

**The Next Generation Teams: Technology Adoption to  
Eliminate the Boundaries of Space through Building an  
Integrated Effective Virtual Team Platform**

فرق عمل الجيل القادم: توظيف التكنولوجيا لإزالة معوقات المكان من خلال بناء  
منصة متكاملة لفعالية فرق العمل الافتراضية

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## Abstract

The revolution of information technology led into more open markets and globalization. This technology revolution and its results put more pressure on corporations and business owners to change their way of thinking and how to manage the ongoing business in order to go with the business flow, survive and increase their revenues.

High operational expenses and costs, challenging competition from others and the need to enhance the level of quality to gain more customers were the main motivation factors to come up with the virtual team concept. The concept started by having offshore resources with less operational costs, less salaries as a benefit from the difference of currency exchange rates with larger pool of expertise and skilled resources. In contrast, corporations faced many challenges in managing the resources in virtual teams especially that those resources are not working together and not available in the same place with no face-to-face interactions.

This study focused on the effectiveness of virtual teams, benefits of virtual team concept, the comparison with traditional teams along with the key challenge areas that face such type of teams. The key challenges were extracted from a thorough reading and research for related work and were furtherly explored using a survey with an intensive analysis to examine the validity and the level of impact for each challenge area. These challenge areas include: *Trust, Technology, Culture, Language and Time-zone*. Also, the study contained face-to-face interviews with resources who are currently working in virtual teams and multiple observation sessions as an extra method to confirm the findings.

The study found that trust and technology factors have the highest effect on the effectiveness of virtual teams, while language gap factor has the lowest impact on the virtual teams to be effective. Many studies discussed different aspects of virtual teams but it was obvious that many researchers discussed the challenges without suggested practical solutions. This study proposes a novel platform that guides to develop an effective virtual team along with building a prototype for a technology solution “*Virtu*” which is a unified communication solution that can help resources to work effectively and be capable to do their tasks with less efforts. *Virtu* focuses on eliminating the resource distraction because of using different technologies to communicate and concentrates more on the task completion and the effective synchronic mutual interactions.

## الخلاصة

مثلت الثورة الحاصلة في مجال تكنولوجيا المعلومات الدافع تعزيز مبادئ العولمة و الأسواق المفتوحة. هذه الثورة التكنولوجية ونتائجها وضعت المزيد من الضغوط على الشركات وأصحاب الأعمال لتغيير طريقة تفكيرهم وكيفية إدارة الأعمال الجارية من أجل مجاراة السوق و القدرة على الاستمرارية و التنافسية وزيادة الإيرادات.

كان لإرتفاع التكاليف التشغيلية، والمنافسة الصعبة من الشركات الأخرى، والحاجة إلى تعزيز مستوى جودة المنتجات و الخدمات المقدمة الدور الرئيسي للتفكير في إيجاد مفهوم الفريق الظاهري. وقد بدأ هذا المفهوم بتوفير موارد بشرية مختلفة المهارات بتكاليف تشغيلية أقل، وأقل مرتبات بالاستفادة من اختلاف أسعار صرف العملات ومع توفير مجموعة أكبر من الخبرات والموارد الماهرة. وفي المقابل، واجهت الشركات العديد من التحديات في إدارة مواردها البشرية من خلال الفرق الافتراضية و ذلك لأن تلك الموارد لا تعمل معا و غير متوفرة في نفس المكان بالإضافة لعدم وجود أي تفاعل بينها ووجهها لوجه. ركزت هذه الدراسة على فعالية الفرق الافتراضية، وفوائد مفهوم الفريق الظاهري، والمقارنة مع الفرق التقليدية جنباً إلى جنب مع مجالات التحدي الرئيسية التي تواجه مثل هذا النوع من الفرق. تم استخلاص التحديات الرئيسية من قراءة وبحث شاملة لأعمال و دراسات ذات الصلة، واستكشفت كذلك باستخدام مسح مع تحليل مكثف لدراسة مدى صحة ومستوى التأثير لكل مجال التحدي التي تم دراستها. و قد شملت مجالات التحدي هذه على عدة عناصر: عنصر توافر الثقة، فعالية استخدام التكنولوجيا، اختلاف الثقافات، اختلاف اللغة و اختلاف المنطقة الزمنية. كما تضمنت الدراسة عدة مقابلات مع أشخاص يعملون حالياً كأفراد في فرق افتراضية بالإضافة الى عقد جلسات متعددة مع بعض الفرق أثناء عملها لملاحظة العمل بشكل مباشر و تفاعلي كتأكيد إضافي للنتائج.

