = .486$, $F(7, 251) = 8.658$, $p < .001$). Additionally, both proposed mediators were significantly related to problem solving, where for affective-based trust; $\beta = .187$, $F(7, 251) = 2.190$, $p = .029$ and for cognitive-based trust; $\beta = .191$, $F(7, 251) = 2.512$, $p = .012$. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: relationship-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and, innovation and creativity as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of both Affective-based

Trust ($\beta=.123$, CI=.020 to .239) and Cognitive-based Trust ($\beta=.092$, CI=.024 to .172), seeing as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and innovation and creativity was weaker in this analysis ($\beta = .271$; $t = 3.531$, $p = .005$) compared to the direct relationship ($\beta = .486$). The direct relationship between relationship-oriented communication and innovation and creativity was still significant ($p < .001$), though this was suggesting only a partial mediation. The covariates, gender ($p = .429$), team leader/teammate role ($p = .126$) and local/global team ($p = .652$) were found to be insignificant, thus they did not affect the mediation model. However, the covariate temporary/ongoing team ($p = .029$) was found to be significant, therefore it affected the model and further tests need to be conducted to understand its impact. These tests were conducted later as part of the H6 set of hypotheses analyses. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-R}^2=.347$, $F(7,351)=17.397$, $p < .001$). The H4b hypothesis was fully supported where both affective- and cognitive-based trust were found to be partial mediators (Figure 21).

Figure 21 - Multiple mediation model with relationship-oriented communication as IV, affective- and cognitive-based trust as mediators and, innovation and creativity as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 60 - Mediation analysis with relationship-oriented communication as IV and innovation/creativity as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.657	13.846	.000***
Cognitive-based trust	.481	8.734	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.187	2.190	.029*
Cognitive-based trust	.191	2.516	.012*
Total Effect of IV on DV (c path)			
	β	t	Sig.
Relationship-oriented communication	.486	8.658	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Relationship-oriented communication	.271	3.531	.000***
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	.089	.792	.429
Team leader, Teammate or both role	.119	1.533	.126
Temporary, Ongoing or both team	.228	2.195	.029*
Local, Global or both team	-.032	-.452	.652
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.347	17.397	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

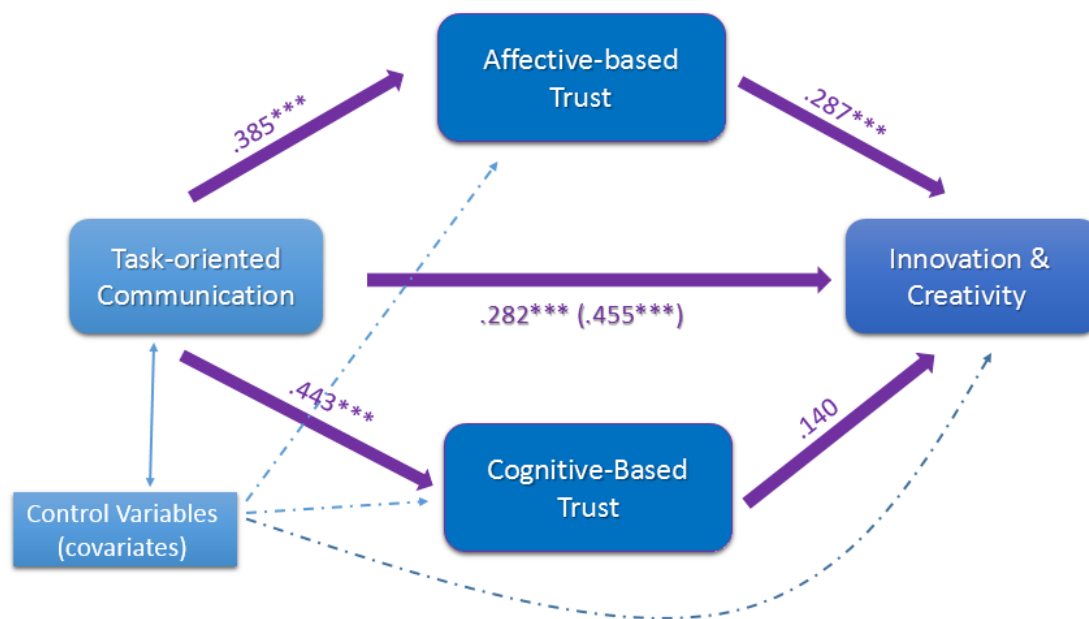
Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
		Bias Corrected Confidence Intervals	
	Data	Lower	Upper
Total	.215	.117	.328
Affective-based trust	.123	.020	.239
Cognitive-based trust	.092	.024	.172

* p<.05, **p<.01, ***p<.001

For the second innovation and creativity mediation analysis (Table 61), the independent variable task-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .385$, $F(7, 251) = 5.969$, $p < .001$) and cognitive-based trust ($\beta = .443$, $F(7, 251) = 6.755$, $p < .001$). Task-oriented communication was also significantly related to the dependent variable innovation and creativity ($\beta = .455$, $F(7, 251) = 7.526$, $p < .001$). Only affective-based trust ($\beta = .287$, $F(7, 251) = 3.838$, $p < .001$) was significantly related to innovation and creativity. Cognitive-based trust ($\beta = .140$, $F(7, 251) = 1.920$, $p = .56$) was not significantly related to innovation and creativity. Because cognitive-based trust was correlated with innovation and creativity (Table 57) but no significant relationship was observed between them in the linear regression, it is possible that the covariates affect this relationship. Indeed, this linear regression was re-run without covariates and cognitive-based trust was found to be significant ($p = .45$). This issue was investigated later as a part of the H6 hypotheses' set. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: task-oriented communication as independent variable, affective-based trust and cognitive-based trust as mediation variables and innovation and creativity as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of affective-based trust ($\beta = .110$, $CI = .053$ to $.192$) which was without a no-zero result in the confidence interval. The result for cognitive-based trust ($\beta = .062$, $CI = .004$) was very close to a zero result in the confidence interval (Lower $CI = .004$), therefore, in addition to the bootstrap test, a Sobel test was also run in order to get a more conclusive result. The result of the Sobel test ($z = 1.903$, $p = .057$) confirmed the doubt and the role cognitive-based trust as a mediator in the relationship was not conclusive. However, the relationship between relationship-oriented communication and innovation and creativity was weaker in this analysis ($\beta = .282$, $t = 4.360$, $p < .001$) when compared with the direct relationship ($\beta = .455$). The direct relationship between relationship-oriented communication and problem

solving was still significant ($p < .001$), and this suggested only a partial mediation of affective-based trust. The covariates, gender ($p = .410$), team role ($p = .299$) and local/global team ($p = .470$) were found to be insignificant, thus they did not affect the mediation model. However, the covariate temporary/ongoing team ($p = .023$) was found to be significant, therefore it affected the model and further tests need to be conducted to understand its impact. These tests were conducted later as part of the hypothesis H6 analyses. And finally, this mediating model explained a significant proportion of variance in relationship-oriented communication (adj- $R^2 = .367$, $F(7,351) = 18.834$, $p < .001$). The H5b hypothesis was partially supported where affective-based trust seemed to be a partial mediator but the result for cognitive-based trust was not conclusive (Figure 22).

Figure 22 - Multiple mediation model with task-oriented communication as IV, affective- and cognitive-based trust as mediators and, innovation and creativity as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 61 - Mediation analysis with task-oriented communication as IV and innovation/creativity as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.385	5.969	.000***
Cognitive-based trust	.443	6.755	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.287	3.838	.000***
Cognitive-based trust	.140	1.920	.056
Total Effect of IV on DV (c path)			
	β	t	Sig.
Task-oriented communication	.455	7.526	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Task-oriented communication	.282	4.360	.000***
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	.094	.825	.410
Team leader, Teammate or both role	.081	1.040	.299
Temporary, Ongoing or both team	.226	2.290	.023*
Local, Global or both team	-.052	-.723	.470
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.367	18.834	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.173	.104	.254
Affective-based trust	.110	.053	.192
Cognitive-based trust	.062	.004	.131

* p<.05, **p<.01, ***p<.001

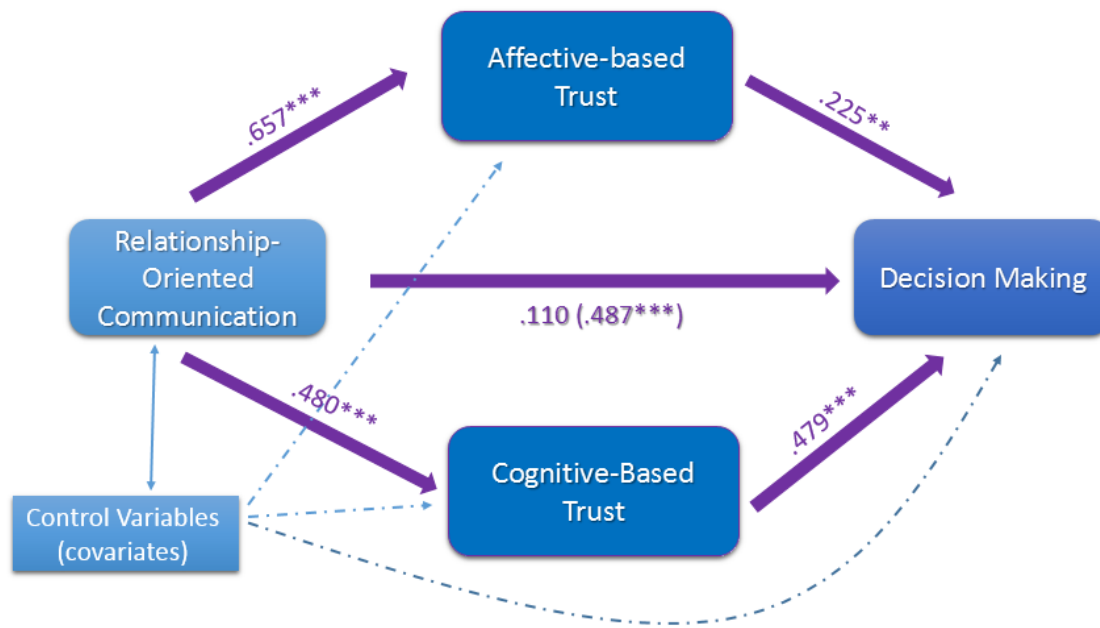
Concluding the mediation analyses with innovation and creativity as DV, several observations could be noticed. The first was that in the case of relationship-oriented communication, the two types of trust acted as partial mediators where affective-based trust seemed to have a slightly higher impact than cognitive-based trust. The β result for affective-based trust was .123 and for cognitive-based trust it was .092. The second observation was that cognitive-based trust's role as a mediator between task-oriented communication and innovation and creativity was not conclusive, therefore it seemed that only affective-based trust had a mediating effect on the relationship. The β result for affective-based trust was .110 and for cognitive-based trust it seemed not to be relevant (Sobel test; $z = 1.903$, $p = .57$). Finally, the covariate temporary/ongoing team seemed to affect this model in a significant way in both cases. This last observation was investigated later on during H6 hypotheses analyses.

6.2.4.3 Mediation analysis with decision making as DV

For mediation analysis between relationship-oriented communication and decision making, case 72 was removed as it was required by the previous outliers' analysis (Table 62). The independent variable relationship-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .657$, $F(7, 250) = 13.859$, $p < .001$) and cognitive-based trust ($\beta = .480$, $F(7, 250) = 8.726$, $p < .001$). Relationship-oriented communication was also significantly related to the dependent variable decision making ($\beta = .487$, $F(7, 250) = 8.293$, $p < .001$). Additionally, both proposed mediators were significantly related to decision making, where for affective-based trust; $\beta = .225$, $F(7, 250) = 3.298$, $p = .001$ and for cognitive-based trust; $\beta = .479$, $F(7, 250) = 7.255$, $p < .001$. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: relationship-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and decision making as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation

analysis confirmed the mediating role of both Affective-based Trust ($\beta=.148$, $CI=.064$ to $.245$) and Cognitive-based Trust ($\beta=.230$, $CI=.158$ to $.315$), seeing as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and problem solving was weaker in this analysis ($\beta = .110$; $t = 1.594$, $p = .112$) compared to the direct relationship ($\beta = .489$). The direct effect between relationship-oriented communication and decision making was insignificant ($p = .112$), and this suggested the full mediation of affective- and cognitive based trust on the relationship. The covariates, gender ($p = .388$), temporary/ongoing team ($p = .784$), local/global team ($p = .653$) were found to be insignificant, thus they did not affect the mediation model. However, the covariate team role ($p = .009$) was found to be significant. Thus, the role of the team member within the team as a team leader or regular teammate seemed to have an impact on the mediation model involving relationship-oriented communication and decision making. Further research needs to be conducted to understand this impact but this research was not a part of the framework of this study. And finally, this mediating model explains a significant proportion of variance in relationship-oriented communication ($adj-R^2=.511$, $F(7,350)=44.258$, $p < .001$). The H4c hypothesis was fully supported where affective- and cognitive-based trust together seemed to be fully mediating the relationship (Figure 23).

Figure 23 - Multiple mediation model with relationship-oriented communication as IV, affective- and cognitive-based trust as mediators and decision making as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 62 - Mediation analysis with relationship-oriented communication as IV and decision making as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.657	13.859	.000***
Cognitive-based trust	.480	8.726	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.225	3.298	.001**
Cognitive-based trust	.479	7.255	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Relationship-oriented communication	.487	8.293	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Relationship-oriented communication	.110	1.594	.112
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	.081	.865	.388
Team leader, Teammate or both role	.166	.2.645	.009**
Temporary, Ongoing or both team	-.022	-.274	.784
Local, Global or both team	.027	.450	.653
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.511	44.278	.000***

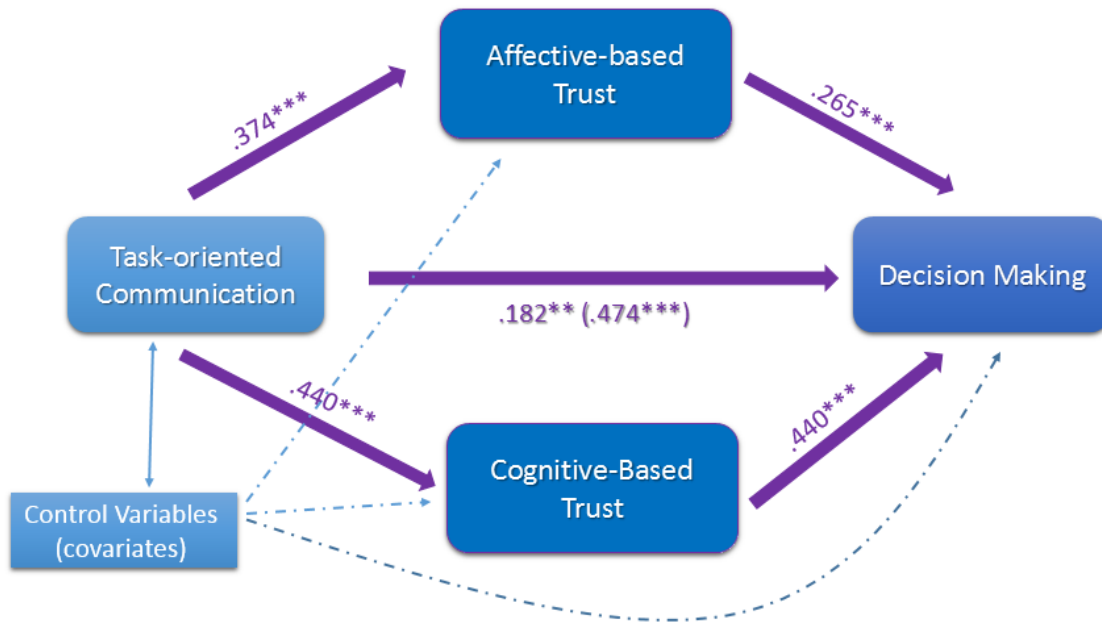
BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.378	.272	.497
Affective-based trust	.148	.064	.245
Cognitive-based trust	.230	.158	.315

* p<.05, **p<.01, ***p<.001

For mediation analysis between task-oriented communication and decision making (Table 63), three cases were removed (72, 180, 217) as was required according to the previous outliers' analysis. The independent variable task-oriented communication was significantly related to both affective-based trust ($\beta = .374$, $F(7, 248) = 5.665$, $p < .001$) and cognitive-based trust ($\beta = .440$, $F(7, 248) = 6.538$, $p < .001$). Task-oriented communication was significantly related to the dependent variable decision making ($\beta = .474$, $F(7, 248) = 7.002$, $p < .001$). Additionally, both proposed mediators were significantly related to decision making, where for affective-based trust; $\beta = .265$, $F(7, 248) = 4.766$, $p < .001$ and for cognitive-based trust; $\beta = .440$, $F(7, 248) = 6.434$, $p < .001$. To test for mediation, a multiple linear regression analysis via IBM SPSS macro [Hayes, 2014] was conducted. The following variables were entered: task-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and decision making as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of both Affective-based Trust ($\beta = .099$, $CI = .053$ to $.165$) and Cognitive-based Trust ($\beta = .193$, $CI = .127$ to $.279$) seeing as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and innovation and creativity was weaker in this analysis ($\beta = .182$; $t = 3.040$, $p = .003$) when compared with the direct relationship ($\beta = .474$). The direct relationship between relationship-oriented communication, innovation and creativity was still significant ($p < .001$), and this suggested only a partial mediation of affective- and cognitive-based trust in the relationship. The covariates, gender ($p = .223$), team leader/teammate role ($p = .478$), temporary/ongoing team ($p = .377$) and local/global team ($p = .138$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-R}^2 = .560$, $F(7, 348) = 51.549$, $p < .001$). The H4c hypothesis was fully supported where both affective- and cognitive-based trust were found to be partial mediators (Figure 24).