وجدت الدراسة أن عوامل الثقة والتكنولوجيا لها أعلى تأثير على فعالية الفريق الظاهري في حين أن عامل اختلاف اللغة له أقل تأثير على فعالية الفرق الافتراضية. ناقشت العديد من الدراسات جوانب مختلفة من الفرق الافتراضية ولكن كان من الواضح أن العديد من الباحثين ناقشوا التحديات دون حلول عملية مقترحة. وقد جاءت هذه الدراسة ببعض الحلول المرتبطة ببعضها البعض عن طريق مع بناء منصة عمل تهدف لتشكيل فريق افتراضي فعال مع حل أساسي وهو نموذج أولي لحل التكنولوجيا "فيرتو" وهو برنامج موحد للتواصل يعمل على تمكين الأفراد في الفرق الافتراضية على العمل بشكل فعال مع القدرة على القيام بالمهام بشكل متميز و بجهد أقل. الفكرة الرئيسية من بناء برنامج فيرتو هو تقليل الوقت المستغرق من قبل الأفراد في الفرق الافتراضية لتعلم استخدام تقنيات الإتصال المختلفة و التفاعل معها مع التركيز أكثر على إنجاز المهمة والاتصال الفعال مع زملاء العمل.

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# Table of Contents

Chapter 1 Introduction .....	8
Aims and Objectives .....	8
Overview about Team Virtualization.....	9
Research Hypotheses .....	10
Structure of the Dissertation .....	11
Chapter 2 Literature Review .....	12
Virtual Teams Concept .....	12
Virtual Teams versus Traditional Teams .....	13
Why Virtual Teams.....	16
Key Challenges .....	19
Chapter 3 Methodology .....	27
Research Approach and Used Techniques.....	27
Data Collection .....	27
Chapter 4 Analysis and Hypothesis Testing .....	29
Interviews Analysis.....	29
Analysis for Observation Sessions.....	32
Pre-Survey Analysis.....	33
Experimental Analysis .....	33
Descriptive Analysis of Studied Variables .....	57
Testing Research Hypotheses .....	62
Chapter 5 Discussion .....	67
Analysis .....	67
Recommendations.....	69
Key Solutions.....	71
Virtu Solution.....	71
Effective Virtual Team Platform (EVT) .....	73
Chapter 6 Conclusion, Future Work and limitations .....	75
References.....	77

# Chapter 1 Introduction

The introduction chapter provides a summary about the core subjects that will be discussed. It starts with the objectives behind this study, provide some general details about the virtualization model, and explains briefly the expected outcomes of the study. Also, the introduction will give an idea about the hypotheses that will be analyzed and examined through the analysis and discussion sections in this research paper. The last part of the introduction section is responsible to explain the thesis structure and the flow of the ideas.

## Aims and Objectives

Since 1946, the business world has been changed forever because computers were invented. Through the time, Computers assisted human-beings to complete various difficult tasks in seconds or less, and helped to open new windows for the business worldwide. Computers played a key role in setting the new business strategies, resources management strategies and organizational boundaries. Also, computers considered as the basis for the current technological boom, and was used as a foundation to build and assist other technologies: smart radars, aircrafts, cars, handheld mobiles and tablets...etc.

Similarly, Data is a key component for knowledge, which is power and base for any social, human or technological improvement in this world. It is essential to analyze the data, share it at the right format, right time and to the right person or pool of people in order to transform it into useful information that can be used to make quick accurate decisions. The necessity to have useful information and the existence of computers forced researchers to utilize the information technology in order to manage the huge flow of information. The *information technology* term was coined by Harvard business review to define the study and use of computer, systems and telecommunication tools to send, store and retrieve information.

Consequently, and as a result for the rapid business development, many studies discussed and recommended that it is compulsory to have better communication means that can help various business stake-holders to share the useful information. So, software and hardware development companies took the opportunity to start building effective, advanced and quick communication devices and applications such like: Mobile Phones, short messaging service



(SMS), free messaging application and video conferencing solutions. Such evolution in the communication technologies opened the door for the virtualization model as a new business model that rely on the virtual teams to complete the various projects or daily operational activities.

This research aims to study the concept of virtual teams, its impact factors and constraints. Also, the research will give a look to the challenges and benefits of using the model within an organization or projects. Likewise, the research will provide some solutions for the constraints of the virtual team model along with a conceptual platform to build an effective virtual team to maximize these expected benefits. The Conceptual platform was built and examined through related work, intensive survey and analysis, four interviews along with two different observation sessions.

## **Overview about Team Virtualization**

Virtualization refers to the act of making a virtual (not actual) version of something, it includes virtual computer and hardware platforms, storage machines, and computer networks. In 1960s, virtualization started as a new trend that used to logically divide the system resources that are provided by supercomputer between different applications. Since that time, the terminology has expanded (Graziano 2011).

Team virtualization concept was founded as a complementary for the traditional teams instead of being an alternative. Corporations can have a mix of virtual and traditional teams as a hybrid model. Resources can work at the same time with colleagues from different or same countries, regions, time-zones or cultures. Using the communication technologies became important for workers to deal between each other's and accomplish their tasks regardless the type of the team: virtual, traditional or even hybrid. It is obvious that people who work in the same place become more and more dependent on using the various technologies to communicate and work with other colleagues.

**Keywords:** *Virtual team's effectiveness, Effective virtual team platform (EVT) trust, technology, culture gap, language gap, time zone, communication.*

## Research Hypotheses

- 1- **Hypothesis (H1):** Trust has positive impact on virtual team effectiveness.
- 2- **Hypothesis (H2):** Culture gap has negative impact on virtual team effectiveness.
- 3- **Hypothesis (H3):** Technology has impact on virtual team effectiveness.
- 4- **Hypothesis (H4):** Time-Zone Difference has impact on virtual team effectiveness.
- 5- **Hypothesis (H5):** Language gap has negative impact on virtual team effectiveness.

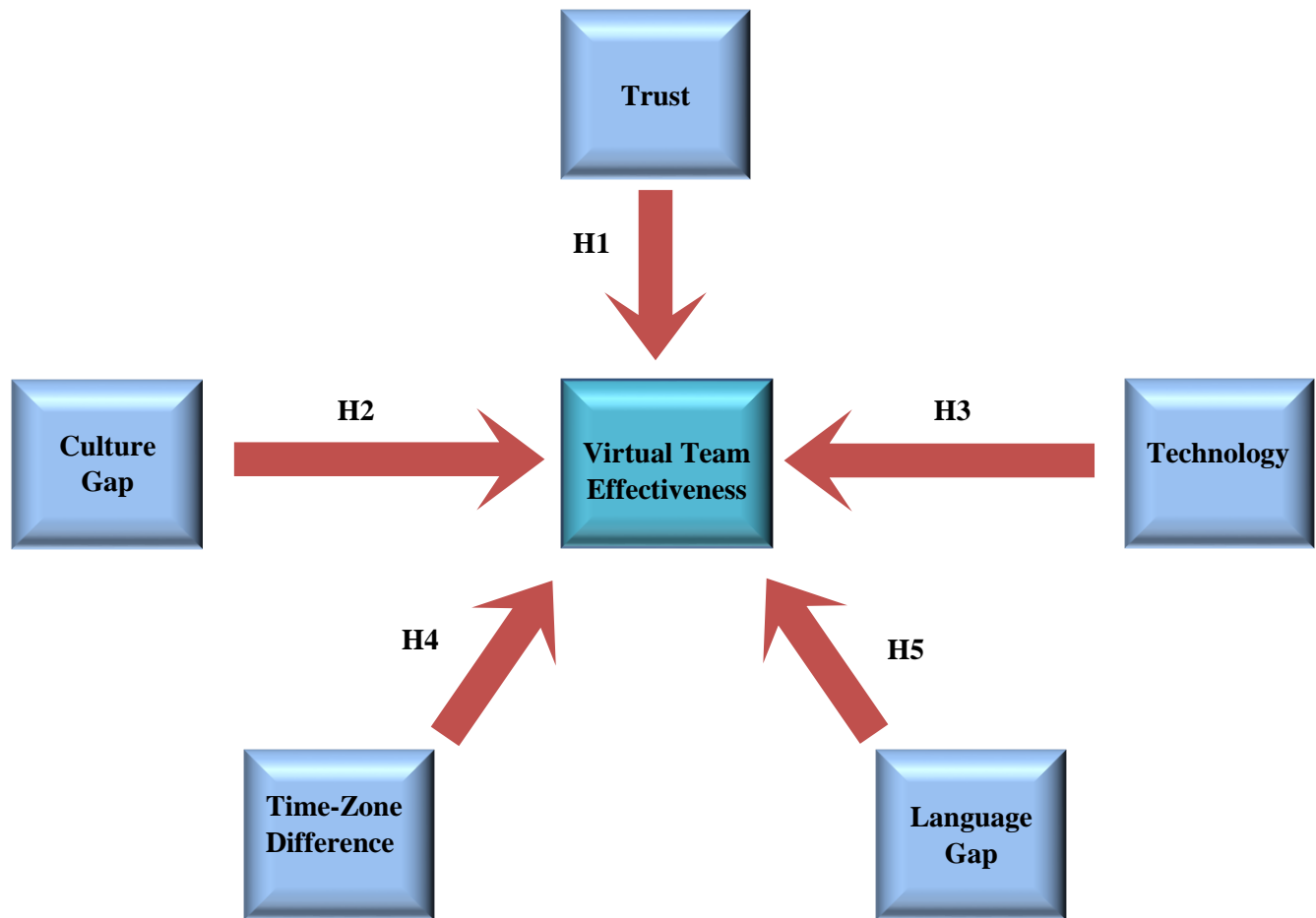


FIGURE 1: RESEARCH FRAMEWORK

## **Structure of the Dissertation**

The study will start with discussion for the related work that was conducted by other researches to illustrate the various benefits of virtual teams and factors that impact the performance and effectiveness of virtual teams. After that, the study will explain the methodology in chapter 3, research approach and techniques that were used to collect data and views about the challenges and impact factors of virtual teams.