Figure 24 - Multiple mediation model with task-oriented communication as IV, affective- and cognitive-based trust as mediators and decision making as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 63 - Mediation analysis with task-oriented communication as IV and decision making as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.374	5.665	.000***
Cognitive-based trust	.440	6.538	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.265	4.766	.000***
Cognitive-based trust	.440	6.434	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Task-oriented communication	.474	7.004	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Task-oriented communication	.182	3.040	.003**
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	.080	.867	.387
Team leader, Teammate or both role	.113	1.855	.065
Temporary, Ongoing or both team	-.021	-.269	.788
Local, Global or both team	.016	.266	.791
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.560	51.549	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.293	.208	.394
Affective-based trust	.099	.053	.165
Cognitive-based trust	.193	.127	.279

* p<.05, **p<.01, ***p<.001

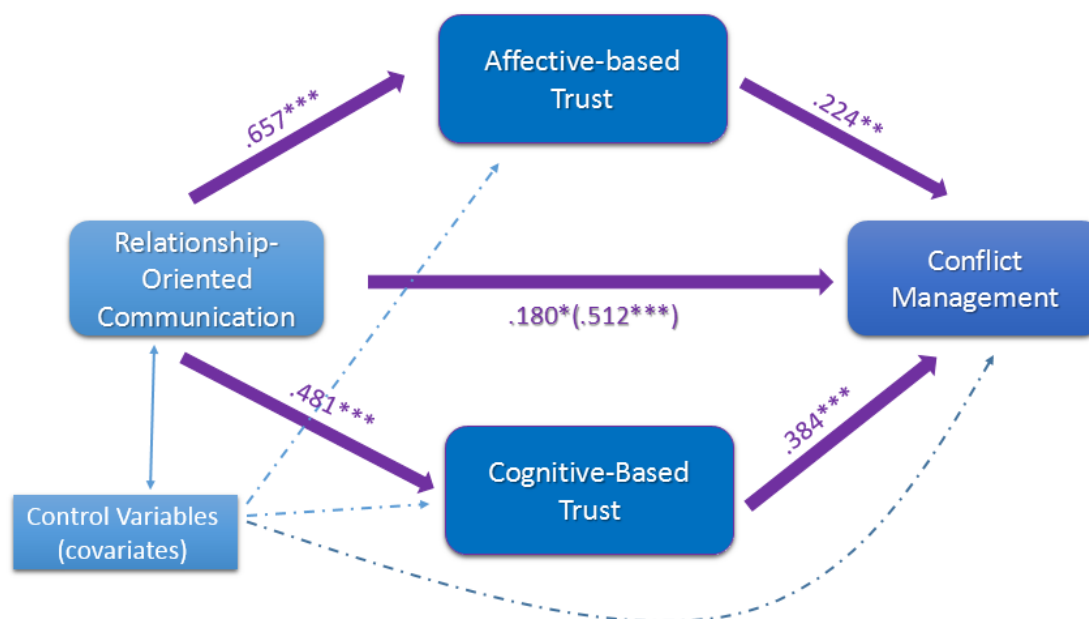
Concluding these two multiple mediation analyses, the two types of trust acted together as full mediators for relationship-oriented communication where cognitive-based trust ($\beta = .230$) seemed to have a greater impact than affective-based trust ($\beta = .148$) on the relationship. For task-oriented communication, affective- and cognitive based trust seemed to be only partial mediators and cognitive-based trust ($\beta = .193$) also seemed to have a greater impact than affective-based trust ($\beta = .099$) on the relationship. Another observation was that the team role of the team members seemed to have an impact on the multiple mediation model but since this observation was not a part of this study's framework, no further investigation was carried out.

6.2.4.4 *Mediation analysis with conflict management as DV*

In the first mediation analysis of conflict management (Table 64), the independent variable relationship-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .657$, $F(7, 251) = 13.846$, $p < .001$) and cognitive-based trust ($\beta = .481$, $F(7, 251) = 8.734$, $p < .001$). Relationship-oriented communication was also significantly related to the dependent variable conflict management ($\beta = .512$, $F(7, 251) = 8.562$, $p < .001$). Additionally, both proposed mediators were significantly related to conflict management, where for affective-based trust; $\beta = .224$, $F(7, 251) = 2.868$, $p = .004$ and for cognitive-based trust; $\beta = .384$, $F(7, 251) = 5.597$, $p < .001$. To test for mediation, a multiple linear regression analysis was conducted via an IBM SPSS macro [Hayes, 2014]. The following variables were entered: relationship-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and conflict management as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of both Affective-based Trust ($\beta = .147$, $CI = .050$ to $.258$) and Cognitive-based Trust ($\beta = .185$, $CI = .120$ to $.262$), seeing as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and conflict

management was weaker in this analysis ($\beta = .180, t = 2.353, p = .019$) when compared with the direct relationship ($\beta = .512$). The direct relationship between relationship-oriented communication and conflict management was still insignificant ($p = .019$), and this suggested only a partial mediation. The covariates, gender ($p = .395$), team role ($p = .360$) temporary/ongoing team ($p = .771$), local/global team ($p = .260$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explains a significant proportion of variance in relationship-oriented communication ($\text{adj-R}^2=.444, F(7,351)=32.852, p < .001$). The H4d hypothesis was fully supported where both affective- and cognitive-based trust were found to be partial mediators (Figure 25).

Figure 25 - Multiple mediation model with relationship-oriented communication as IV, affective- and cognitive-based trust as mediators and conflict management as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 64 - Mediation analysis with relationship-oriented communication as IV and conflict management as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.657	13.846	.000***
Cognitive-based trust	.481	8.734	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.224	2.868	.004**
Cognitive-based trust	.384	5.597	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Relationship-oriented communication	.512	8.562	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Relationship-oriented communication	.180	2.353	.019*
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	-.089	-.852	.395
Team leader, Teammate or both role	.064	.918	.360
Temporary, Ongoing or both team	-.29	-.292	.771
Local, Global or both team	.072	1.128	.260
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.444	32.852	.000***

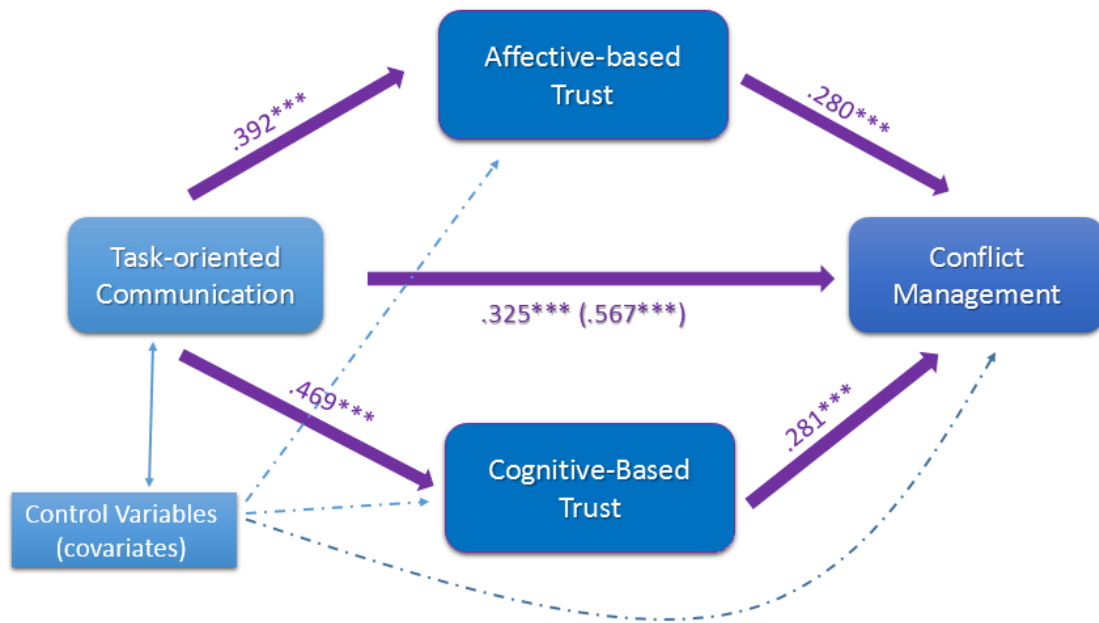
BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.332	.159	.343
Affective-based trust	.147	.050	.258
Cognitive-based trust	.185	.120	.262

* p<.05, **p<.01, ***p<.001

For analysis of the mediation between task-oriented communication and conflict management (Table 65), case 43 was removed as was required by the previous outliers' analysis. The independent variable task-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .392$, $F(7, 250) = 5.959$, $p < .001$) and cognitive-based trust ($\beta = .469$, $F(7, 250) = 7.581$, $p < .001$). Task-oriented communication was also significantly related to the dependent variable conflict management ($\beta = .567$, $F(7, 250) = 9.623$, $p < .001$). Additionally, both proposed mediators were significantly related to conflict management where for affective-based trust; $\beta = .280$, $F(7, 250) = 4.734$, $p < .001$ and for cognitive-based trust; $\beta = .281$, $F(7, 250) = 4.312$, $p < .001$. To test for mediation, a multiple linear regression analysis was conducted via an IBM SPSS macro [Hayes, 2014]. The following variables were entered: task-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and conflict management as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of both Affective-based Trust ($\beta=.110$, $CI=.057$ to $.185$) and Cognitive-based Trust ($\beta=.132$, $CI=.079$ to $.204$), seeing as none of them had the result of zero in the confidence interval. Furthermore, the relationship between relationship-oriented communication and conflict management was weaker in this analysis ($\beta = .325$, $t= 5.361$, $p < .001$) when compared with the direct relationship ($\beta = .567$). The direct relationship between relationship-oriented communication and conflict management was still significant ($p < .001$), and this suggested only a partial mediation. The covariates, gender ($p = .639$), team role ($p = .715$), temporary/ongoing team ($p = .789$), local/global team ($p = .597$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-}R^2=.505$, $F(7, 250)= 42.126$, $p < .001$). The H5d hypothesis was fully supported where both affective- and cognitive-based trusts were found to be partial mediators (Figure 26).

Figure 26 - Multiple mediation model with task-oriented communication as IV, affective- and cognitive-based trust as mediators and conflict management as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 65 - Mediation analysis with task-oriented communication as IV and conflict management as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.392	5.959	.000***
Cognitive-based trust	.469	7.581	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.280	4.734	.000***
Cognitive-based trust	.281	4.312	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Task-oriented communication	.567	9.623	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Task-oriented communication	.325	5.361	.000***
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	-.046	-.470	.639
Team leader, Teammate or both role	.025	.365	.715
Temporary, Ongoing or both team	-.025	-.267	.789
Local, Global or both team	.033	.530	.597
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.505	42.126	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.242	.167	.327
Affective-based trust	.110	.057	.185
Cognitive-based trust	.132	.079	.204

* p<.05, **p<.01, ***p<.001

Concluding the mediation analysis with conflict management as DV, it could be noticed that in the case of both relationship- and task-oriented communication, the two types of trust acted as partial mediators where cognitive-based trust seemed to have a higher impact than affective-based trust. The β result for cognitive-based trust was .185 and for affective-based trust it was .147 in the model with relationship-oriented communication. The β result for cognitive-based trust was .132 and for affective-based trust it was .110 in the model with task-oriented communication.

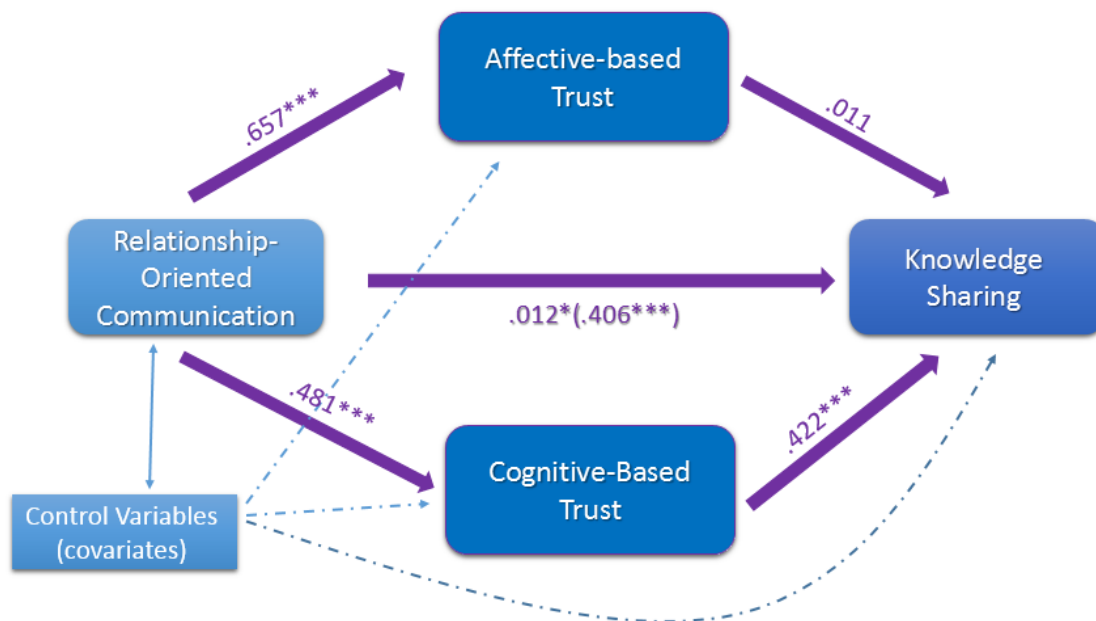
6.2.4.5 Mediation analysis with knowledge sharing as DV

For the first knowledge sharing mediation analysis (Table 66), the independent variable relationship-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .657$, $F(7, 251) = 13.846$, $p < .001$) and cognitive-based trust ($\beta = .481$, $F(7, 251) = 8.734$, $p < .001$). Relationship-oriented communication was also significantly related to the dependent variable knowledge sharing ($\beta = .406$, $F(7, 251) = 6.717$, $p < .001$). Only cognitive-based trust ($\beta = .422$, $F(7, 251) = 6.315$, $p < .001$) was significantly related to knowledge sharing. Affective-based trust ($\beta = .011$, $F(7, 251) = 0.092$, $p = .908$) was not significantly related to knowledge sharing. Therefore, only cognitive-based trust was expected to act as a mediator in this relationship. To test for mediation, a multiple linear regression analysis was conducted via an IBM SPSS macro [Hayes, 2014]. The following variables were entered: relationship-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and knowledge sharing as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of cognitive-based trust ($\beta = .203$, $CI = .133$ to $.284$) and rejected affective-based trust ($\beta = .007$, $CI = -.104$ to $.129$) as a mediator as it had a result of zero in the confidence interval. The relationship between relationship-oriented communication and knowledge sharing was weaker in this analysis ($\beta = .196$, $t = 2.725433$, $p = .012$) when

compared with the direct relationship ($\beta = .406$). The direct relationship between relationship-oriented communication and knowledge sharing was still significant ($p = .012$), and cognitive-based trust was only a partial mediator. The covariates, gender ($p = .882$), team role ($p = .157$), temporary/ongoing team ($p = .952$), local/global team ($p = .686$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-R}^2=.316$, $F(7,351)=17.728$, $p < .001$). The H4e hypothesis was only partially supported as only cognitive-based trust acted as a mediator in the relationship while affective-based trust did not (

Figure 27).

Figure 27 - Multiple mediation model with relationship-oriented communication as IV, affective- and cognitive-based trust as mediators and knowledge sharing as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 66 - Mediation analysis with relationship-oriented communication as IV and knowledge sharing as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.657	13.846	.000***
Cognitive-based trust	.481	8.734	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.011	.092	.908
Cognitive-based trust	.422	6.315	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Relationship-oriented communication	.406	6.717	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Relationship-oriented communication	.196	2.543	.012*
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	-.017	-.148	.882
Team leader, Teammate or both role	.117	1.419	.157
Temporary, Ongoing or both team	-.007	-.061	.952
Local, Global or both team	-.029	-.404	.686
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.316	17.728	.000***

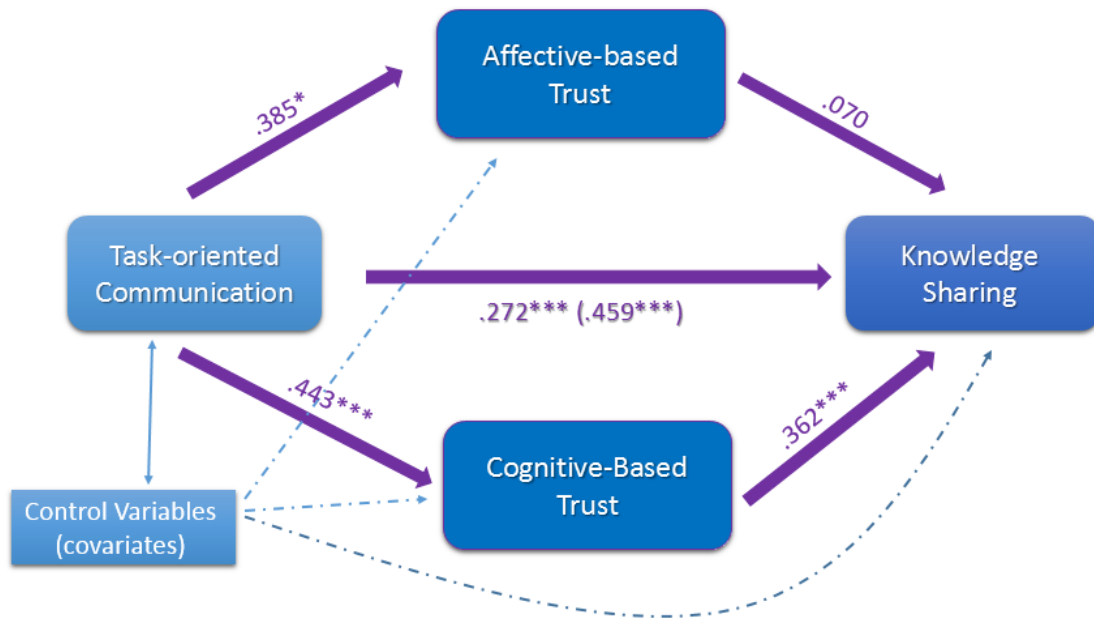
BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.210	.103	.332
Affective-based trust	.007	-.104	.129
Cognitive-based trust	.203	.133	.284

* p<.05, **p<.01, ***p<.001

For the second knowledge sharing mediation analysis (Table 67), the independent variable task-oriented communication was significantly related to both proposed mediators; affective-based trust ($\beta = .385$, $F(7, 251) = 5.969$, $p < .001$) and cognitive-based trust ($\beta = .443$, $F(7, 251) = 6.755$, $p < .001$). Task-oriented communication was also significantly related to the dependent variable knowledge sharing ($\beta = .459$, $F(7, 251) = 7.156091$, $p < .001$). Only cognitive-based trust ($\beta = .362$, $F(7, 251) = 5.046$, $p < .001$) was significantly related to knowledge sharing. Affective-based trust ($\beta = .070$, $F(7, 251) = .955$, $p = .341$) was not significantly related to knowledge sharing. Therefore, only cognitive-based trust was expected to act as a mediator in this relationship. To test for mediation, a multiple linear regression analysis was conducted via an IBM SPSS macro [Hayes, 2014]. The following variables were entered: task-oriented communication as the independent variable, affective-based trust and cognitive-based trust as mediation variables and knowledge sharing as the dependent variable. The covariates (gender, team role, temporary/ongoing team, local/global team) were also entered as controller variables to check whether they affected the multiple mediation model. The results of the mediation analysis confirmed the mediating role of cognitive-based trust ($\beta = .160$, $CI = .098$ to $.242$) and rejected affective-based trust ($\beta = .027$, $CI = -.024$ to $.009$) as a mediator, as it had a result of zero in the confidence interval. The relationship between relationship-oriented communication and knowledge sharing was also weaker in this analysis ($\beta = .272$; $t = 4.330$, $p < .001$) when compared with the direct relationship ($\beta = .459$). The direct relationship between relationship-oriented communication and knowledge sharing was still significant ($p < .001$), and this suggested only a partial mediation. The covariates, gender ($p = .938$), team role ($p = .363$), temporary/ongoing team ($p = .956$), local/global team ($p = .507$) were found to be insignificant, thus they did not affect the mediation model. And finally, this mediating model explained a significant proportion of the variance in relationship-oriented communication ($\text{adj-}R^2 = .351$, $F(7, 351) = 22.920$, $p < .001$). The H5b hypothesis was only partially supported as only affective-based trust acted as a mediator in the relationship while cognitive-based trust did not (Figure 28).