Chapter 4 will be responsible to explain the results of analysis for the data that was collected in the survey, interviews and observation sessions. While chapter 5 will discuss these results, relate them to the related work in this study and provide recommendations and solutions that will be the base to build the platform for effective virtual teams. Finally, chapter 6 will provide conclusion for the whole study results and explain the development opportunities in the future and how this study can be improved to gain better results.

## Chapter 2 Literature Review

This chapter describes the virtual team's concept, their positive impact and benefits for the working in environments. Also, this chapter will talk about the constraints that have been discussed by other researchers in previous studies and can be faced when the virtual team's concept is applied.

Mainly, many researchers have discussed the virtual team's concept and challenges to work in a virtual team, but it is not easy to find research papers that discuss and suggest solutions to build and develop an effective virtual team, which is one of the key reasons for this study. Also, this section compares between the virtual and traditional teams and discuss why traditional team skills are insufficient or hard to find in order to complete all the required tasks.

### Virtual Teams Concept

Before understanding the virtual team as a concept, there should be a common definition for the virtual team that needs to be also agreed on by all the researchers. Through their study, (Dubé, Line & Paré 2001) could find various conflicted definitions for the virtual teams and even without clear distinguished features from the traditional teams. They could put a simple definition for the virtual team as a small group of people that communicate, share information and collaborate through the information technology tools and coordinate their efforts, skills and goals to complete specific goals with responsibility that is shared among the team members.

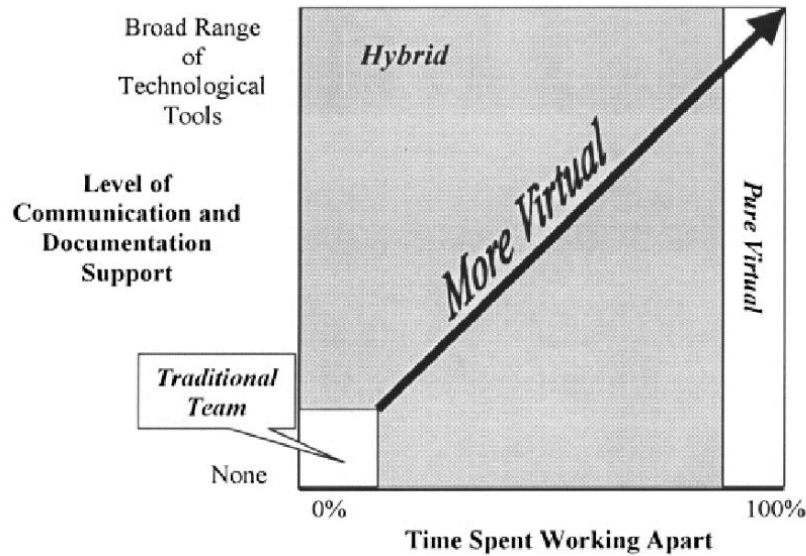
(Gibson & Cohen 2003) stated in their book, "Virtual Team that Work" that virtual team is a functioning team where the members depend on technology to communicate rather than face-to-face, interdependent to complete the tasks and all members are responsible to accomplish the mutual goals. Virtual team members manage their social relationships collectively across the organizational boundaries. Also, (Keyzerman 2003) sees that virtual teams are cross-functional teams with members who work across space and time along with diversity in culture and geographically distributed without organizational boundaries and communicate via computer technologies. Moreover, virtual teams can be briefed as a group of people who are gathered to accomplish a project, task(s) within a project or operational activities using information technology tools. (Anawati & Craig 2006).

(Berry, 2011) thinks that a team can be named as virtual when it mainly does rely on email, electronic chat groups, electronic databases and video calls to accomplish the required work. The virtual team can be at the same office but most likely across the country or the world located without meeting face-to-face. Furthermore, the rapid development in the information technology field with the complexity of the market and the high competitive pressures led to increase the need to have virtual teams for the 24/7 customer care, system programming and product development. These factors could increase the studies about the virtual teams but still the understanding of the virtual teams is in the primary stages (Dubé & Paré 2004). In 1998, Harvard Business School projected that around 15 million people in the United States of America are working in “Virtual Environments” with 20 percent as a yearly growth for this number (Keyzerman 2003).

## **Virtual Teams versus Traditional Teams**

Many researches encourage the use of group of people “team” to increase capability, awareness, and flexibility within organizations to create synergies among team members with various types of expertise, skills, or knowledge. All teams use technology to some extent, so virtualization rises the degree of reliance on electronic communication increases (Berry 2011).