Figure 28 - Multiple mediation model with task-oriented communication as IV, affective- and cognitive-based trust as mediators and knowledge sharing as DV



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 67 - Mediation analysis with task-oriented communication as IV and knowledge sharing as DV

IV to Mediators (a paths)			
	β	t	Sig.
Affective-based trust	.385	5.969	.000***
Cognitive-based trust	.443	6.755	.000***
Direct Effects of Mediators on DV (b paths)			
	β	t	Sig.
Affective-based trust	.070	.955	.341
Cognitive-based trust	.362	5.046	.000***
Total Effect of IV on DV (c path)			
	β	t	Sig.
Task-oriented communication	.459	7.609	.000***
Direct Effect of IV on DV (c' path)			
	β	t	Sig.
Task-oriented communication	.272	4.330	.000***
Partial Effect of Control Variables on DV			
	β	t	Sig.
Gender (Female, Male)	-.009	-.078	.938
Team leader, Teammate or both role	.076	.911	.363
Temporary, Ongoing or both team	-.006	-.055	.956
Local, Global or both team	-.047	-.665	.507
Model Summary for DV Model			
	Adj R-sq	F	Sig.
	.351	22.920	.000***

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)			
	Data	Bias Corrected Confidence Intervals	
		Lower	Upper
Total	.187	.123	.265
Affective-based trust	.027	-.024	.090
Cognitive-based trust	.160	.098	.242

* p<.05, **p<.01, ***p<.001

Concluding the mediation analyses with knowledge sharing as DV, it could be observed that with both relationship- and task-oriented communication as IV, only cognitive-based trust seemed to act as a mediator in the relationship.

6.2.4.6 *Variables' effect on collaboration processes analysis*

In order to be able to compare the impact of the different variables on the DVs, all variables were standardized (Z-score) before the linear regressions were run. In that way, comparison could be made between the strength of the β value between the different variables (Table 68).

Three different types of comparison analyses were conducted; the mediation effect strength of trust on the collaboration processes depending on the type of communication, the mediation effect strength of trust on the collaboration processes depending on the type of trust and effect strength of communication on the collaboration processes depending on the type of communication.

For each of the collaboration processes, the mediation effect of trust was higher when relationship-oriented communication was the antecedent. For problem solving and conflict management, the mediation effect of trust had over 20% more impact on the relationship with relationship-oriented communication as IV than with task-oriented communication. For decision making and knowledge sharing, the mediation effect of trust had over 10% more impact on the relationship with relationship-oriented communication as IV than with task-oriented communication. And lastly, for innovation and creativity, only 6% more impact. For four of the collaboration processes (problem solving, decision making, conflict management and knowledge sharing) the mediating effect of trust was over 50% of the relationship (with decision making over 78%) when relationship-oriented communication was the antecedent and only 44% for innovation and creativity. However, in the case of task-oriented communication as the antecedent only for decision making, the mediating effect of trust was over 50% of the relationship, while for the four others it was around 40%.

For four of the collaboration processes (problem solving, decision making, conflict management and knowledge sharing), no matter what type of communication the antecedent was, cognitive-based trust had a higher impact

than affective-based trust. For knowledge sharing, the effect of affective-based trust was insignificant and only cognitive-based trust played a role as mediator. For decision making, the difference was significant, and 16% higher when relationship-oriented communication was the IV and 20% when task-oriented communication was the IV. For problem solving and conflict management the difference was very weak with only around 5% in favor of cognitive-based trust on affective-based trust. For the fifth collaboration process, innovation and creativity, affective-based trust played a more important role than cognitive-based trust with 6% more impact on the relationship in the case of relationship-oriented communication and 11% in the case of task-oriented communication. Moreover, for task-oriented communication, the role of cognitive-based trust was not conclusive. Even though there were no zero results in the bootstrap confidence interval, the Sobel test was insignificant.

The last comparison was the impact strength of the type of communication on the collaboration processes. For three of the collaboration processes, task-oriented communication had a greater impact than relationship-oriented communication. For conflict management and knowledge sharing, the impact difference was over 10% and for problem solving, around 7%. For the two other collaboration processes, relationship-oriented communication had a greater impact, even if it was slight. For decision making there was around 3% more impact and for innovation and creativity around 7%.

Table 68 – strenght of β value comparison between the different variables

	β 's value				Ratio value in percentage		
	Total effect of IV on DV	Indirect effect of IV on DV	AT indirect effect	CT indirect effect	Indirect effect / Total effect	AT indirect effect / Total effect	CT indirect effect / Total effect
Relationship-oriented communication							
Problem solving	.536	.334	.153	.181	62%	29%	34%
Innovation/creativity	.486	.215	.123	.092	44%	25%	19%
Decision making	.487	.378	.148	.230	78%	30%	47%
Conflict management	.512	.332	.147	.185	65%	29%	36%
Knowledge sharing	.406	.210	.007	.203	52%	2%	50%
Task-oriented communication							
Problem solving	.579	.238	.109	.129	41%	19%	22%
Innovation/creativity	.455	.173	.110	.062	38%	24%	14%
Decision making	.474	.293	.099	.193	62%	21%	41%
Conflict management	.567	.242	.110	.132	43%	19%	23%
Knowledge sharing	.459	.187	.027	.160	41%	6%	35%

AT = Affective-based trust
 CT = Cognitive-based trust

6.2.4.7 Summary

All the ten multiple mediation hypotheses were fully or partially supported (Table 69). Three analyses of ten were partially supported and seven fully. The hypotheses with knowledge sharing as DV showed that only cognitive-based trust was found to have mediating effect on the relationship no matter the type of communication. For the hypothesis H5b, regarding the relationship between task-oriented communication and innovation and creativity, the role of cognitive-based trust as a mediator was not conclusive, therefore only affective-based trust seemed to have a mediating effect on the relationship. All the other hypotheses showed that both affective- and cognitive-based trust were found to have a mediating effect. Therefore, all the multiple mediation hypotheses were supported, most of them fully and the others only partially.

One test found that there was not just a partial mediating effect of trust, but it was a fully mediating effect. Indeed, for the decision making variable with relationship-oriented communication as IV, results indicted a full mediation of affective- and cognitive-based trust together. It was observed that without the effect of trust in the relationship between relationship-oriented communication and decision making, the direct effect became insignificant ($p = .112$).

All analyses were run with four covariates in order to check whether there were other variable that affected the relationship. The covariates that were run in the models were the gender of the respondent, the role the respondent played within the team i.e. team leader or regular team member, the type of virtual team based on time i.e. temporary or ongoing and the type of virtual team based on distance i.e. local or global. In four cases, evidence was found that covariates could affect the multiple mediation model. The type of virtual team based on distance seemed to affect the relationship between task-oriented communication and problem solving ($p = .011$). The position of the teammates within the team seemed to affect the relationship between relationship-oriented communication and decision making. But no further tests were conducted in this study to understand the impact because it was not part of the research framework. However, the two other cases were further investigated as part of the research framework. Indeed, with innovation and creativity, no matter the

type of communication, the type of virtual team based on time was found to have a significant impact ($p = .29$ in the case of relationship-oriented communication and $p = .23$ in the case of task-oriented communication). In the next section (Section 6.2.5), as a part of the H6 hypotheses' set, these results were analyzed.

Table 69 - Outcomes summary for mediation hypotheses

Hypothesis	Expected Effect	Observed Effect	Verification status
H4a	Affective- and cognitive-based trust act as mediators in the relationship	Affective- and cognitive-based trust are both partial mediators	fully supported
H4b		Affective- and cognitive-based trust are both partial mediators	fully supported
H4c		Affective- and cognitive-based trust are together fully mediating the relationship	fully supported
H4d		Affective- and cognitive-based trust are both partial mediators	fully supported
H4e		Only cognitive-based trust is a partial mediator	partially supported
H5a		Affective- and cognitive-based trust are both partial mediators	fully supported
H5b		Only affective-based trust is a partial mediator	partially supported
H5c		Affective- and cognitive-based trust are both partial mediators	fully supported
H5d		Affective- and cognitive-based trust are both partial mediators	fully supported
H5e		Only cognitive-based trust is a partial mediator	partially supported

Post-hoc statistical power analysis was also conducted for all these hypotheses. For all these hypotheses the value of $1-\beta$ was equal to 1. Therefore, the Type II error was completely repudiated for all of the hypotheses. The values were all calculated with G*Power 3.1 software.

6.2.5 Temporary vs. ongoing virtual team mediation analysis

6.2.5.1 Temporary/ongoing/both virtual team type covariate variable analysis

The last set of hypotheses in the study assumed that there was a difference between the impacts of the two types of trust depending on the nature of the team (temporary or ongoing). In order to validate these hypotheses, during the mediation analyses described above, the temporary/ongoing/both virtual team variable was added to the models as a covariate (controller variable) to define whether it had an impact on the models. Apart from the case of innovation and creativity as DV where the temporary/ongoing/both virtual team variable was found to be significant in both the case of relationship-oriented communication ($\beta = .228$, $t(251)= 2.195$, $p = .029$) and task-oriented communication ($\beta = .226$, $t(251)= 2.290$, $p = .023$) as IVs, for the other DV variables the effect was insignificant (Table 70 - Table 71).

Table 70 - Effect of temporary/ongoing/both control variables on DVs in case of relationship-oriented communication

	β	t	Sig.
Problem solving	-.033	-.347	.729
Innovation/creativity	.228	2.195	.029*
Decision making	-.022	-.274	.784
Conflict management	-.290	-.292	.771
Knowledge sharing	-.007	-.061	.952

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 71 - Effect of temporary/ongoing/both control variables on DVs in case of task-oriented communication

	β	t	Sig.
Problem solving	.074	.715	.476
Innovation/creativity	.226	2.290	.023*
Decision making	-.021	-.269	.788
Conflict management	-.025	-.267	.789
Knowledge sharing	-.006	-.055	.956

* $p < .05$, ** $p < .01$, *** $p < .001$

Therefore, multiple mediation analyses for trust mediation were run again with the innovation and creativity variable as DV and with relationship-oriented communication and task-oriented communication as IVs, but this time differentiating between temporary and ongoing virtual teams. With relationship-oriented communication, in the case of temporary virtual teams, neither affective-based trust ($\beta = .140$, $CI = -.058$ to $.587$) nor cognitive-based trust ($\beta = .036$, $CI = -.147$ to $.252$) were identified as mediators in the relationship as both of them had the result of zero in the confidence interval. This was also confirmed with the Sobel test where for affective-based trust; $Z = 1.147$, $p = .251$ and for cognitive-based trust; $Z = .400$, $p = .689$. In the case of ongoing virtual teams, both affective-based trust ($\beta = .155$, $CI = .043$ to $.282$) and cognitive-based trust ($\beta = .081$, $CI = .003$ to $.181$) had no zero results in the confidence interval. Even if the lower CI of cognitive-based trust was suspicious (lower $CI = .003$), the Sobel test confirmed that both had a mediation effect where for affective-based trust; $Z = 2.623$, $p = .009$ and for cognitive-based trust; $Z = 2.183$, $p = .029$ (Table 72). With task-oriented communication, in the case of temporary virtual teams, affective-based trust ($\beta = .164$, $CI = .007$ to $.562$) seemed to be mediating but the lower CI was suspicious (lower $CI = .007$). The Sobel test confirmed the suspicion with a result of $Z = 1.818$ and $p = .069$. Therefore, the role of affective-based trust as a mediator in this relationship was not conclusive. For cognitive-based trust ($\beta = .022$, $CI = -.164$ to $.224$) the result was conclusive: it had no mediating effect on the relationship as it had the result

of zero in the confidence interval. This was also confirmed with the Sobel test where for cognitive-based trust; $Z = .256$, $p = .798$. In the case of ongoing virtual teams, affective-based trust ($\beta=.137$, $CI=.066$ to $.227$) was found to have a mediating effect on the relationship while cognitive-based trust ($\beta=.060$, $CI=-.007$ to $.148$) had a result of zero in the confidence interval. The Sobel test result also confirmed this finding for affective-based trust; $Z = 3.528$, $p < .001$ and for cognitive-based trust; $Z = 1.772$, $p = .085$ (Table 73).

Table 72 - Bootstrap and Sobel tests with relationship-oriented communication as IV according to temporary or ongoing team type

	Data	Bias Corrected Confidence Intervals		Sobel test		
		Lower	Upper	Z	Sig.	
Temporary team	Affective-based trust	.140	-.058	.587	1.147	.251
	Cognitive-based trust	.036	-.147	.252	.400	.689
Ongoing team	Affective-based trust	.155	.043	.282	2.623	.009**
	Cognitive-based trust	.081	.003	.181	2.183	.029*

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 73 - Bootstrap and Sobel tests with task-oriented communication as IV according to temporary or ongoing team type

	Data	Bias Corrected Confidence Intervals		Sobel test		
		Lower	Upper	Z	Sig.	
Temporary team	Affective-based trust	.164	.007	.562	1.818	.069
	Cognitive-based trust	.022	-.164	.224	.256	.798
Ongoing team	Affective-based trust	.137	.066	.227	3.528	.000***
	Cognitive-based trust	.060	-.007	.148	1.772	.085

* $p < .05$, ** $p < .01$, *** $p < .001$

6.2.5.2 Summary

No fundamental difference was observed between the impact of affective- and cognitive-based trust as mediating factors between communication and collaboration depending on the nature of the team (temporary or ongoing) except for innovation and creativity. Indeed, in the case of innovation and

creativity, for temporary virtual teams neither type of trust acted as a mediator but for ongoing virtual teams, affective-based trust was found to act as a mediator in both communication types when cognitive-based trust also had a mediating effect on relationship-oriented communication. The set of hypotheses that assume that the type of virtual team (temporary or ongoing) has a significant impact on the mediation effect of affective-based trust and cognitive-based trust on the relationship between communication and collaboration, was supported in the case of innovation and creativity but was not supported in the other cases (Table 74).

Table 74 - outcomes of temporary vs. ongoing virtual teams mediation hypotheses

Hypothesis	Expected Effect	Observed Effect	Verification status
H6a	Significant impact of the type of virtual team on trust mediating effect	No significant difference was found	Not supported
H6b		Significant difference was found	Supported
H6c		No significant difference was found	Not supported
H6d			Not supported
H6e			Not supported

Chapter 7 – Qualitative Phase

7.1 Data Collection

7.1.1 Data collection method

As for the qualitative phase, a web survey was used for gathering qualitative data via open-ended questions. This allowed the author to receive data from chosen respondents from the quantitative sample as recommended for an explanatory study [Creswell & Plano Clark, 2011]. Moreover, the web survey is an easy and low cost way to collect qualitative data from an international sample and gives the respondents time to think about the answers, unlike in an interview.

7.1.2 Sample design

The more important requirement when defining the qualitative sample is to purposively select it from the quantitative sample so that it consists of respondents that best provide the detail needed to expand on the quantitative results [Creswell & Plano Clark, 2011]. A stratified purposive sampling strategy was employed to ensure the sample provided adequate coverage of the population being studied and to maximize the diversity of the sample. Thus, four criteria were used to define it: gender, professional qualification, team type and country of origin.

- Respondents from both genders were selected to avoid deviation of results.
- For the professional qualification criteria, both team leaders and regular team members were selected in order to get points of view from two different angles within the team. Furthermore, virtual team consultants were also selected to get a professional opinion from people counseling in such an environment.
- The type of team based on time (temporary or ongoing) was a crucial element in this study. Thus, it was also a criterion for selecting the respondents. This requirement was the most complex to fulfill because three quarters of the quantitative samples were only from ongoing virtual teams. However, some respondents from both temporary and ongoing virtual teams were found to be suitable for the qualitative survey and agreed to answer it.

- The last criteria required respondents from different countries and continents to maintain the international aspect of the study.

The final sample consisted of fourteen respondents (

Table 75). Six of them were females and eight male. For the professional qualification criteria, six were team leaders, four of them were regular team members and four were virtual team consultants. All of the respondents worked in an ongoing virtual team environment but five of them also worked in a temporary virtual team environment. And finally, for the place of origin, five respondent were from Europe, three from America, four from Asia and two from Australia. In order to choose suitable respondents, several contacts with quantitative respondents were made via email or chat.

7.1.3 Sample Size

Qualitative data collection is from a much smaller sample than quantitative data collection in a sequential mixed design because the goal is not to compare or merge data but to try to explain previously gathered data [Creswell & Plano Clark, 2011]. And so, as described in the previous section (Section 7.1.2), a sample of fourteen respondents was selected.

Table 75 - Qualitative respondent descriptives

	Gender	Team Role	Team Type	Country
Respondent 1	Female	VT Consultant	Both	Israel
Respondent 2	Male	Team Leader	Both	Israel
Respondent 3	Male	Team Leader	Ongoing	USA
Respondent 4	Male	Team Leader	Ongoing	France
Respondent 5	Male	Team Member	Ongoing	Germany
Respondent 6	Female	VT Consultant	Ongoing	USA
Respondent 7	Male	Team Member	Ongoing	Israel
Respondent 8	Female	Team Member	Both	Israel
Respondent 9	Female	VT Consultant	Both	Australia
Respondent 10	Male	VT Consultant	Ongoing	Canada
Respondent 11	Male	Team Leader	Ongoing	Australia
Respondent 12	Female	Team Member	Ongoing	Austria
Respondent 13	Female	Team Leader	Ongoing	United Kingdom
Respondent 14	Male	Team Leader	Both	Germany

7.1.4 Questionnaire design

Based on the results of the quantitative analyses, the study tried to understand the sources and the reasons that lead to some of the interesting quantitative results. Three major issues were identified as requiring further investigation. One of the aims of this study was to check whether a difference between temporary and ongoing virtual teams regarding the different variables (i.e. trust, communication and collaboration) exists. Apart from the case of cognitive-based trust, significant differences were found. However, it was decided to investigate the first issue, the existing differences between the two types of teams regarding collaboration only, more deeply. Collaboration was the product of the other variables (trust and communication) in this study. Indeed, understanding these differences could help to define what collaboration processes are more essential to develop according to the team's type as well as the reason for it. All the collaboration processes were found to have significant level differences between the two team types. However, some interesting variations were found in the levels of significance and size effect. These variations can help us to understand the processes taking place and the reasons for these differences. Therefore, the first qualitative question was formulated as follows:

Question 1

It has been found that there is a big difference in levels of collaboration between ongoing teams and temporary teams regarding innovation and creativity, decision making and problem solving. However, there is much less difference between the two types of team regarding knowledge sharing and conflict management. Why do you think this is?

This study also aimed to understand the relationship between communication and collaboration. Thus, the second issue that was investigated concerned this relationship where the quantitative results showed that some collaboration processes were more dependent on relationship-oriented communication than task-oriented communication while with others, the opposite was the case. This analysis could help to define what types of

processes are needed from the team to be more focused on relationship-oriented communication and what types of processes needed from the team to be more focused on task-oriented communication. Therefore, the second qualitative question was formulated as follows:

Question 2

What might be the reasons that, on one hand, relationship-oriented communication is more significant than task-oriented communication for decision making and innovation and creativity but on the other hand, task-oriented communication is more significant for conflict management, knowledge sharing and problem solving?

The third and last investigated issue was the core question of this study. According to the quantitative results, trust was found to have a mediating effect between communication and collaboration. Understanding the reason could help organizations and team leaders to identify the items that can help them to develop a better quality of communication to lead to a high level of collaboration. Therefore, the third qualitative question was formulated as follows:

Question 3

How do you explain the fact that if communication is not also used to develop trust, the impact of communication on collaboration is negatively affected?

To be able to understand the questions and to be able to answer them, the respondents required some fundamental background on the subject. For this purposes, a few sentences were introduced to the questionnaire before the questions themselves. Following the introduction to the questions:

Dear respondent, I want to thank you again for taking part in the second and last stage of my study. This time, the survey consist of three open questions where you are asked to answer with free text. The aim of the questions is to understand some findings of the first stage, therefore the survey is

accompanied by explanations of results previously observed.

In order to be able to answer the questions, you need first to know some definitions of background terms used for this study:

Temporary teams are teams that work on a temporary project with a team, usually no more than a year.

Ongoing teams are teams that work on a permanent basis with the same team, usually over a year.

Cognitive-based trust is based on performance-relevant cognitions such as competence, responsibility, reliability and dependability. Individuals employ rational thought in order to trust others.

Affective-based trust is based on emotional attachment to the people involved in the relationship.

Task-oriented communication focuses on how well project information, tasks and deliverables are being handled through the communication.

Relationship-oriented communication focuses on building and maintaining good relationships with people and ensuring others are comfortable with the interactions.

In this study, the concept of team collaboration is defined by five processes:

Problem solving is defined as a process used to obtain a best answer to an unknown, or a decision subject to some constraints.

Decision making is defined as a process that allows one to identify possible alternatives, select the best solution and evaluate the consequences

Innovation is a dynamic process through which problems and challenges are defined, new and creative ideas are developed, and new solutions are selected and implemented.

Conflict management is the process of limiting the negative aspects of conflict while increasing the positive aspects of conflict.

Knowledge sharing is an activity through which knowledge (i.e. information, skills or expertise) is exchanged among people, friends, families, communities or organizations.

7.1.5 Questionnaire testing

The questions included several concepts which are known by professionals but not well known by most people. Therefore, it was essential to test the questionnaire to be sure that the questions were well understood. The questionnaire was checked by an English native speaker to ensure the clarity of the sentences. Then the questionnaire was sent to three different respondents from the quantitative survey for remarks and/or corrections. Some changes were made to increase the clarity of the questionnaire. Despite the efforts that were made, it still happened that a respondent did not understand a question and the answer was not related to the question. Thus, these few answers were not taken into consideration because they did not meet the purposes of the survey. After collecting all the answers and having them analyzed, given that the amount of answers enabling a qualitative analysis was sufficient to draw conclusions and create a thematic map, it was decided to do nothing with these unrelated answers. Two reasons were behind the decision. Firstly, because only a maximum of two answers (of fourteen) per question were unrelated, it did not affect the analysis and enough related data was collected. The second reason was more technical: as the respondents had responded to the web survey anonymously, it would have been complicated if not impossible to identify them in order to get in contact with them for a related answer.

7.2 Data analysis and results

7.2.1 Gap analysis between temporary and ongoing virtual teams related to collaboration

As has been highlighted by the quantitative results, there are significant differences in the level of collaboration between temporary virtual teams and ongoing ones. However, some level differences have been noticed: some collaboration processes have convincing level differences, others weak ones. This analysis aims to improve our understanding of the reasons for this.

7.2.1.1 *Elementary team activity*

According to this qualitative study, the reasons that knowledge sharing and conflict management had weak level differences could be split into two major themes.

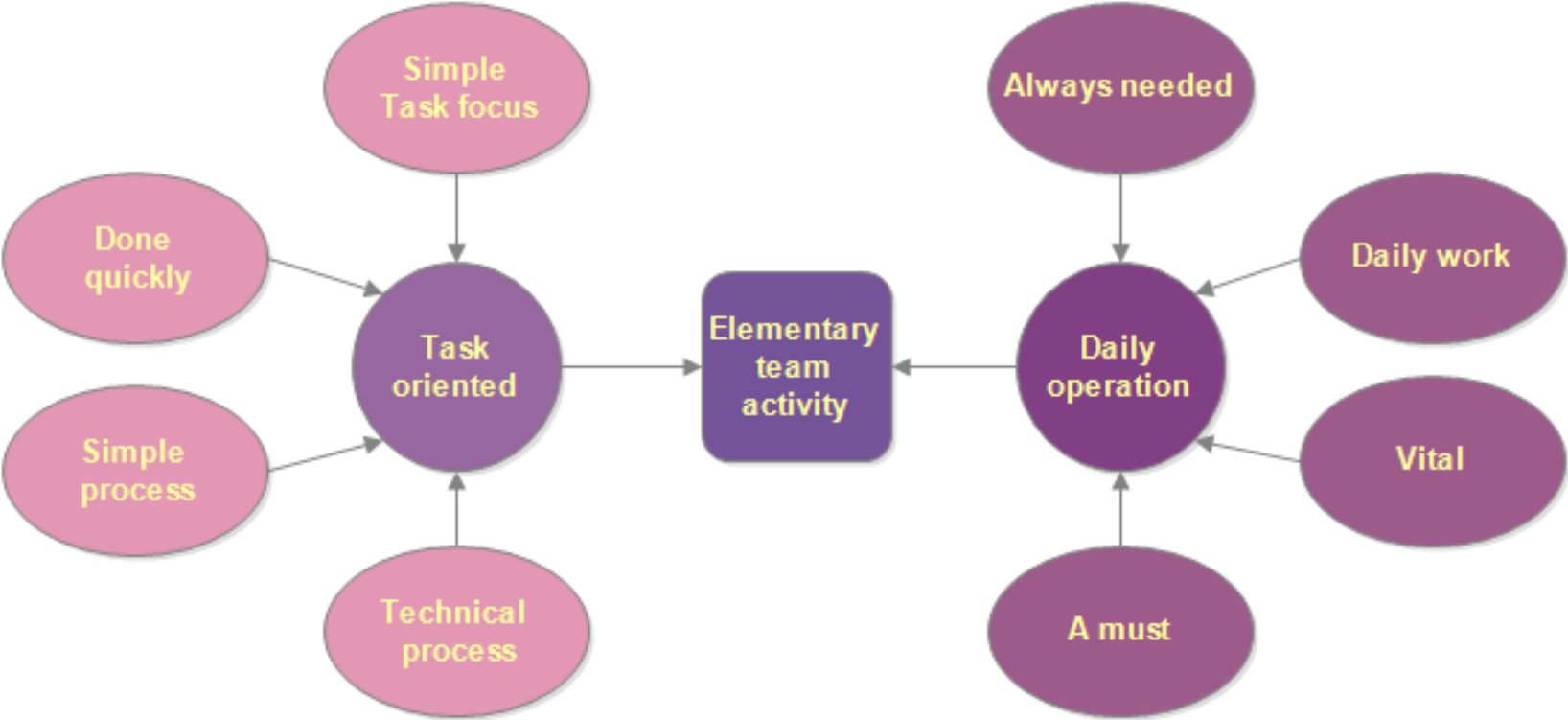
The first is that they are needed on a daily basis to allow the team to operate properly. These processes are "a must" and so they are vital for the operation of any type of team. Respondent 1 claimed that they were "a MUST for the team to operate correctly". Without knowledge sharing and conflict management, it seems that a team cannot achieve its tasks in the most efficient way. Respondent 9: "knowledge sharing and conflict management would be vital for all teams to be able to deliver". Indeed, according to respondent 12, they "are important for daily work" and therefore some of the collaboration processes like conflict management "is going to be needed regardless of whether the virtual team is ongoing or temporary", as respondent 10 said. He explained that for conflict management "people will almost always have challenges that need to be understood and managed". Respondent 13 affirmed that his style of dealing with conflict management is "on a one to one basis – which would be true, however long the team existed". Thus, all these arguments showed that when a collaboration process is needed for the daily operation of the team, even if it is significantly higher in an ongoing virtual team, it is still essential for the proper functioning of a temporary one.

The second theme the study highlighted was that basic processes which are more task-oriented and are essentially simple, quick to implement and technical, will also have a weaker difference of level than others. Respondent 4: "knowledge sharing and conflict management are (at least in my company) documented therefore nearly technical processes which make the nature of the teams less impacting on the result". Processes that are well documented, clear and rational, do not need social relationships (which take time to develop) to be implemented. They are basically mechanical and simple. "Knowledge sharing is a relatively straightforward exercise whether the virtual team is ongoing or temporary" as respondent 10 said. Hence, the nature of the team based on time is irrelevant for the implementation of the processes. These processes can be

done quickly, as explained respondent 6: "Knowledge sharing and conflict management can be dealt with relatively quickly/immediately. It doesn't take much for information to be exchanged, or for conflict to arise and be dealt with ASAP". Not only can they be done fast, they also give fast results: "So knowledge sharing and managing conflicts are (is) keys to get to a quick solution" (respondent 5). This type of process uses technical tools allowing the fulfillment of the task, and: "relies on the use of tools as Team Room Repository for shared information. Both types of team would typically use such tools" claimed respondent 13. Therefore, the dimension of time does not have a real impact on these collaboration processes. The reason that these processes are basically simple, quick to implement and technical, seems to be "that the project the team works on is smaller and then well defined in term of scope" and "the complexity of tasks might be reduced" as said respondent 8. When the team assignment is focused only on a well-defined scope and the task is relatively simple and clear, the team needs collaboration processes that are very task-oriented and therefore the level difference between the types of team is smaller.

To conclude this analysis, it seems that when collaboration processes are task-oriented and are needed for daily operations, and because that type of process is usually for elementary team activities, the level differences between temporary virtual teams and ongoing virtual teams is weaker (Figure 29).

Figure 29 -Thematic network for elementary team activity for virtual team



7.2.1.2 *Advanced team activity*

In contrast, teams which are formed for a long periods of time, need to not only rely on elementary processes but also on advanced ones. Two major themes were also identified that could explain the reasons that problem solving, decision making and innovation and creativity had convincing and significant level differences between temporary virtual teams and ongoing ones.

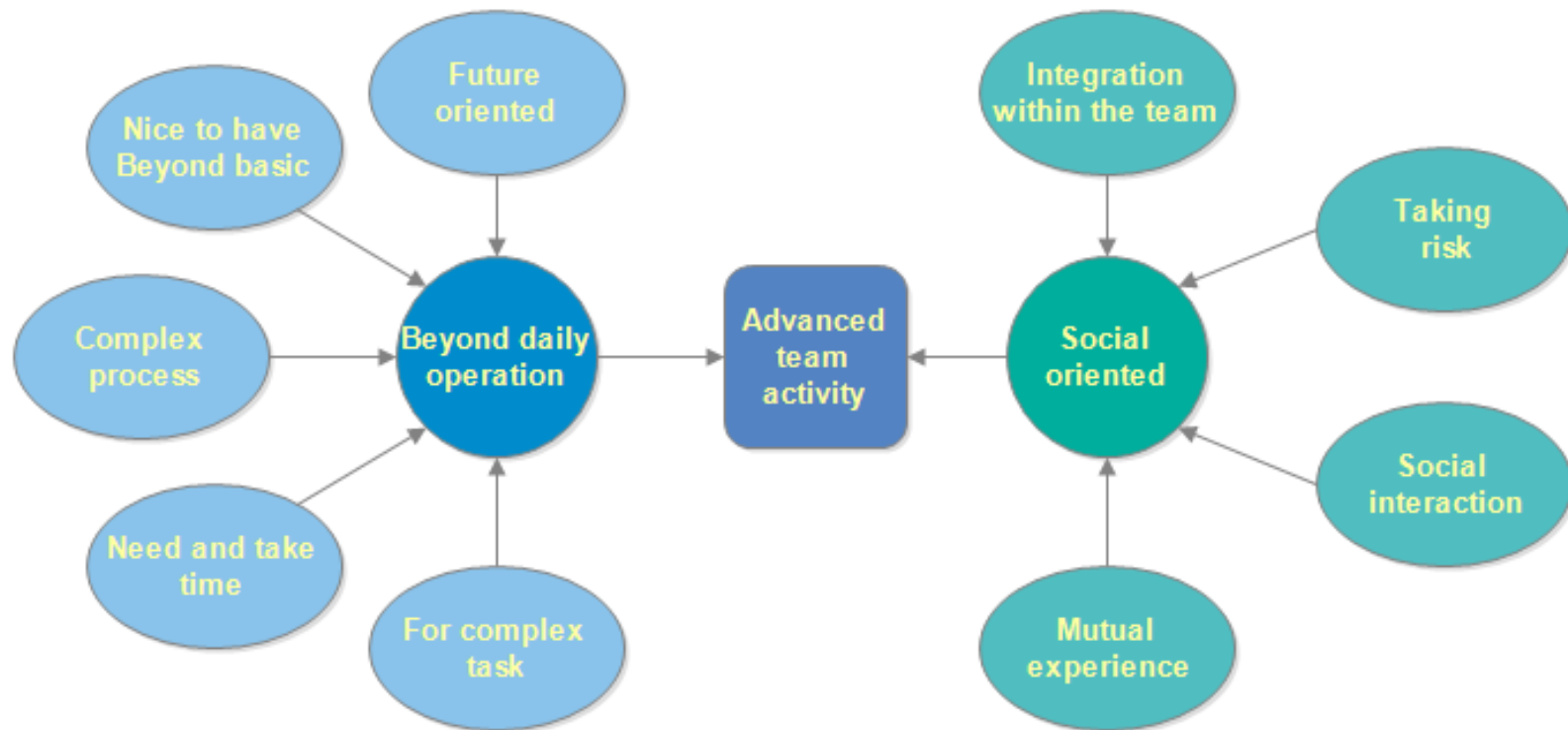
The first theme that was observed was that these types of processes are usually beyond the daily operations of a team. These are processes which allow one to look over the horizon: "Innovation and creativity are more important for the future", as argued respondent 12. These processes are appropriate for teams that are looking to invest in the long term and over time. "Ongoing teams have a vested interest in their future success", as claimed respondent 3. Respondent 1 even argued that these processes for some of the teams are, in a way, a sort of niche: "the other 3 levels of collaboration (innovation, creativity, decision making) are not or are not always in the prerogatives of all teams." Not every team may need all of the collaboration processes, some processes might not have an impact on the outcomes of the team: "A possible reason may be the ad-hoc nature of the so-called temp teams... where innovation, creativity, decision making may be irrelevant", according to respondent 14. These processes take more time and are more complicated than the processes that are more task-oriented. "Innovation and creativity, decision making, and problem-solving all take time. They require input from multiple team members, weighing pros and cons, brainstorming, and collaboration", as affirmed respondent 6. Ongoing virtual teams have to deal with a larger number of tasks over time, they meet multiple obstacles, have to take multiple decisions. In other words, this is a more challenging environment. "In ongoing teams, the diversity of the tasks are very wide during the years and employee often meet obstacles where they need to find new solutions by being creative. In the same way, decisions have to be taken 'on the fly' to resolve unexpected issues. Additionally, ongoing teams might design a solution, which consists mainly of making decisions" noticed respondent 8. The challenge is not only the complexity and the diversity of the tasks themselves but also the demand of the team for more involvement in the processes.

This leads us to the second theme, the need for the ongoing virtual team to be

more involved in the human/social relationships within the team. In this type of team, the team members "know each other in ways that are different than in short term teams" (respondent 3). For example, "innovation and creativity require teams to be synchronized; it requires that the teams remove all barriers (a priori) before innovation and creativity can occur", as said respondent 4. The team members have to learn how to work together and do their jobs in a more efficient way because this type of process "requires better integration between team members and trust" (respondent 2). And to do that, team members need to know and understand each other over time. "Ongoing teams take the time to develop specific collaboration strategies around innovation, decision making and problem solving because they feel the need for long term productivity. Project teams probably don't have as much time or necessity to do this" as argued respondent 9. Moreover, over time, trust between team members can be developed and get stronger as supported by the quantitative results above. Trust is an asset for developing processes that involve human/social relationships successfully: "These tasks also require trust in other team members, and in the team as a whole, which is more difficult to develop in a virtual team", as affirmed respondent 6. When team members work for a long time together, they also build mutual experiences, these experience will allow them to deal with different obstacles that they meet during their work as a team. "Also, creativity as well as problem solving are facilitated by the experience on the topic, as well as by the mutual experience", according to respondent 4. And finally, after they have taken the time to get to know each other, to build social relationships based on trust and mutual experience, they feel enough confidence to risk proposing ideas in front of everyone else: "Innovation, decision making and problem solving require people to take a few 'risks' in the sense of making suggestions that may turn out to look a little silly. In ongoing teams, this will just be laughed off and forgotten because people already have a good relationship and track record" (respondent 11).

To conclude this analysis, it seemed that when the collaboration processes are for more advanced team activities that are beyond daily operations and need to be more social-oriented, the level differences between temporary virtual teams and ongoing virtual teams is much significant (Figure 30).