Organizations started gradually to rely more on the team work instead of the individual accomplishments. This has been influenced by the assumption that the decision-making process will be easier and more accurate with higher quality when it goes through a team instead of one person. Especially that it is difficult or impossible to find one resource even if he is a skillful manager with all the required set of expertise. Over the time, studies and experience proved that working as a team and share the collected information and knowledge could provide better performance and innovative solutions that are related to high-quality deliverables. (Griffith & Neale 2001)



**FIGURE 2: DIMENSIONS OF VIRTUAL-NESS AS PRESENTED BY GRIFFITH & NEALE, 2001**

(Griffith & Neale 2001) have developed a two-dimensional model (Figure2), the model is concerned about:

- *The time that a team member is spent to do work with his team members across space as a geographical factor and time (X-axis).*
- *And the level of the used technological tools to support communication and documentation within the team (Y-axis).*

As shown in figure 2, the model claims that the teams can be classified into three types: traditional, Hybrid and pure virtual teams. Traditional teams should work more time together in the same place without or with minimum usage of technology. Also, a team can be considered as a hybrid one when it works at the same time and within the same geographical place, but with a high level of technology usage and utilization. On the other hand, the more use of technology along with diversity in working times or locations means that a team is more virtual until it reaches the state of pure virtual team.

In addition, (Griffith & Neale 2001) have assessed the diversity factor in each type of teams that were previously discussed. For example, informational diversity gives the virtual team an advantage. It is difficult to have sufficient information diversity and requisite knowledge within traditional teams that work in the same geographical location.

The conducted assessment of the diversity factor has led for multiple propositions, the following are the key propositions:

- *Virtual teams have greater social diversity than traditional teams.*
- *Virtual teams have more informational diversity.*
- *Teams with members that are geographically distributed have greater added-value diversity than teams whose members working in the same location.*
- *Teams with members that are geographically distributed are more likely to be involved in uncertain tasks with less routine than teams whose members working in the same location.*

Furthermore, (Berry 2011) tried to discuss the relation between virtual and traditional teams from the similarity angle. Virtual teams are groups of people who share the same characteristics same as in the traditional teams, but communication in virtual teams is more to be computer-mediated one. Communication in virtual teams is asynchronous instead of being synchronous like the face-to-face communication in the traditional teams.

Consequently, the management of virtual teams became into a nightmare and more complex to manage virtual teams effectively, the manager needs to have the knowledge and understand the essential principles of teams regardless the location, time or differences in communication.

(Berry 2011) claimed that virtual teams have some characteristics that can be shared with the traditional ones. These characteristics include but not limited to:

- *The team sometimes but not always has a clear and limited membership and this membership is defined and understood by all team members. Any minor changes in the kind of this membership will not change the team from working as a whole.*
- *The members of the team work interdependently, regularly for a common purpose that is given to them or agreed within the team itself.*
- *The team members are mutually responsible for the outcomes and their quality.*
- *The members jointly manage the relationships among the team and with the other internal organizational boundaries.*

In contrast, the virtual teams are different as the following:

- *The team members are geographically dispersed.*

- *The team members mainly rely on computer-mediated communication methods instead of face-to-face communication in order to accomplish the required tasks.*

Dissimilar to conventional teams, (Keyzerman 2003) explained that virtual teams are teams with resources that can work across time, space and out of organizational boundaries using the computer communication means. Virtual teams contain resources that are geographically distributed, differ in culture and will work together for a short period. Also, he stated that virtual team's concept can bring more benefits for the organizations by giving the chance to have employees who can work 24/7 and serve different regions which can increase the quick responses and productivity. Besides, that organization can minimize their costs by moving the business to the virtual environment instead of having costly offices like in the traditional teams. Members in virtual teams are better performers when it comes to the quick responses for the rapid required changes and they have more flexibility and creativity than employees in traditional teams since there are less organizational constraints within the virtual environments.

However, virtual teams can be harder to manage because of the limited face-to-face meetings if they exist. Trust and personal conflicts can be one of the major issues within a virtual environment. Various barriers and issues that are facing the virtual team's concept and were discussed in several studies. The next part will try to explore and discuss these barriers and challenges which can help later to suggest practical solutions.

## **Why Virtual Teams**

Despite the many benefits of information technology, it created more pressure and challenges for the organizations to provide high quality services. Virtual team model was created and encouraged as a solution for these challenges. More organizational, team and personal benefits will be explained in this section and throughout the research.

(Townsend, DeMarie & Hendrickson 1998) see that the importance and benefits will be more in the future since organizations are under a big pressure to deliver their products in a competitive business world. They stated that virtual teams are helpful in connecting people from various levels of expertise and perspectives which can enable more productivity for the team. Also, the team member can be more efficient by assigning him/her to more than one



team or task. At the same time, organizations should be careful not to overload the team member in such stressful environments. Leadership played a key role in the load distribution matter as it will be clarified in a later stage in this study.

As per (Townsend, DeMarie & Hendrickson 1998), organizations need to move from the traditional teams to the virtual ones because of the following factors:

- *The non-logical increasing prevalence of various organizational structures.*
- *Competitive business world requires Inter-organizational cooperation.*
- *Changes in employees' expectations of organizational contribution.*
- *Organizations shift from producing goods to provide services or knowledge.*
- *Globalization of trade has been increased.*

Likewise, (Arnison & Miller 2002) explained that the rapid growth in business globalization was a key reason why companies started to apply the virtual team's model. Also, there is a need for more inter-organizational cooperation in order to achieve better mutual benefits. Through the virtual model, employees have more flexibility with the work-place and time along with the ability to work in multiple projects or even companies. These benefits are associated with the needness to relocate employees to work together which save housing, air tickets and offices rental expenses. Virtual model gave the chance for companies to involve their employees in businesses at worldwide levels which means more business opportunities and extra income.