Figure 30 - Thematic network for advanced team activity for virtual team



7.2.2 Analysis of the strength effect of task- and relationship communication on collaboration

From the quantitative results, some collaboration processes seemed to need higher levels of relationship-oriented communication than task-oriented processes and for others, the opposite was the case. This analysis was aimed at understanding which are the attributes that require more relationship-oriented communication and which are those that imply more task-oriented communication.

7.2.2.1 Mechanical activity

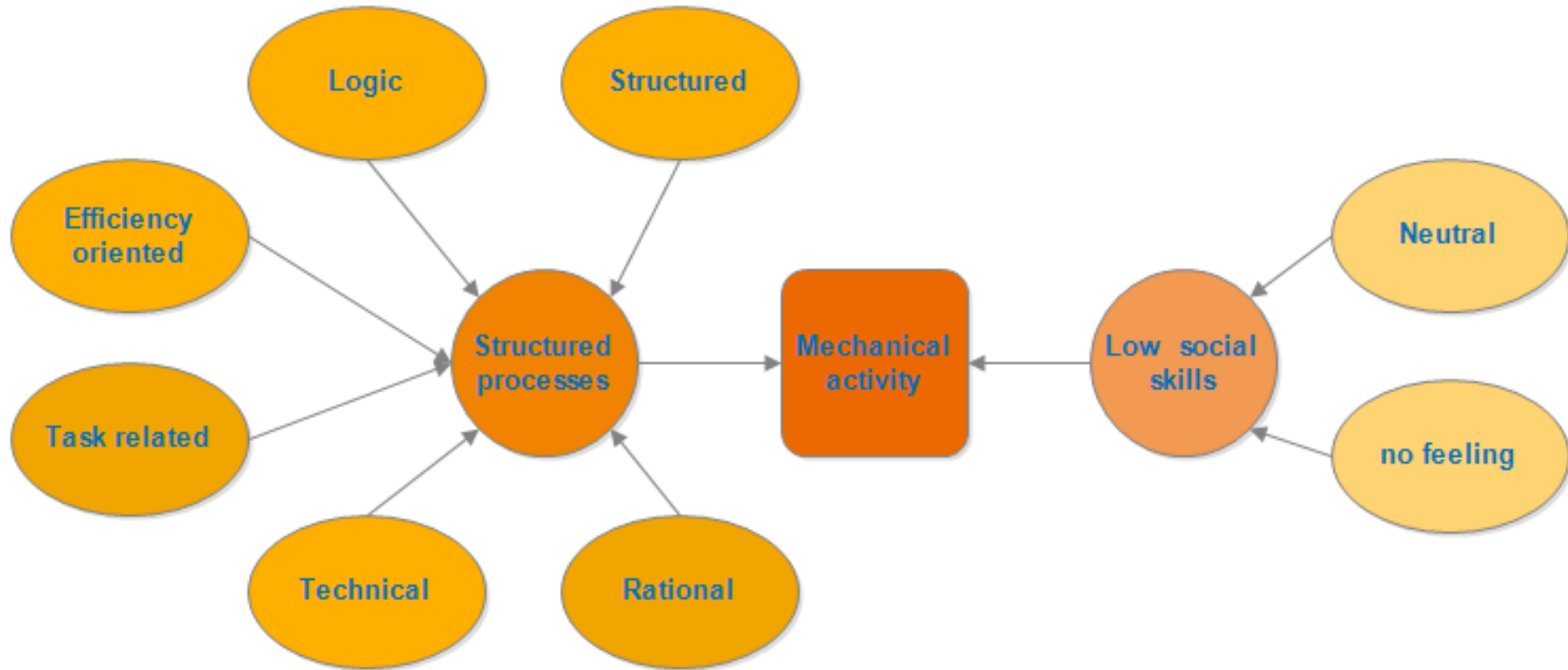
From the answers of the respondents, it could be deduced that task-oriented communication is most suitable for mechanical activities when two principal themes were prominent. The first was that these processes are very structured: "Task-oriented communication allows one to have a more structured and rational approach to conflict management, problem solving and knowledge sharing" (respondent 1). These processes are rather based on rationality and logic than on innovation and originality. "These three (conflict management, problem solving and knowledge sharing) require a more logical, efficiency-oriented perspective which task-oriented communication can provide", as said respondent 6. In other words, according to respondent 6, conflict management, problem solving and knowledge sharing are about doing the task and activity with the least waste of time or effort while the others are more about doing it with a "think-outside-the box mentality" (respondent 6). Task-oriented communication is more prominent when the activities need an essentially technical process: "conflict management and knowledge sharing can be considered as technical processes where task-oriented communication will be more significant" (respondent 4). This idea of a technical process is shared by other respondents. Respondent 8 also wrote: "Conflict management and knowledge sharing are to me more technical and directly related to tasks" and respondent 14 reinforced this idea by stating that "conflict management, knowledge sharing and problem solving are technical activities".

The second theme was that in that type of process, social skills seemed not to be essential to the success of the process. Respondents argued that

feeling is not an issue. For respondent 3: "we simply focus on the issue at hand and do not let the personal feelings influence our approach or decision". These processes use an approach that is a "less emotional one" (respondent 1). Therefore, according to respondent 5, task-oriented communication is more significant for these processes because "for immediate problems (conflicts etc...) task oriented is neutral and a solution must be found". That is, these processes are much more task-oriented and feelings can be put aside more easily.

To conclude, with processes that are very structured, social skills do not affect their results much, and they can be easily managed through task-oriented communication rather than relationship-oriented communication (Figure 31).

Figure 31 - Thematic network for mechanical activity



7.2.2.2 *Innovative activity*

While task-oriented communication seemed to be more suitable for collaboration processes that involved mechanical activities, relationship-oriented communication seemed to be more suitable for collaboration processes that involved innovative activities. Here too, two major themes could be deduced from the respondents' answers.

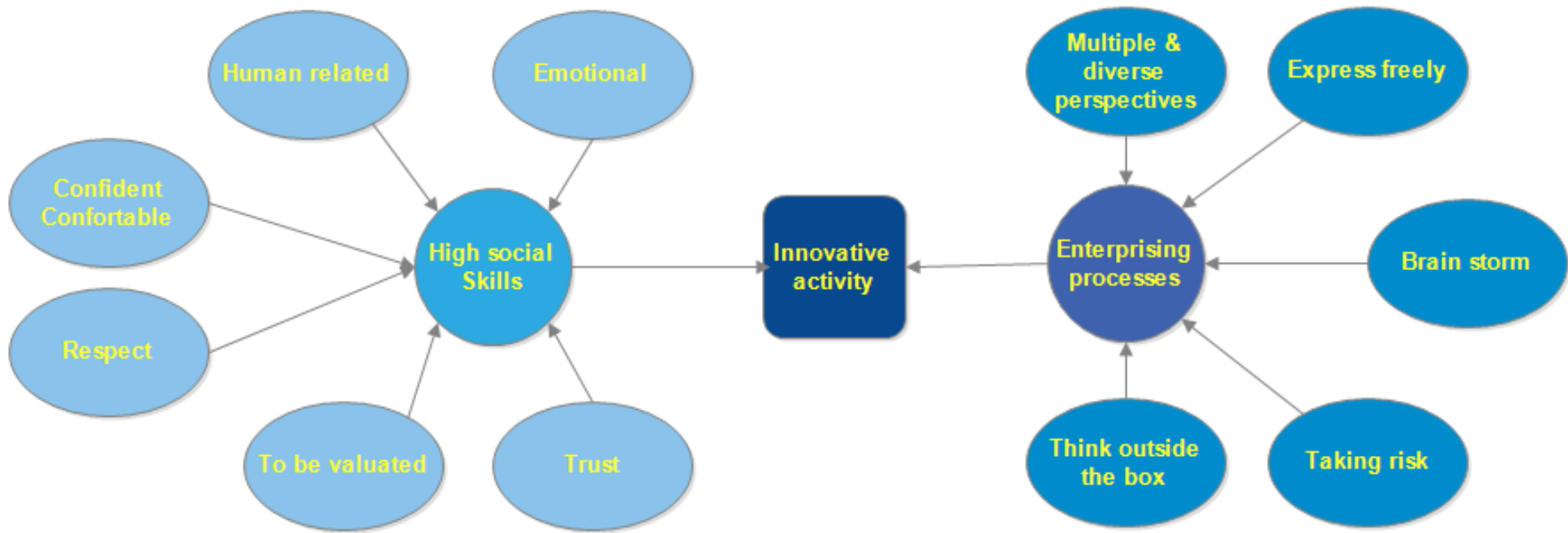
The first theme based on analysis of the answers was that these processes seem to be enterprising ones. These processes require broad vision and knowledge, as said respondent 6: "Relationship-oriented communication is more significant than task-oriented communication for decision-making, innovation and creativity, because all three require input from multiple, diverse perspectives". It is beyond a rational and technical process, it necessitates creative thinking, "a think-outside-the-box mentality between multiple parties" (respondent 6). The environment must be very dynamic "where ideas are bouncing back and forth" as respondent 6 also said. Indeed, to create such an innovative environment, methods like brain storming must be used and developed: "while for more creative tasks the relationship for brain storming, bouncing off new ideas etc... is more important", as affirmed respondent 5. This will allow these processes to grow because "decision making, innovation and creativity depend more on... opinion than knowledge sharing, conflict management and problem solving" (respondent 12). In order for the team members to be able to come up with and propose new and intrepid ideas, they need be able to to speak and express themselves freely: "I believe that for being innovative one has to feel he can express himself freely.... Same goes for decision making" (respondent 8). They also need to take risks: "Decision making and innovation and creativity require taking a level of risk" (respondent 11).

The second theme defined the atmosphere needed for the team to be able to develop these aptitudes. They need to feel that they are in a sympathetic and supportive environment. Respondent 8 wrote: "I believe that for being innovative one has to feel... his colleagues will value his creativity and opinion. Same goes for decision making". It is easier to propose solutions, to

advance new ideas and to take risks when the atmosphere is friendly and encouraging. Relationship-oriented communication can help to create such feelings: "relationship-oriented communication allows teams' members to be more confident/comfortable in order to be in a position to innovate, to express creativity and to smooth the decision making process" (respondent 1). Social and human relationships seem to be the key to allowing these processes to develop in the most effective way. According to respondent 8: "Decision making and innovation are 'human' components" or at least "much more human related" in the words of respondent 4, where trust play a critical role. Indeed, "you always feel 'safer' taking risks when you are dealing with people you trust and get on well with" (respondent 11). This is strengthened by respondent 13 who wrote: "For effective decision making, innovation and creativity to occur, team members will be bound together in an atmosphere of trust, respect and inspiration to deliver upon a shared goal(s)". Or as respondent 3 said: "We use our trust and knowledge of people when we innovate and make decisions".

Thus, if the team wants to employ processes that enable innovative activities, the team needs to employ some enterprising processes that can be developed in an environment that allows a high level of social skills.

Figure 32 - Thematic network for innovative activity



7.2.3 Analysis of the cause of trust being a mediator between communication and collaboration

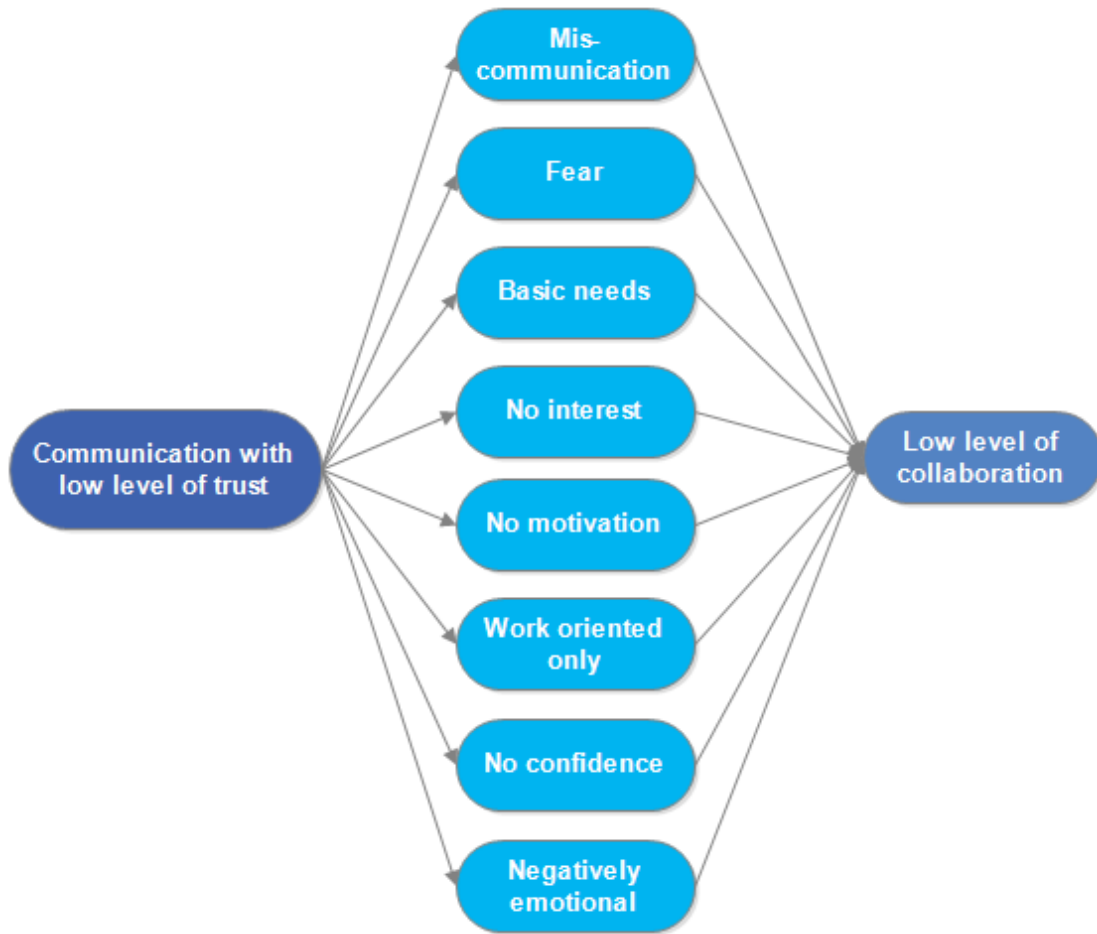
The follow analysis is one of the core objectives of this study. The analysis aims to understand the reason for the impact of trust on the relationship between communication and collaboration. Why do virtual teams need to build and develop trust? Why is not enough to simply communicate within the team in order to collaborate? Why does trust play the role of a catalyst for communication to lead to collaboration? The quantitative analysis showed that effectively trust is needed for the relationship to be a successful one but does not explain the reasons. This analysis helped in understanding the "why?"

7.2.3.1 Items causing a low level of collaboration because of lack of trust in communication

Firstly, based on the answers of the respondents, the study analyzed the impact of communication that does not include trust between teammates on collaboration quality. The most repeated impact of the lack of trust on teammates is that they will have a low level of motivation and interest in their work. Without trust as an ingredient in communication and "with people you don't know personally, the answers are usually shorter ... they (the answers) come later" (respondent 5). If there is no trusting atmosphere then teammates do not have the motivation and personal interest to invest in long and well thought out answers and, they also do not find the time to do it. As argued respondent 12: "One just does not listen so much to people one does not trust". This was also supported by respondent 11 who affirmed that "you simply do not openly communicate with them" and "you tell them only the bare minimum and you don't collaborate with them openly". Moreover, according to respondent 11, the teammates fear having open relationships with their peers which negatively affects the collaboration between them. And when we fear people, "we are less likely to share ideas for fear they will be disregarded" (respondent 3). The lack of trust also has a direct impact on the quality of communication. Without trust, communication could be badly affected and poor quality communication could be generated. Without a high level of quality of communication, collaboration is

negatively affected, as affirmed by respondent 9: "If team members don't work to build trust, misinterpretations of communication often occur and the type of communication can be quite defensive and emotionally based, which negatively affects collaboration". The team members are on guard, if one feels threatened he will react and answer emotionally rather than in a logical and rational manner. Thus, a non-confidence atmosphere is developed within the team, as said respondent 10: "If one is not feeling valued, understood, or included, it is difficult to imagine said individual being trustful and transparent". All this creates a solely work-oriented ambience, creates a distance between the teammates: "Without trust there is no communication but a superior to inferior relationship" (respondent 7). Then there is no place for innovation and progress, as wrote respondent 7: "without any chance of progress or innovation". The team members are focused only on the basic needs of the tasks or project which does not allow the team to evolve and look towards the future: "If there is no trust and no personal relationship, you only respond to direct needs, you solve immediate problems, but you don't go beyond and into the future" (respondent 5). In this analysis, several items were identified as obstacles to reaching a high level of collaboration because of lack of interpersonal trust in the relationship, even if task- and relationship-oriented communication are present (Figure 33).