However, (Arnison & Miller 2002) see that there are many other benefits when a company is using the virtual model and there is a possibility to get these benefits in the traditional teams by enhancing the technology usage and changing work rules. These benefits include but not limited to:

- *Increase communication among the team members.*
- *Flexible working-hours and job design.*
- *Organization can give more attention to the personal contributions and results.*
- *Building global business network for both: organizations and team members.*
- *Enhance collaboration across the organizational borders.*
- *Less response-time to tasks.*

(Bergiel, Bergiel & Balsmeier 2008) support the idea of saving accommodation and travel costs in virtual teams by giving the example that IBM could estimate 50 Million US dollars as a yearly saving for the down-time, travel and building workstation costs. As per (Bergiel, Bergiel & Balsmeier 2008), the application of the virtual team model can also help many organizations to recruit talents from various locations and nationalities which may provide more knowledge and different languages to serve global business chances. As well, virtual teams help to reduce cost and time for meetings especially in the high-traffic cities. Virtual teams provide heterogeneous team members which create a bigger room for creativity and originality in the team

(Bergiel, Bergiel & Balsmeier 2008) have raised other interesting points as benefits for the virtual teams, including:

- *Virtual teams can help to achieve the equality principle for physically disadvantaged people and make it easier for them to work since they can work from home or any other place instead of coming to office.*
- *Virtual team discourage the discrimination of age or race since the focus in virtual teams is on the productivity and contribution of the team member instead of focusing on his personal attributes.*

Apart from the time and cost reduction benefits, virtual teams help more in the cross-functional projects that need cross-boundary knowledge and skills. Projects can be executed by various talents from different locations. Also, clients will have greater levels of satisfaction since the team can produce extra hours the whole day because of the different time-zones. The company can employ members with different shifts in different countries to provide support 24/7 for the clients world-wide (Ebrahim, Ahmed & Taha 2009).

On a team member level, virtual team concept allows the employees to produce and collaborate more at a distance. The talents from world-wide will feel free with the working times and have more flexibility to complete their assignments (Ebrahim, Ahmed & Taha 2009). Knowledge capture and experiences share can be facilitated among the virtual team members. Team members also work in a self-assessed environment with high performance since they know that the focus will be more on the delivered work instead of personal relations (Alqaryouti, Alqudah & Shaalan 2016).

## Key Challenges

Apart from the benefits of virtual teams, it is pretty useful to study the challenges and constraints that face virtual teams which can be more into risks that need to be mitigated and transformed into useful opportunities. Different constraints have been discussed and assessed by researchers and need to be measured in this study to help in building the effective model for the virtual teams. This section will be responsible to explore various constraints that were argued in other related studies.

Many researchers have identified trust as a key constraint to apply the virtual team model. It is a challenge to build trust between people especially in the work environments. Trust factor on any team relies on creating opportunities and paths for the team member to have the deep dialogue that is necessary for a shared future creation. In her study paper, (Holton 2001) claimed that trust in any team can be developed through regular and meaningful interactions between the team members, where people can learn to feel comfortable and open to share their personal insights, views and concerns. Such comfortable feeling is not easy to be built and developed in virtual teams because of the lack of direct interaction or face-to-face meeting.

(Holton 2001) insisted that it is essential in any team to have ideas, expectations or assumptions that can be challenged with no risk or fear of consequences. Diversity of opinions is healthy for the team and should be valued since it helps to have more knowledge. The various opinions cannot be shared without the existence of mutual trust, respect and self-confidence. Also, (Holton 2001) explained the importance of that individuals within a team need to have some caring talks, tell stories and explain some personal issues. These forms of self-disclosure are crucial to break the ice, increase the level of support and encouragement within the team and minimize the personal concerns and challenges.

Through the experiment, (Holton 2001) could test the positive improvement impact of having personal talk and feeling discussion between the members of a virtual team. The experiment examined a team that included six self-employed professionals who were geographically-dispersed and tried to work in a fully virtual environment for seven weeks. Through the experiment, and despite the mutual respect for the diversity of expertise of each team member, Holton observed that the team were in a need to start the personal talk and discuss openly their work preferences in order to build the required trust. Likewise, it is required for

the team to spend time together to share the various knowledge areas, individual concerns and agree on the team goals and priorities. The participants suggested to have communication protocol to ensure the reliability and governance in team work. Also, the team recommended to recognize the group roles and goals at the beginning of the task, and to have a coffee break or happy hour weekly or bi-monthly to help in building and maintaining the proper relationship.