Figure 33 - Items causing low level of collaboration because of lack of trust in communication

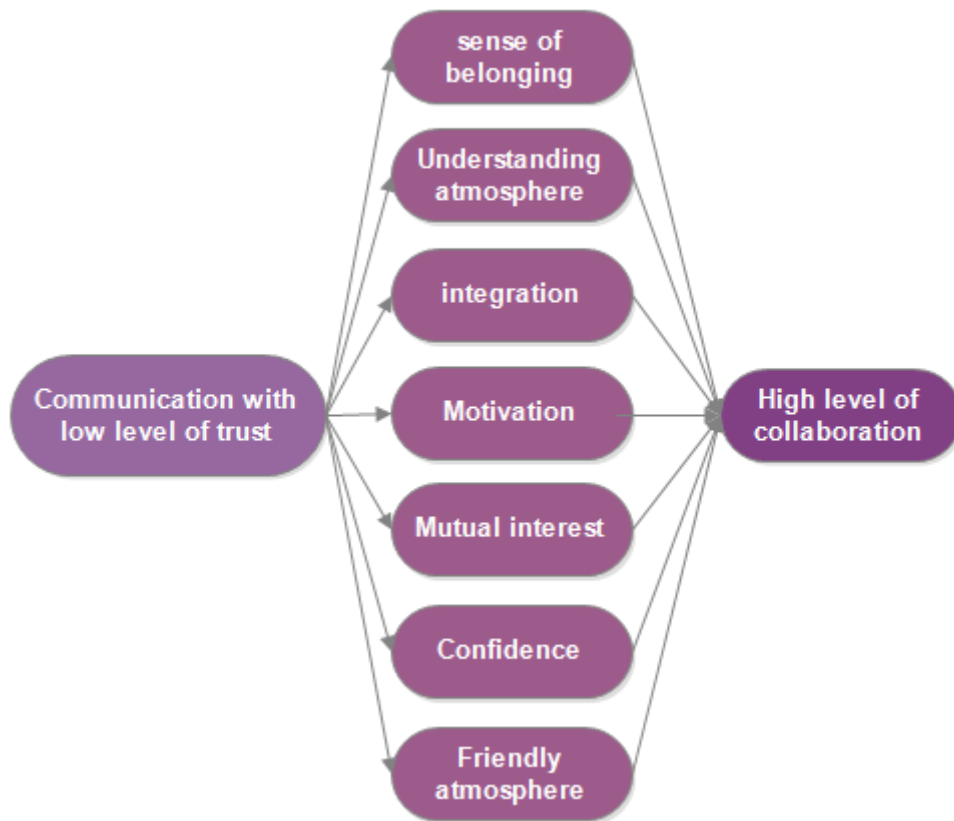


7.2.3.2 items helping to have high levels of collaboration thanks to trust in communication

When interpersonal trust is present in the relationship between communication and collaboration, the teammates seem to develop a sense of belonging which is essential to the development of healthy relationships within the team: "Just communication is not enough to get things done while trust bring more of the "belonging feeling" for collaboration" (respondent 1). Moreover, "Trust (in communication) breeds familiarity and allows us to share freely", as said respondent 3. This sense of belonging motivates the teammates to invest in their work beyond the basic needs of the tasks or project. They find interest in their work. The motivation and the interest in their work will cause them to

"work better and faster" because "the requirement comes from a colleague he (they) appreciate at a personal level", as affirmed respondent 8. When interpersonal trust is joined to communication it allows a team to develop communication at a higher level where communication is not just an exchange of messages. This higher level is an upgrade of communication to a means that enables communication not only for an exchange of messages but also for a deeper understanding and better integration between the members of the virtual team as wrote respondent 2: "trust and respect are important for any type of communication which requires deep understanding and integration between the different parties". When people understand each another and when there is integration between them, they are ready to share knowledge, ideas and thought and the others are ready accept and trust the input. Thus, respondent 13 argued: "It was therefore essential that each & every team member was encouraged to share their knowledge with the team and that their input was trusted by their fellow team members. Without this high level of trust, our complex business development efforts would simply not have succeeded". Interpersonal trust as a mediator of communication allows collaboration to lead to a higher performance of the team: "Therefore, when leading a team, considering that the objective is to perform as much as possible, this can only be reached if all members are top performing, which in most cases, requires collaboration between the team members. And the collaboration will only take place if the members trust each other, and if they trust their team leader" (respondent 4). As has been deduced from the answers of the respondents, several items were identified as catalysts for reaching a high level of collaboration with the help of interpersonal trust in the relationship between communication and collaboration (Figure 34).

Figure 34 - items helping to have high level of collaboration thanks to trust in communication



Chapter 8 – Discussions and Conclusions

8.1 Discussion

The aim of this study was to understand the processes of collaboration as a function of team communication and team trust within a virtual environment and, more specifically, depending on whether the virtual team is a temporary or an ongoing one. To analyze these processes, the study explored the subject by trying to answer three sets of questions. The first set explored the ' differences in levels of trust, communication and collaboration depending on the team's type i.e. temporary or ongoing. The second set of questions explored the relationship between these variables based on a mediation model. And finally, the last set of questions enquired whether this relationship was influenced by the team type.

8.1.1 Temporary and ongoing virtual team gaps hypotheses

Related to the first set of questions, the study's results showed that the levels of trust are higher in ongoing virtual teams than in temporary ones. This is in agreement with the statement that trust develops over time [Mayer, et al., 1995; Lewicki & Bunker, 1995]. Trust needs personal interaction and communication in order to develop, and time can give this opportunity to team members. The more time the teammates have to get to know each other, the more they will be able to build trust between them. Regarding the gap between the two types of trust, in both types of team, the level of cognitive-based trust is higher than the level of affective-based trust. This is explained by the fact that in the workplace, it is essential to trust the other team members on a professional and rational basis in order to perform the tasks and activities requested by managers and the organization. To perform tasks within the team, team members need to be able to rely on others, to depend on them, to believe in their competence and responsibility when completing tasks. These expectations must be met before teammates will invest in further relationships [Schaubroeck, et al., 2011] which are more affective-based trust oriented. Moreover, as cognitive-based trust is an antecedent to affective-based trust,

according to several researchers [McAllister, 1995; Kauffmann & Carmi, In press; Schaubroeck, et al., 2011], it seems to be logical that the level of cognitive-based trust is higher than affective-based trust, as this is one of its outcomes. First, the team has to build a high level of cognitive-based trust in order to develop its affective-based trust. It should also be noticed that the gap between cognitive-based trust and affective-based trust in ongoing virtual teams is lower than the gap in temporary ones. In other words, it seems that ongoing virtual teams place a greater importance on the development of affective-based trust than temporary teams. This finding is consistent with the study of McAllister [1995], where it was argued that in order to maintain trust in the long run (as in ongoing virtual teams), the affective aspect of trust must be developed.

Of the communication types, task-oriented communication was the only variable in this study that did not show significant differences between the two types of team. This can be explained by the fact that task-oriented communication is needed for planning, scheduling and coordinating work and activities [Yukl, 2012]. Therefore, the type of team seems to be irrelevant in this case because whatever the type of team, it has to communicate on a task basis to accomplish its mission. Without task-oriented communication, the team leader and the team members cannot communicate the goals, the tasks and the progress of work within the team. Regarding relationship-oriented communication, the picture is different. Indeed, the findings showed that a significant difference in levels exists between the two types of team, and in ongoing virtual teams the level is higher. This finding was expected since ongoing virtual teams have the time needed to develop communication patterns [Saunders & Ahuja, 2006]. Moreover, the relationship dimension of communication is for building social relationships and solidarity among virtual team members [Lau, et al., 2000], while for temporary virtual teams these qualities are not always sought because of their low interest in investing in the future. Indeed, this type of team is disassembled after a short-term task or project has been accomplished.

Trust and communication levels' gap analysis for temporary and ongoing

virtual teams was based only on quantitative data, whereas for collaboration processes both quantitative and qualitative data was used. As the understanding of collaboration processes was a major aim of this study, in addition to the quantitative analysis, a qualitative study was conducted to understand the reasons that lead to the quantitative findings. First of all, a higher level of collaboration in ongoing virtual teams was observed for each of the collaboration processes defined in this study framework (i.e. knowledge & information sharing; conflict management; problem solving; decision making; innovation and creativity), as expected. Collaboration is reliant on communication and trust [Johnston, et al., 2004; Hosley, 2010], and as the above findings showed, higher levels of trust and relationship-oriented communication were found in ongoing virtual teams, and it followed that there would be higher levels of collaboration also. However, the gap size varied according to the process of collaboration. For three of the processes, the gap size was relatively significant (problem solving, decision making, innovation and creativity), while for the two others the gap was small (knowledge and information sharing, conflict management).

The quantitative analysis only allowed the author to test whether a gap existed and how large the gap was. Therefore, qualitative analysis was conducted to understand the reasons for the variance between the different collaboration processes. This analysis differentiated between two types of team activities. The first was defined in the study as elementary team activities and the second as advanced team activities. Elementary activities are activities that are needed on a daily basis and are more task-oriented. Advanced activities are more social-oriented and are beyond daily operations. When an activity is needed for the daily operation of the team, when it is not too complex and requires only technical skills, the gap between temporary and ongoing virtual teams is small. On the contrary, when an activity is complex, needs skills beyond the technical, such as the social, and is not needed on a daily basis but more for the future development of the team, than the gap between these two types of team is larger. Knowledge sharing and conflict management were defined by the respondents as elementary team activities, while the others (i.e.

problem solving, decision making, innovation and creativity) were defined as advanced team activities. The more the activity requires social skills and the more it is needed for future development, the more the gap will be. According to this analysis, the innovation and creativity process requires high levels of social skills and is more highly future oriented than, in descending order: decision making, problem solving, conflict management and finally, knowledge sharing, which is apparently the most needed process for the daily operation of the team and the most technical one. This observation is in agreement with another finding of the quantitative analysis, when analyzing the gap between the direct effects of task- and relationship-oriented communication on the collaboration processes (Table 68). The gap is in favor of task-oriented communication for knowledge sharing, conflict management and problem solving where the largest gap is for knowledge sharing and the smallest for problem solving. And conversely, the gap is in favor of relationship-oriented communication for innovation and creativity and decision making with the largest gap for innovation and creativity. This gap analysis is in exactly the same order as the gap analysis between temporary and ongoing virtual teams against each of the collaboration processes.

8.1.2 Trust as a mediator between communication and collaboration hypotheses

The next set of questions that this study tried to answer concerned the relationship between communication, trust and collaboration. The assumptions of this relationship were based on a framework that claimed that trust, as a mediator, affected the relationship between communication and collaboration.

The first stage of these mediation analyses was to find a correlation between all the variables. The findings of the correlation analyses supported previous studies that discovered the existence of a relationship between these variables. Firstly, communication is highly related to collaboration as an outcome [Mattessich, et al., 2001; Qureshi, et al., 2006; Hosley, 2010]. Indeed, all the Pearson's r values were found to be around .5 which is considered a large size effect (

Table 55). In addition, all the linear regressions of collaboration processes on the two communication types showed high standardized β coefficients (Table 68).

Secondly, high levels of correlation were also found between communication and trust (Table 56). These findings are consistent with other studies and support previous empirical research that has studied this relationship [Jarvenpaa & Leidner, 1999; Zeffane, et al., 2011; Remidez & Jones, 2012]. The findings highlight the fact that relationship-oriented communication and affective-based trust, being both related to social and interpersonal relationships, are highly correlated and got the highest Pearson's r value of .664. On the other hand, task-oriented communication got a higher Pearson's r value with cognitive-based trust than with affective-based trust, cognitive-based trust being based on rational roots and therefore more task-oriented.

Lastly, the two types of trust and collaboration processes also showed high correlation results (Table 57). All the Pearson's r values indicated large size effects, with the exception of two values with medium size effects. These findings are consistent with previous studies that showed that trust has a significant impact on collaboration in the regular work environment [Martínez-Miranda & Pavón, 2012] as well as in the virtual environment [Leitch Peters, 2003; Peters & Manz, 2007]. Moreover, cognitive-based trust seems to be more predominant than affective-based trust for collaboration processes with higher correlation values, apart from the innovation and creativity process, where affective-based trust had a higher result. The largest gap was for knowledge management where cognitive-based trust had a Pearson's r value of .524 and affective-based trust, .389. This is also consistent with the findings of this study where the gap found between task- and relationship-oriented communications was the highest for knowledge sharing in favor of task-oriented communication and the highest in favor of relationship-oriented communication for innovation and creativity.

It is obvious, according to this research, that there are collaboration processes which are based more on rational and technical roots and others

more on social and relationship roots. The qualitative analysis helped in identifying the attributes of such processes in order to classify them on the spectrum between ones which are more rational and technical based and ones which are more social and relationship based. Thus, the rational and technical based activities (or mechanical activities as they are called in the quantitative findings section – 7.2.2.1) do not need high social skills among team members and are much more structured processes (Figure 31). Social and relationship based activities (or innovative activities as they are called in the quantitative findings section – 7.2.2.2) require high levels of social skills from the team members and are more enterprising activities (Figure 32). This research allows the drawing up of a scale of the differences between these two types of activities: the collaboration processes where knowledge sharing is the most mechanical activity, then in ascending order, conflict management, problem solving, decision making and finally innovation and creativity which is the most innovative activity.

The second stage, after finding a correlation between the variables, was the mediation analyses themselves. Thus, all models of mediation for this study found that trust is a mediator between both task- and relationship-oriented communication and each of the collaboration processes. This study strengthens the argument that trust is a mediating factor and therefore has an indirect effect [Dirks, 1999; Dirks & Ferrin, 2001; Qureshi, et al., 2004; Brahm & Kunze, 2012] versus the argument that trust has a direct effect [DeRosa, et al., 2004; Sarker & Valacich, 2003]. The existence of the trust itself between teammates does not ensure collaboration. It is through communication that collaboration can be established. But without trust between the teammates, the quality of this collaboration will be low. With the help of trust, communication can lead to a higher quality of collaboration and a more effective one.

According to the results for seven of the ten mediation hypotheses, both cognitive- and affective-based trust have a mediation effect between communication and collaboration. In the three remaining hypotheses, only one of the types of trust has a significant impact as a mediator of the relationship. For knowledge sharing, in both cases of communication type, only cognitive-

based trust has a mediating effect. These results are in agreement with a former study which found that teams seeking knowledge sharing must be focused on cognitive-based trust rather than affective-based trust [Chowdhury, 2005]. For innovation and creativity, in the case of relationship-oriented communication, only affective-based trust has a mediating effect. Apart from innovation and creativity, cognitive-based trust has a more predominant effect as a mediator than affective-based trust on collaboration processes. Thus, cognitive-based trust seems to have a better impact than affective-based trust on the relationship, but to reach a higher level of collaboration, affective-based trust is essential. As cognitive-based is the first type of trust to developed within a team, it must present at first for collaboration. Then, over time, affective-trust can strengthen the collaboration's quality. However, for innovation and creativity, it is important to build affective-based trust as soon as possible because it has more effect on the relationship.

From the quantitative analyses, it is clear that trust plays a crucial role in the relationship but it does not explain why. The qualitative analyses allow one to understand the reasons why communication with trust leads to better collaboration. Lack of trust creates a negative atmosphere at work where people have neither interest nor motivation; they fear getting involved and being active. Miscommunication leads to misunderstanding and often causes negative emotional reactions. In these conditions, teammates cannot reach high levels of collaboration. On the contrary, the presence of trust allows team members to feel that they belong to a group not only for work purposes but also on a social basis. It allows them to develop mutual interest and motivation by creating a friendly and understanding atmosphere. This will help the team to achieve better and more effective collaboration.

8.1.3 Temporary vs. ongoing virtual teams mediation hypotheses

Apart from one hypothesis related to the innovation and creativity process, no significant difference was observed between temporary virtual teams and ongoing ones regarding the role of trust as a mediator between communication and collaboration. It seems that even if the previous findings showed a

significant level gap between these two types of team in affective- and cognitive-based trust, relationship-oriented communication and the collaboration processes, the role of trust as mediator does not vary according the team's type. Therefore, the assumptions that such a gap exists due to the arguments that trust (especially affective- based) and relationship-oriented communication, which is mostly based on social bonds, are developed over time [Mayer, et al., 1995; Lewicki & Bunker, 1995; Yukl, 2012], were not validated. Thus, time does not have an impact on the trust mediation models. However, as noticed, for the innovation and creativity process, a significant gap was found. Neither the findings of this study nor the literature review could explain why it is only for this process that time has an impact. Therefore, further research need to be done to get a better understanding of the process.

8.2 Contributions to knowledge

This study emphasized two principle contributions to knowledge. The first is that some elements of interpersonal relationships, including both affective- and cognitive-based trust, relationship-oriented communication and the five collaborative team processes defined in this study, are significantly higher in ongoing virtual teams than in temporary ones. The dimension of time has a significant impact on the nature of the team relationship, even in a virtual environment where the teammates almost never meet face-to-face.

The second is that the existence of trust between teammates does not ensure collaboration, but collaboration can be established and developed through communication. However, on the one hand, without trust between teammates, the quality of this collaboration will be weak. On the other, with the help of trust, communication can lead to higher quality and more effective collaboration.

8.3 Implications of findings

8.3.1 Choosing the type of team

The first virtual teams were essentially temporary teams assembled to

accomplish limited tasks or to complete a project in a timely manner. But nowadays, more and more organizations are developing ongoing teams [Julsrud, 2008]. This study, with a maximum variation sample from a large range of organizations, found that only 17.0% are still temporary teams. Organizations seem to be developing more and more ongoing teams at the expense of temporary teams. Given that the two types of trust, relationship-oriented communication and the five collaboration processes were all found to be significantly higher in ongoing virtual teams than in temporary ones. and given that all these factors were identified, as has been reported in this study, as essential for the effectiveness, the performance and the quality of the team outcomes, this study strongly encourages organizations to use ongoing teams to raise the level of all the factors that have been studied in order to increase the performance of the team and the quality of its outcomes. Therefore, even if such a team's goal is to complete a task or a project in a timely manner, the organization must try to use the same team for different time-limited tasks or projects or at least to keep changes in the makeup of individuals in the team to a minimum as much as possible. This will enable teammates to create deeper relationships and greater levels of trust by giving them the desire to develop and invest in social bonds and act as ongoing virtual teams. However, the managers must be aware that a strong sense of belonging of the team members could sometime lead the team to justify their continued existence by creating new tasks that are not always relevant to the purpose of the project [Gray, 2004].

Another outcome of this study is that organizations, by analyzing the aspects of the activities that the team needs to accomplish in order to complete its tasks successfully, will be able to determine how much it is essential to develop the team with ongoing team attributes. By defining two types of activities, advanced activity and elementary activity, organizations can categorize them. Elementary activities are those which are needed on a daily basis and require low levels of social skills and advanced ones are those which require high levels of social skills and are needed beyond daily operation. The more the activity is an advanced one and not an elementary one, the more the

team has to have ongoing team attributes. When forming a team, the types of activities to be performed will allow organizations to enhance the accuracy of their decisions about the types of teams which are built.

8.3.2 Choosing the communication means and style

It is clear from this study, due to the high level of correlation that has been found, that organizations have to develop and invest in communication skills and trust building if they aspire to achieve a high level of collaboration. Moreover, from the mediation models it can be deduced that if organizations develop and invest only in communication skills and neglect trust within their teams, the impact of communication on collaboration will be badly affected and degraded. Therefore, trust is critical and must be developed by any available means. Furthermore, this analysis will also allow organizations to determine the type of relationship characteristics that are most necessary to develop depending on the types of activities to be accomplished. In the case of mechanical activities, the relationship's characteristics have to be based essentially on rational roots and this is more task-oriented. The reason is that this type of activity requires a low level of social skills and is a structured process. In the case of advanced activities, the relationship's characteristics have to be essentially based on emotional roots and this is more social oriented. The reason is that this type of activity requires a high level of social skills and enterprising processes. All this will have a direct impact on the choice communication means that the team will use, depending on the characteristics being developed. As argued above, the principal, if not the only means in the virtual environment is the use of ICTs. Hence, it is imperative that the organization ensures that the team leader, as well as the team members, learn how to use the right ITC channels according to the aim of the communication. Kauffmann and Carmi [2014] provide an extensive description of ITC channels and their recommended use. This could be used by organizations to develop communication and trust within their virtual teams.

The study also showed that the social side of relationships is no less important than the rational side, if not even more so in some collaborative

processes. Usually, the manager tends to develop the rational side more and be more task-oriented, especially in a virtual environment where social relationships seem very hard to develop due to the challenges of this type of environment. Thus, the use of media like Email, voice calls and video-conferencing for task updates and delegation is common. However, they have to find ways to develop social bonds to achieve higher levels of collaboration. Organizations must create and seek any opportunity for social interaction by using any and all available means of communication and sharing at their disposal. The first step is to consider the possible social uses of each ICT channel, such as showing an interest in team members' personal lives or sharing elements of one's own personal life.

ICTs can be used to facilitate virtual games and icebreaker activities that will help team members develop interpersonal relationships beyond their daily working relationships. They will get to know one other in a more pleasant and relaxed environment. Team leaders should be creative and find a way for teammates to have virtual "face time". Even when the team cannot be brought together in one room, virtual social meetings can be organized to help make them feel as though they are together. During these meetings, the topic of work should be avoided. Instead, pleasant topics should be discussed using video or phone conferencing. Some organizations, such as GE Aviation, Stanley Black & Decker and The Financial Times, even develop social networks for their teams based on software similar to Facebook, like IBM's SocialBlue network and Salesforce's Chatter. This helps team members share personal information and pictures and to connect over shared interests and ideas. People will get to know each other on a social level, rather than only on a strictly professional level. Lastly, nothing can compete with actual face-to-face meetings, and such meetings should be organized whenever possible. If face-to-face meetings for the entire global team cannot be arranged, an attempt should at least be made to gather team members in small groups, and then to connect the groups by means of video conferencing.

The study could help organizations and team leaders to make more accurate decisions on the type and style of the teams to be built. It could also

help them to define the best means of communication and the content style of the message according to the team's and the organization's needs.

8.4 Limitations and further research

This study has several limitations and some of the major ones are enumerated in this section. The first limitations concern the sample size.

On the one hand, the sample has maximum variation, which allows one to elicit a wide range of approaches to the questions. On the other hand, the conclusions might differ according to the sector of the organization (e.g. finance, health, electronics...), the type of organization (e.g. low-tech or high-tech), the education and culture of the teammates and other parameters. The sample used in this study included respondents with most of these parameters but not in sufficient quantity for them to yield significant results. Therefore, further research must be conducted to study and compare the findings of this research against these different parameters.

Another major limitation is the sample size of the temporary virtual teams. Only 44 respondents were categorized as team members of such teams. In some of the findings the power size was under .8, meaning that the risk of a type II error was significant and could have affected the conclusions. Therefore, some of the findings need to be validated with a larger sample of temporary virtual team members.

The second type of limitation is related to the framework of this study. This study was based on former studies, and it assumed that the relationship between communication, trust and collaboration is linear where the two types of communication are antecedent to the two types of trust and collaboration, and that the two types of trust are antecedent to collaboration. But the relationship between these variables is much complex and needs further research in order to get the whole picture of the relationship. For example, Kauffmann and Carmi (in press) studied the relationship between communication and trust where the two types of communication mediate the relationship between cognitive- and affective-based trust. Another limitation

related to the framework is that this study defined collaboration as being based on five processes which were found to be strongly related to collaboration in the literature review. However, collaboration can also be defined by other processes like the learning process of two or more people working together [Dillenbourg, 1999]. Therefore, although this study tried to adopt a wide approach to the concept of collaboration, not all approaches could be checked and analyzed. Thus, further research could be conducted to analyze other aspects of collaborative processes.

Another type of limitation concerns the statistical method used in the research. Mediation analysis is complex analysis which is based on many assumptions. It is enough that one of the assumptions is not completely complied with to producing biased estimates of mediation effects. In this study, the qualitative analysis merely helped in the understanding of the reasons for such relationships but assumed that the relationships already existed as a result of the quantitative analysis. Thus, further qualitative research could be conducted to validate these mediation relationships.

Another element that could also have produced biased estimates of mediation effects, was that the common mediation procedure used here does not require experimental manipulation of mediators. On the contrary, the mediation analysis procedure proposed by Baron and Kenny [1986] and used in this study, encouraged the use of unmanipulated mediators. One of the principle problems is that in the social sciences, multiple mediators have an influence on mediation model factors. Indeed, most of the effects that interest social scientists are likely to have multiple correlated mediators. But it is impossible for the researcher to include all the factors in the model. New methods are being developed that involve experimental manipulation of mediators. But these methods still have some limitation as noticed by Bullock and Ha [2011].

These are some of the limitations of this study that require further research to acquire a deeper understanding and to check the consistency of the findings.

8.5 Conclusion

Due to the fast pace of technological evolution, virtual teams are becoming more common every day. Organizations develop such teams because of the many benefits involved, and some of these benefits have been raised by several scholars. Such teams "facilitate around-the-clock work and allow the most qualified individuals to be assigned to a team" [Wakefield, et al., 2008] or allow "the availability of a flexible and configurable base infrastructure" [Ebrahim, et al., 2009]. However, companies encounter several difficulties when developing these teams to be as effective as they first anticipated. Indeed, these teams also have negative sides. The lack of direct and daily face-to-face relationships could become the source of poor interpersonal communication and trust, making team collaborative processes a real challenge.

. The findings showed significant gaps between the two types of team, with all the communication, trust and collaboration variables being higher in ongoing virtual teams than in temporary ones, with the exception of the task-oriented communication variable. Therefore, this study clearly encourages organizations to form ongoing virtual teams rather than temporary ones. Furthermore, the findings can help organizations to make accurate decisions about team types according to the kind of activities the team has to accomplish. Relative to the relationship analysis between communication, trust and collaboration, the findings showed that a high level of communication with both task and relationship dimensions will lead to a higher level of collaboration. The findings also highlight the fact that the strength of the communication impact on collaboration is mediated by the level of trust existing between team members. Furthermore, the findings showed that there are collaboration processes which require more task-oriented communication and cognitive-based trust than others, and that there are some collaboration processes which require more relationship-oriented communication and affective-based trust than the others. This differentiation is a result of the nature of the collaboration process. It depends on the degree of social skills required to successfully complete the process and on whether the process is more a structured or an innovative one.

This can help organizations to choose the right communication means and style depending on the collaborative processes they aim to achieve. In the case of collaborative processes that need more task-oriented communication, the use of tools like "Collaborative writing" and "Online Shared files" will lead to better collaboration. In addition, to enhance cognitive-based trust, team leaders could use these tools by updating online work plans, including the responsibilities and achievements of teammates. For collaborative processes which are more social and innovation oriented, team leaders could use tools like video conferencing for relationship-oriented communication enhancement and to organize social discussions (without a work interest) in order to get the team to socialize and develop affective-based trust.

By investing in the quality of interpersonal communication and trust, and trying to create more long-term teams, organizations will elevate the quality of collaboration among their teammates. The results of this study can help organizations to have a better understanding of the collaborative processes and mechanism in virtual teams, allowing them to increase their efficiency, their performance and their quality of outcomes in order to be more competitive.

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APPENDIX A – Quantitative Items Source

Trust Items

Items	Lambdas
Affect-based trust	
We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.	.89
I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.	.82
We would both feel a sense of loss if one of us was transferred and we could no longer work together.	.81
If I shared my problems with this person, I know (s)he would respond constructively and caringly.	.79
I would have to say that we have both made considerable emotional investments in our working relationship.	.66
Cognition-based trust	
This person approaches his/her job with professionalism and dedication.	.90
Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.	.86
I can rely on this person not to make my job more difficult by careless work.	.81
Most people, even those who aren't close friends of this individual, trust and respect him/her as a coworker.	.77
Other work associates of mine who must interact with this individual consider him/her to be trustworthy.	.73
If people knew more about this individual and his/her background, they would be more concerned and monitor his/her performance more closely. ^b	.69

Figure 35 - Trust items from McAllister [1995]

Morris (1995). The questionnaire administered to subordinate employees included various demographic items (e.g., gender, number employed in firm, managerial status, firm tenure) and items assessing this employee's affect-based trust and cognition-based trust of the supervisor. More specifically, four items from McAllister's (1995) scale measuring affect-based trust (e.g., "If I shared my problems with this person I know (s)he would respond constructively and caringly", "We have a sharing relationship; we can share our ideas, feelings, and hopes", "I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen", "We would both feel a sense of loss if one of us was transferred and we could no longer work together") were used to assess the subordinate employee's affect-based trust level of his or her supervisor. Likewise, five items from McAllister's (1995) scale measuring cognition-based trust (i.e., "This person approaches his/her job with professionalism and dedication", "Given this person's track record, I see no reason to doubt his or her competence and preparation for the job", "I can rely on this person not to make my job more difficult by careless work", "Most people, even those who aren't close friends of this individual, trust and respect him or her as a supervisor", "Other work associates of mine who must interact with this individual consider him or her to be trustworthy") were used to assess the subordinate employee's cognition-based trust level of his or her supervisor. A five-point Likert scale format (1 = "strongly agree,"..., 5 = "strongly

Figure 36 - Trust items from Costigan et al. [2006]

Communication items

1. Shows solidarity, raises other's status, gives help, and rewards.
2. Shows tension release, jokes, laughs, shows satisfaction.
3. Agrees, shows passive acceptance, understands, concurs, and complies.
4. Gives opinion, evaluation, analysis, expresses feeling, wish.
5. Gives suggestion, direction, implying autonomy for other.
6. Gives task orientation, information, repeats, clarifies, and confirms.
7. Asks for orientation, information, repetition, or confirmation.
8. Asks for opinion, evaluation, analysis, expression of feeling.
9. Asks for suggestion, direction, possible ways of action.
10. Disagrees, shows passive rejection, formality, withholds help.
11. Shows tension, asks for help, withdraws out of field.
12. Shows antagonism, deflates other's status, defends or asserts self.

Figure 37 - Bales's interaction process analysis (IPA) content categories

Factor	Best Channel	Other Channel
Face-to-Face When possible	The Closet is: Video Conference	
Use of Social Network like Facebook or Team Social Network	Social Network	Second choice: Blog web
Organize virtual social meeting, Create Virtual Face Time	Group Chat, Conference call, Video conference	
Share personal interest and information	Social Network, Blog web	During virtual social meetings: Group chat, Conference call or Video conference.
Take time to get know as individual, Show interest in their personal life	One to One Chat/Instant messaging, Phone/VoIP	
Ice breaker exercises and games	Be creative by using any ICT Channel	

Figure 38 - Relationship-orientend factors from Kauffmann & Carmi [2014]

Factors	Best Channels	Other Channels
Work progress communication	For updates: Email Then post in: Web page, Wiki	During team meeting: Conference call and Video Conference
Communicate Team member competencies and skills	Web page, Wiki	
Communication of goals and tasks	For updates: Email Then post in: Web page, Wiki	If needed to be update by other team members: Online Shared files
Communication of roles and Responsibility	For updates: Email Then post in: Web page, Wiki	If needed to be update by other team members: Online Shared files
Establish commitments, Keep promise and perform as expected	Email, Web page, Wiki	
Encourage Sharing knowledge and experience	Web Blogs, Wikis, Forums	
Response time, be responsive	Chat/Instant Messaging , Phone/VoIP	Second choice: Email, Voice Message
Transparency	Web Blog	Second choice: Web page, Wiki During team meeting: Conference call and Video Conference
Encourage Participation	All Multi-Way Communication Channels	

Figure 39 - Task-oriented factors from Kauffmann & Carmi [2014]

Collaboration Items

Problem-solving items

When I have a conflict at work, I do the following:

Yielding

1. I give in to the wishes of the other party.
2. I concur with the other party.
3. I try to accommodate the other party.
4. I adapt to the other parties' goals and interests.

Compromising

5. I try to realize a middle-of-the-road solution.
6. I emphasize that we have to find a compromise solution.
7. I insist we both give in a little.
8. I strive whenever possible towards a fifty-fifty compromise.

Forcing

9. I push my own point of view.
10. I search for gains.
11. I fight for a good outcome for myself.
12. I do everything to win.

Problem solving

13. I examine issues until I find a solution that really satisfies me and the other party.
14. I stand for my own and other's goals and interests.
15. I examine ideas from both sides to find a mutually optimal solution.
16. I work out a solution that serves my own as well as other's interests as good as possible.

Avoiding

17. I avoid a confrontation about our differences.
18. I avoid differences of opinion as much as possible.
19. I try to make differences loom less severe.
20. I try to avoid a confrontation with the other.

Figure 40 - The Dutch Testfar Conflict Handling (DUTCH)

Internal collaboration. Four items representing the problem-solving dimension from the Dutch Test for Conflict Handling (DeDreu, Evers, Beersma, Kluwer, & Nauta, 2001) were used to assess collaboration of the working relationships among members of the project teams. The questions were revised to reflect a team, versus dual-level, relationship and the scale was adjusted from a 5-point to a 7-point scale. Cronbach's coefficient alpha for the problem-solving dimension in the original, unmodified scale was 0.81. Items included: (1) Team members examine issues until a solution is found that really satisfies all the members; (2) Each team member stands up for his or her own and the other members' goals and interests; (3) Team members examine ideas from all sides to find a mutually optimal solution; and (4) Team members work out solutions that serve my own as well as the other members' interests as good as possible. The alpha reliability for this modified scale in the present study was 0.91.

Figure 41 – Problem-solving items from Peters [2003]

Innovation and Creativity items

Employee creativity items:

“Please indicate how often the following statements characterize this employee.”

1. Demonstrated originality in his/her work.*
2. Took risks in terms of producing new ideas in doing job.
3. Found new uses for existing methods or equipments.*
4. Solved problems that had caused other difficulty.*
5. Tried out new ideas and approached to problems.*
6. Identified opportunities for new products/processes.
7. Generated novel, but operable work-related ideas.
8. Served as a good role model for creativity.
9. Generated ideas revolutionary to our field.

* adapted from Ettlle & O’Keefe (1982)

Figure 42 - Creativity items from Tierney et al. [1999]

Team innovativeness. Innovation is a concept that conveys "intentional" change (Price & Mueller, 1986). In other words, in order for innovation to occur, change must be intentionally implemented. The concept of creativity, or innovativeness, is set apart from that which provides routine or expected outcomes. Items used to assess the innovation dimension of performance were taken from an existing self-report instrument (Ettlie & O'Keefe, 1982; Tierney, Farmer, & Graen, 1999) and modified slightly by changing the context from the individual to the team and using a continuous scale (ranging from 0 = Not at all to 100 = Very much) instead of a 6-point Likert scale. Managers and team members were asked to indicate the extent to which the statement characterizes the project team. The four items were (1) The team demonstrates originality in their work; (2) The team has found new uses for existing methods or equipment; (3) The team has solved problems that have caused others difficulty; and (4) The team has tried out new ideas and approaches to problems. Cronbach's coefficient alpha for the study completed by Tierney, et al. (1992) was 0.95; however, the measure also included five additional items that were not included in this study. The alpha reliability for the present study was 0.77.

Figure 43 - Innovation items from Peters [2003]

Knowledge sharing items

No.	Item	Source
1	It would have been fine with me if other team members asked me for any notes I might have made during the meeting	Jarvenpaa & Staples (2000)
2	It would have been fine with me if other asked for my help in explaining a certain aspect of our task.	Jarvenpaa & Staples (2000)
3*	I would have been justified in refusing to help other team member understand what is meant by a certain aspect of our assignment?	Jarvenpaa & Staples (2000)
4	It was very likely that I was going to share what I knew about our task with the other team members if needed.	Jarvenpaa & Staples (2000)
5	It was very likely that I was going to share my knowledge with the other team members when needed.	Jarvenpaa & Staples (2000)
6	It was very likely that I was going to share knowledge I gained from education or prior training with the other team members.	Bock, et al. (2005)
7	It was very likely that I was going to share my expertise with the other team members if needed.	Researcher

* Reverse-coded

Figure 44 - Willingness to Share Knowledge items from Samarah [2006]

Decision making items

Satisfaction with decision making process

Satisfaction with the decision making process refers to the member's perception regarding the decision procedure. Comprehensive evaluation of alternatives, consensual solution of the conflict, sufficient time to reach the solution, completeness of the process and the progress towards the group's stated goals are the various attributes which constitute the member's satisfaction with the decision making process. This variable was measured using a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Satisfaction with decision outcome

Satisfaction with the decision outcome refers to the perceived quality of the group's decision. When members perceive that their group's decision was practical, fair and implementable, they are satisfied with their group's decision outcome. This variable was assessed by using a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Figure 45 - Decision Making process and outcome variables from Paul et al. [2004]

No.	Item	Source
1	The decision made by my team is practical	Paul et al. (2004)-b
2	The decision made by my team is fair	Paul et al. (2004)-b
3	I am confident that the final decision we came up with is the best decision	Paul et al. (2004)-b
4	I feel that the quality of the group's decision would have positive effects on the proposed public relations campaign	Paul et al. (2004)-b
5*	Overall, it is my opinion that our final decision is of high quality	Paul et al. (2004)-b

* Item 5 was included for validity checks only

Figure 46 - Decision making items from Samarah [2006]

Conflict management items

Cooperative Approach

Team members encourage a “we are in it together” attitude.

Team members seek a solution that will be good for all of us.

Team members treat conflict as a mutual problem to solve.

We work so that to the extent possible we all get what we really want.

Team members combine the best of positions to make an effective decision.

Competitive Approach

Team members demand that others agree to their position.

Team members want others to make concessions but do not want to make concessions themselves.

Team members treat conflict as a win-lose contest.

Team members overstate their position to get its way.

Figure 47 - Conflict management items from Tjosvold et al. [2006]

APPENDIX B - Quantitative Questionnaire

Personal Details

My name is David Kauffmann and I am a PhD candidate. Currently, lecturer at two Academic Colleges and former team leader at IBM.

I am investigating the impact of Trust and Communication on Collaboration in virtual environment. The survey takes about 7mn (50 questions - Max 10 second per question). It is completely confidential, no information will be given to any other party.

Thank you for taking the time to respond to this survey on the impact of Communication and Trust on Virtual Team Collaboration. Understanding this vital issue should provide knowledge that will contribute to more effective virtual teams.

For the purposes of this study a virtual team (also known as a geographically dispersed team) is a group of people, working together to a common goal, but is spread over more than one work site, and whose members communicate heavily on electronic communications, technology and means other than face to face meetings at one physical location.