As well, (Keyzerman 2003) supported the idea that trust is a key factor for the success of virtual teams. He claimed that trust helps to increase the team's effectiveness, performance and the flexibility. (Keyzerman 2003) claimed that building and improving the trust within a virtual team is difficult and entirely impossible, but since the trust is a key factor to build a successful virtual team, to solve this issue Keyzerman suggested to let the members of virtual team to meet in person at the beginning in order to build a certain level of trust and personal relation. He sees that trust encourages people to enjoy their work and work harder to solve the challenges and consider them as opportunities. Trust based-organizations can get more productivity and profits by spreading the trust among the virtual teams.

Apart from trust, (Keyzerman 2003) stated that effective communication is another issue that is faced by virtual teams more than in traditional teams. He noted that effective communication based on three main concerns: social, organizational and technological concerns. As per (Keyzerman 2003), Social concerns create obstacles that harm virtual team's effectiveness and prevent team from functioning. Social relationships are important in order to have effective team that can collaborate and perform at the maximum. In virtual teams, social interactions are limited since the contact happens through mails and video-conferencing. Members in virtual teams cannot meet in front of the coffee machine or informal lunch, there is no chance in virtual teams to pass by for a reminder or a discussion. Also, virtual team members have no luxury to be familiar with each other's since normally they are from different organizations, cultures, countries and speak different languages.

Also, (Keyzerman 2003) emphasized that management and leaderships should help to form the objectives into actions and play a key role to eliminate the stress in the team and build the relationships among the team members. It is difficult to lead and manage people with various locations, cultures and specialties and there is a huge responsibility on the management to make the virtual teams effective and successful. (Keyzerman 2003) suggested to have a self-managed virtual team where the leader should coordinate instead of manage and help people

to do their tasks by being more democratic and give them more space to think and finish the work.

The last concern as per (Keyzerman 2003) is technology, which is linked to communication. Virtual teams face many challenges that are related to the lack of effective communication. Some technology tools could provide a sort of communication effectiveness such as *Groupware* that provides the ability to search, customize and manage the various types of documents along with multi-levels of user accessibility. Despite these benefits, many technology tools are expensive solutions and required extensive training, time to learn and customization. Management is responsible to choose the right tool to be used by the team as per the team's size, goals, locations and the ability of the technology solution to serve various locations. *Microsoft solutions* provide usable solutions for communication and document management that are web browser-based to serve team members in multiple locations.

On the other hand, (Sanders, Pilkington & Alexander 2016) have discussed five main constraints for the virtual teams: communication, trust, time, leadership and technology. They considered that communication and trust are correlated and based of sharing the mutual organizational and team goals to achieve collaboration. Collaboration is totally dependent on communication, mutual trust and responsibility among the team. Communication is the base for trust while trust is the biggest risk for virtual teams since it is related to all other factors; they insisted that a team member should learn more about his colleagues. They discussed the importance for team members to know each other's and to apply integrity and collaboration.

(Sanders, Pilkington & Alexander 2016) discussed two types of trust in virtual teams: "knowledge-based" trust and "swift trust" where "knowledge-based" trust requires more information about the team members and their capabilities to be available quickly, and is crucial to complete tasks, achieve virtual team goals and confront the various risks.

Knowledge-based trust is important to solve the trust challenges in building the ad-hoc virtual teams which is a high risk since there is no opportunity to build regular trust or assess the ambiguity or to handle the uncertainty. Also; (Sanders, Pilkington & Alexander 2016) supported "swift trust" concept that relies on the assumption that each member in the virtual team is trustworthy in his position or task. As example; senior student is mature and more capable than undergraduate students.

(Sanders, Pilkington & Alexander 2016) see virtual teams are self-managed with different type of authority structure in a compare to the traditional teams. They noted that leader in

virtual teams is self-appointed and must be the most trusting one who volunteered to do this role by developing the trust in the team and communicate clearly to everyone to set and achieve goals. Leadership in virtual teams is a risk since it should be handled by a high-skilled expert who can manage people with various cultures, languages, work times and skills.

As per (Sanders, Pilkington & Alexander 2016), time is a factor that impact all team members and stakeholders throughout the collaboration activities. A time-based risk was identified and is related to the trust which has been defined as the length of time that team members know each other's, trust and share their identity.

Team members often judge the capability and contribution of a particular team member on his perceived ability to be available to help and use the technology to share knowledge and collaborate which will eventually impact the relationships and the development of trust within the team (Alqaryouti, Alqudah & Shaalan 2016). Two time-based risks that are related to the technology: the time that a team member has used a particular technology and the needed time to learn how to use it. Another risk which is the planned time to complete a task which requires to assign resources who are able to use the right collaboration technology in a limited time manner to deliver the task quickly with high quality (Sanders, Pilkington & Alexander 2016).