PhD Thesis

Personal Details

1. First Name *

2. Family Name (your real name is not a must) *

3. Gender *

- Female
- Male

4. Organization Name (Instead of the organization name, you can write the sector like Financial, Technology or Services)

5. My first language (Mother tongue) is *

6. Work experience as part of virtual teams (in years) *

7. What is your role in the virtual team? *

Team member

Team leader

other

8. What kind of team is it? *

Temporary one (working on a timely project with a team, usually no more than a year)

Ongoing one (working on a permanent base with the same team, usually over a year)

other

9. Is your Virtual Team a: *

Local Virtual Team (Almost all Team Members are spread over your country)

Global Virtual Team (Almost all Team Members are spread all over the world)

Both

10. What is your English level? *

Poor

Adequate

Good

Excellent

Mother tongue

11. On average, how often do you meet face-to-face your most remote team member? *

Every week

Every Month

Every Quarter

Every Year

Almost Never

12. Were you trained on using technology-mediated communications systems for working with teams on a collaborative assignments (e.g Email, Messenger, Call or Video Conference)? *

Not at all	Basic Training	Medium Training	Good Training	Comprehensive Training
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Trust related questions

13. The team has a sharing relationship. We can freely share our ideas, feeling and hopes. *

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. I can talk freely to a team member about difficulties I am having at work and known that s(he) is willing to listen. *

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Team members would feel a sense of loss if one of them was transferred and could no longer work with the team. *

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. If I share my problems with a team member, I know (s)he would respond constructively and caringly. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

17. I can say that the team members made considerable emotional investments in the team working relationship. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

18. Generally, the team members approach their job with professionalism and dedication. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

19. I have **no** reason to doubt in the team members competence and preparation for the job. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

20. I can rely on the team members not to make my job more difficult by careless work. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

21. Generally, team members, even if they are not close friends, trust and respect each other as coworkers. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

22. Other employees, that are not part of the team and who interact with it, consider my team members to be trustworthy. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

Communication related questions

23. The team members show solidarity, give help or rewards to one another. *

Never

Rarely

Sometime

Most of the
Time

Always

24. Team member are willing to share personal interest and information. *

Never

Rarely

Sometime

Most of the
Time

Always

25. Team members take time to get know as individual and show interest in others personal life. *

Never

Rarely

Sometime

Most of the
Time

Always

26. Team members use communication means (channels) for social interactions. *

Never	Rarely	Sometime	Most of the Time	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

27. During meetings (via electronics channels like call & video conference), Team members have small talks. *

Never	Rarely	Sometime	Most of the Time	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. Team members report their work progression and update scheduled tasks status. *

Never	Rarely	Sometime	Most of the Time	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29. Team members give suggestion, propose solutions or technical assistance. *

Never	Rarely	Sometime	Most of the Time	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. Team member discuss about their common tasks and goals. *

Never	Rarely	Sometime	Most of the Time	Always
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31. Team members coordinate tasks and activities. *

Never Rarely Sometime Most of the Time Always

32. Team members know about others team members responsibilities, roles, competencies and skills. *

Never Rarely Sometime Most of the Time Always

Collaboration related questions

33. Team members examine issues until a solution is found that really satisfies all members. *

Strongly disagree Disagree Neutral Agree Strongly agree

34. Each team member stands up for his or her own and the other members' goals and interests. *

Strongly disagree Disagree Neutral Agree Strongly agree

35. Team members examine ideas from all sides to find a mutually optimal solution. *

Strongly disagree Disagree Neutral Agree Strongly agree

36. Team members work out solutions that serve my own as well as the other members' interests as good as possible. *

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

37. My team demonstrates originality in its work. *

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

38. My team has found new uses for existing methods or equipment. *

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

39. My team has solved problems that have caused others difficulty. *

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

40. My team has tried out new ideas and approaches to problems *

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

41. Team members are willing to share notes which they might have made during meetings (such as video or call meeting but also face-to-face meeting if applicable). *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

42. Team members are willing to explain to others certain aspect of team's tasks. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

43. Team members are willing to share what they know about the team's tasks *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

44. Team members are willing to share their knowledge to the benefit of the team *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

45. The decisions made by my team are fair. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

46. The decisions made by my team are practical. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

47. I am confident that the final decision made by my team was the best decision. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

48. I feel that the quality of the group's decision would have positive effects on our team tasks/assignment. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

49. Team members encourage a "we are in it together" attitude. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

50. Team members seek a solution that will be good for all of us. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

51. Team members treat conflict as a mutual problem to solve. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

52. We work so that to every extent possible we all get what we really want. *

Strongly
disagree

Disagree

Neutral

Agree

Strongly agree

Thank You!

Thank you for taking our survey. Your response is very important to us.

APPENDIX C – Qualitative Questionnaire

Qualitative

Page One

Dear Respondent, I want to thank you again for taking part in the second and last stage of my study.

This survey consists of four open-ended questions that you may answer freely.

The aim of the questions is to understand some findings from the first stage; therefore the survey is accompanied by explanations of results previously observed

In order to be able to answer the questions, you first need to have some background and definitions of terms used for this study:

Temporary teams are teams that work on a timely project, usually no more than a year

Ongoing teams are teams that work together on a permanent basis, usually over a year

Cognitive-based trust refers to performance-relevant cognitions such as competence, responsibility, reliability and dependability. Individuals employ rational thought in order to trust others.

Affective-based trust is based on emotional attachment to the people involved in the relationship.

Task-oriented communication focuses on how well project information, tasks and deliverables are being handled through the communication.

Relationship-oriented communication focuses on building and maintaining good relationships with people and ensuring others are comfortable with the interactions.

In this study, the concept of team collaboration is defined by five processes:

Problem solving is defined as a process, used to obtain a best answer to an unknown or a decision subject to some constraints.

Decision making is defined as a process that allows possible alternatives to be identified, select the best solution and evaluate the consequences.

Innovation is a dynamic process through which problems and challenges are defined, new and creative ideas are developed and new solutions are selected and implemented.

Conflict management is the process of limiting the negative aspects of conflict while increasing the positive aspects of conflict.

Knowledge Sharing is an activity through which knowledge (i.e., information, skills, or expertise) is exchanged among people, friends, families, communities or organizations.

You can answer to the questions either in English, French or Hebrew
Thank you again for your time.

1) Your name is? (Your real name is not a must)

2) Your gender is?*

Female

Male

3) What is your role?*

Virtual team leader/manager

Virtual team member

Virtual team counselor

4) What type of team are you working in (or with, for counselors)?*

Temporary team

() Ongoing team

() Both

The level of communication (both task- and relationship-oriented), the level of trust (both cognitive- and affective-based) and the level of collaboration are significantly higher in ongoing teams than in temporary ones.

However, some differences have been found in the levels of the five collaboration processes.

5) It has been found that there is a big difference in levels of collaboration between ongoing teams and temporary teams regarding innovation and creativity, decision making and problem solving. However, there is much less difference between the two types of team on knowledge sharing and conflict management.

Why do you think this is?

6) What might be the reasons that on one hand, relationship-oriented communication is more significant than task-oriented communication for decision making and, innovation and creativity but on the other hand, task-oriented communication is more significant for conflict management, knowledge sharing and problem solving?

The study shows that good interpersonal communication with the help of

a high level of trust will lead to a more effective collaboration. In other words, if communication is not also used to develop trust, the positive effect of communication on collaboration is negatively affected.

In a virtual work environment, where the aim is task driven, we may think that only direct orders, updates, tasks distribution etc... via communication will be enough to generate collaboration.

7) How do you explain that if communication is not also used to develop trust, the impact of communication on collaboration is negatively affected?

Furthermore we can observe an interesting result that for knowledge sharing, only cognitive-based trust seems to be significant in the relationship between communication and knowledge sharing.

8) In your opinion, what are the reasons that affective-based trust does not play a significant role in the relationship between communication and knowledge sharing while for the other collaboration processes it does?

Thank You!

Thank you for taking my survey. Your response is very important to me.

APPENDIX D – Qualitative responses

Question 1

It has been found that there is a big difference in levels of collaboration between ongoing teams and temporary teams regarding innovation and creativity, decision making and problem solving. However, there is much less difference between the two types of team on knowledge sharing and conflict management. Why do you think this is?

Respondent 1 (counselor):

I think that for both ongoing and temporary teams knowledge sharing and conflict management is a MUST for the team to operate correctly. While in the other 3 levels of collaboration (innovation, creativity, decision making) are not or are not always in the prerogatives of all teams.

Respondent 2 (Team Leader):

Innovation and problem solving requires better integration between team members and trust.

Respondent 3 (Team Leader):

Ongoing teams have a vested interest in their future success and they know each other in ways that are different than short term team. The teams trust each other and are not trying to find out what the expertise of the temporary team members are they already know them so they can focus on the task at hand.

Respondent 4 (Team Leader):

From my perspective, I would say that knowledge sharing and conflict management are (at least in my company) documented therefore nearly technical processes which make the nature of the teams less impacting on the result. On the other side innovation and creativity require teams to be in synch; it requires that the teams removed all barriers (a priori) before innovation and

creativity can occur. Also creativity as well as problem solving are facilitated by the experience on the topic, as well as by the mutual experience.

Respondent 5 (Team Member):

Because both types have a common goal (short term or long term) and must therefore collaborate, so knowledge sharing and managing conflicts is key to get to a quick solution.

Respondent 6 (Counselor):

Knowledge sharing and conflict management may not be as process-oriented as innovation and creativity, decision-making, and problem-solving. Knowledge sharing and conflict can be dealt with relatively quickly/immediately. It doesn't take much for information to be exchanged, or for conflict to arise and be dealt with ASAP. On the contrary, innovation and creativity, decision making, and problem-solving all take time. They require input from multiple team members, weighing pros and cons, brainstorming, and collaboration. Consequently, there will be a greater difference in performing these tasks on in-person vs. virtual teams. These tasks also require trust in other team members, and in the team as a whole, which is more difficult to develop on virtual teams.

Respondent 7 (Team Member):

Cela va de soit, le travail et la réflexion au sein d'une même équipe qui travaille régulièrement est souvent source de créativité et d'innovation.

Le rapport qui se crée au sein d'une équipe ponctuelle - rattachée à un projet spécifique est dans 99% des cas une relation de décisionnaire vers des exécutants sans adjonction d'innovation.

Respondent 8 (Team Member):

To me, it looks like working on temporary teams means that the project the team works on is smaller and then well defined in terms of scope and there

is no room for innovation or creativity. The complexity of the tasks might be reduced and decisions have been taken at an earlier stage.

In ongoing teams, the diversity of the tasks is very wide during the years and employees often meet obstacles where they need to find new solutions by being creative. In the same way, decisions have to be taken 'on the fly' to resolve unexpected issues. Additionally, ongoing teams might design a solution, which consists mainly of making decisions.

Respondent 9 (Counselor):

Ongoing teams take the time to develop specific collaboration strategies around innovation, decision making and problem solving because they feel they need to for long term productivity. Project teams probably don't have as much time or necessity to do this. However, knowledge sharing and conflict management would be vital for all teams to be able to deliver.

Respondent 10 (Counselor):

Perhaps knowledge sharing is a relatively straightforward exercise whether the virtual team is ongoing or temporary. Perhaps conflict management is going to be needed regardless of whether the virtual team is ongoing or temporary. People will almost always have challenges that need to be understood and managed.

Respondent 11 (Team Leader):

Innovation, decision making and problem solving require people to take a few 'risks' in the sense of making suggestions that may turn out to look a little silly. In ongoing teams, this will just be laughed off and forgotten because people already have a good relationship and track record. In temporary teams, this track record does not necessarily exist.

Respondent 12 (Team Member):

Knowledge sharing and conflict management are important for the daily work. Innovation and creativity are more important for the future and in a

temporary team less important.

Respondent 13 (Team Leader):

Knowledge sharing is not only based on open communication between team members, but also relies on the use of tools such as a Team Room Repository for shared information. Both types of team would typically use such tools.

My style of conflict management was to deal with it on a one to one basis - which would be true, however long the team existed.

Respondent 14 (Team Leader):

Possible reason may be the ad-hoc nature of the so-called temp teams... where innovation, creativity, decision making may be irrelevant I have no answer for "problem solving" rating

Question 2

What might be the reasons that on one hand, relationship-oriented communication is more significant than task-oriented communication for decision making and, innovation and creativity but on the other hand, task-oriented communication is more significant for conflict management, knowledge sharing and problem solving?

Respondent 1 (counselor):

1) Maybe because in relationship-oriented communication allows teams members to be more confident/comfortable in order to be in position to innovate, to express creativity and to smooth the decision making process.

2) On the other hand, task-oriented communication allows to have a more structured & rational approach (and less emotional one) on conflict management, problem solving and knowledge sharing.

Respondent 2 (Team Leader):

I am not sure conflict management is at the right place. Anyway - anything

rational like task management require analytical skills less emotional skills and trust.

Respondent 3 (Team Leader):

We use our trust and knowledge of people when we innovate and make decisions but for conflict we simply focus on the issue at hand and do not let the personal feelings influence our approach or decisions.

Respondent 4 (Team Leader):

Question somewhere similar to the previous one: decision making and, innovation and creativity are much more human related which explains why relationship-oriented communication is in that case more significant. On the opposite, as I wrote before, conflict management and knowledge sharing can be considered as technical processes where a task-oriented communication will be more significant.

Respondent 5 (Team Member):

Same as above, for immediate problems (conflicts etc...) task oriented is neutral and a solution must be found, while for more creative tasks the relationship for brain storming, bouncing off new ideas etc... is more important.

Respondent 6 (Counselor):

Relationship-oriented communication is more significant than task-oriented communication for decision-making, innovation, and creativity because all three require input from multiple, diverse perspectives. There needs to be a collaborative, think-outside-the-box mentality between multiple parties, where ideas are bouncing back and forth, which can be best attained via relationship-oriented communication.

Task-oriented communication is more significant for conflict management, knowledge sharing, and problem-solving because these three require a more logical, efficiency-oriented perspective which task-oriented communication can provide.

Respondent 7 (Team Member):

Les relations dans l'optique solutions, réalisation d'un projet concret et focaliser évite tous conflits au sein de l'équipe car la relation qui se crée n'est aucun moment source de conflit. Il y a une demande et des exécutants. Dans le cas d'un travail de conception il y a alors place à échange et discussion qui de se fait permet l'émergence de conflits/ problème donc discussion et leur résolution avant exécution.

Respondent 8 (Team Member):

I believe that for being innovative one has to feel he can express himself freely and his colleagues will value his creativity and opinion. Same goes for decision making, it is easier to propose solutions and come together to a decision when relationship level is high. Decision making and innovation are 'human' components while conflict management and knowledge are to me more technical and directly related to tasks.

Respondent 9 (Counselor):

I'm not sure what the reason for this would be. In particular, it seems counter-intuitive that task oriented communication is more significant for conflict management.

Respondent 10 (Counselor):

One cannot have creativity and innovation without trust which is the basis for relationship-oriented communication. On the other hand, task oriented communication is more central to knowledge sharing and problem solving. I would say that there must also be some basic relationship oriented communication in the latter where conflict management is concerned. Logic and knowledge are insufficient to address conflict in isolation.

Respondent 11 (Team Leader):

Again, decision making and innovation and creativity require taking a level of risk and you always feel "safer" taking risk when you are dealing with people

you trust and get on well with.

Respondent 12 (Team Member):

Decision making, innovation and creativity depend more on personal trust and opinion than knowledge sharing, conflict management and problem solving.

Respondent 13 (Team Leader):

For effective decision making, innovation and creativity to occur, team members will be bound together in an atmosphere of trust, respect and inspiration to deliver upon a shared goal(s). This is both new and exciting and is the reason why the team exists. Conflict management, knowledge sharing and problem solving are management issues which facilitate the smooth operation of the team, thus allowing the team members to focus on their innovations.

Respondent 14 (Team Leader):

The decision making and, innovation and creativity are driven by relations, while conflict management, knowledge sharing and problem solving are technical activities.

Question 3

How do you explain that if communication is not also used to develop trust, the impact of communication on collaboration is negatively affected?

Respondent 1 (counselor):

Perhaps because in virtual work environment, it is even more important to care about motivation and trust is key in contributing to higher motivation. Just communication is not enough to get things done while trust bring more of the "belonging feeling" for collaboration.

Respondent 2 (Team Leader):

Just as I mentioned above trust and respect are important for any type of communication which requires deep understanding and integration between the different parties.

Respondent 3 (Team Leader):

If we don't trust someone we are less likely to share ideas for fear they will be disregarded. Trust breeds familiarity and allows us to share freely.

Respondent 4 (Team Leader):

Quite strange question :-)

Personally I cannot imagine collaboration without trust. Therefore, when leading a team, considering that the objective is to perform as much as possible, this can only be reached if all members are top performing, which in most of the case, require collaboration between the team members. And the collaboration will only take place if the members trust each other, as well as they trust in their team leader.

Respondent 5 (Team Member):

If there is no trust and no personal relationship, you only respond to direct needs, you solve immediate problems, but you don't go beyond and into the future. I find, with peoples you don't know personally, the answers are usually shorter, more business oriented, they come later.

Respondent 6 (Counselor):

In order for communication to positively affect collaboration, the communication must be both relationship-oriented AND task oriented.

Trust is shared between people with an interpersonal connection, not between people who simply have the same work goal.

Respondent 7 (Team Member):

Communication = trust!!!!

Without trust there is no communication but a superior to inferior

relationship without any chance of progress or innovation.

Respondent 8 (Team Member):

Everything is personal...

Having good relationships with colleagues will improve the collaboration and the efficiency of the work performed. People tend to work better and faster when the requirement comes from a colleague he appreciate at a personal level. Having a good atmosphere among the team is to me a key for success of the project

Respondent 9 (Counselor):

If team members don't work to build trust, misinterpretations of communication often occur and the type of communication can be quite defensive and emotionally based, which negatively affects collaboration.

Respondent 10 (Counselor):

One cannot underestimate the role of emotions in virtual team work. If one is not feeling valued, understood, or included, it is difficult to imagine said individual being trustful and transparent. This has a ripple effect especially if more than one person on the virtual team feels this way.

Respondent 11 (Team Leader):

If you don't trust people then you simply do not openly communicate with them. You tell them on the bare minimum and you don't collaborate with them openly. You can talk about acting "professionally" in the business environment but in most cases this simply doesn't happen. If we don't trust people, we don't work well with them.

Respondent 12 (Team Member):

One just does not listen so much to people one does not trust.

Respondent 13 (Team Leader):

The virtual teams that I managed were made up of many different skill

sets - sales / marketing / technical / financial / legal etc. It was therefore essential that each & every team member was encouraged to share their knowledge with the team and that their input was trusted by their fellow team members. Without this high level of trust, our complex business development efforts would simply not have succeeded.

Respondent 14 (Team Leader):

Communication is mandatory to develop trust; Collaboration is dependent to communication.