On the other hand; (Kayworth, & Leidner 2002) discussed the challenges that are face by the virtual team from the leadership perspective. The challenges contain: culture, communication, technology and logistics and related in a way or another to the leadership. leadership is a risky role in virtual teams since it needs an expert, flexible and social-person who has the ability to build, develop and maintain the social climate within the team and ensure the suitable levels of team's cohesiveness. It is a challenge for the leader to choose the right effective team members who can help him to complete the tasks and spread the trust and positive signs to other junior or non-confident team members.

(Kayworth & Leidner 2002) found that virtual team members face real difficulties to identify the received messages and how to fit these messages with the overall context of communication. Also; team members in such asynchronous environments are tend to send careful messages and longer emails in order to explain ideas or opinions which means more processed information and more load on other team members. Choosing the right technology to be used by the team members is a leadership-based challenge, and it is important to bridge

the gap in the virtual team's communication. The effective leadership in virtual teams concerns about the technology learning curve in the team minimize the impact of technophobia. Technophobia is the dislike or fear to learn or use the new or complex technologies and devices.



**FIGURE 3: FACTORS AFFECTING VIRTUAL TEAMS' PERFORMANCE AS PRESENTED BY GHENI & OTHERS, 2016**

(Kayworth & Leidner 2002) tried to link the leadership challenges into other constraints that face virtual teams and based on cultures. In virtual teams, leaders should expect unrealistic cultural expectations that need to be managed by helping each team member to know more about others backgrounds, countries and hobbies. Leaders should be smart and open-minded to eliminate the cultural bias and work more to enhance the level of communication skills in the virtual team which is effective solution for the cultural gaps case.

Culture is a complex and multidimensional concept that needs to be studied on several levels: global, national, regional, organizational, and business level. Each individual is influenced by a varied range of cultural aspects that include but not limited to: national, organizational, and ethnic. Also, Cultural diversity means sexual, racial, professional and organizational differences (Shachaf 2008).

Working over long distances means that there is a high possibility that team members will communicate with others from different cultures. Basically, the culture term came from anthropology where no specific definition but it is important to assess the culture factor and its impact in to the success of any virtual team. Culture has been defined as the collective programming of the mind that differentiates the members in one group or class of people

from another (Hofstede, G., Hofstede, G. J., & Minkov 1991). While, (Anawati & Craig 2006) see culture as a complex whole that includes beliefs, morals, knowledge and any other habits that are maintained and developed by any member of a specific society.

Despite the fact that having team members from different countries, locations and cultures is beneficial for the team and can help to provide a pool of resources with different skills, different cultures can be a source of conflicts in a virtual team. Team members in a virtual team are from different cultures which means different cultural knowledge and backgrounds. Also, team members mainly communicate through computers and technological means and in most cases without knowing each other, which means that each team member will speak and understand from his own cultural perspective which can build more conflicts in the team. People from different cultures behave in different ways so there should be a way to understand the culture of each team member and how to adapt the personal behavior of each member in order to minimize the cultural and eliminate the problems (Anawati & Craig, 2006).

It is also recommended to give a look for the time-zone differences since which is a risk that need to be measured in virtual teams. It is vital to manage the time zone difference in a way that can help to complete the required tasks and transform it into an advantage. (Sivunen, Nurmi & Koroma 2016) claimed that time-zone difference is a challenging factor in the virtual teams, and it can harm the work of the team and the collaboration level especially when the time zone difference is large (e.g: USA and India) while the impact of the time zone is minimized and can be healthy when it is small like between Sweden and Finland. But, Time-zone differences can provide more benefits in some tasks like the customer care activities because it can help with the 24/7 services.

In their article, (Gheni, Jus, Jabar & Ali 2016) argued that there are various factors that are affect the performance of virtual teams. These factors can be seen in figure 3 and illustrated as the following:

- ***Cultural Differences***: it is logical and mandatory to give a consideration for the cultural differences between the team members. Cultural differences may provide huge tension and conflicts within the virtual teams and can affect the performance. For instance; Manager in Japan and Korea are not big fan of using emails to communicate.



- **Language Problems:** people from different countries speak different languages and even different accents in the same language which means more communication difficulties within the virtual teams. Different language is not simple challenge, it may end with misunderstanding for the tasks and goals. It is important for virtual team members to have the ability to read, speak and understand heavy accents in order to contribute in any synchronous communication and not affecting the performance negatively.

**Time-Zone Differences:** In many cases, virtual teams rely more on asynchronous communication means (emails and SMS) than the synchronous ones (calls and video-conferencing especially when the time-zone index is large and there are less overlapping work hours. In many case, team members need help from colleagues to complete different activities and it is possible that those colleagues are not available because of the different time-zones. Subsequently, communication, collaboration and response time will be impacted negatively which affect the performance results and the quality of the deliverables.

- **Team Size:** There are various types of teams as per their sizes: small-size team (10 or fewer people), medium-size team (11 to 25 people), large-size team (above 26 people). Many projects or tasks fail because of the team size and their level of communication. It is very difficult to manage the flow of information, communication, meeting and feedbacks in large virtual teams.
- **Technical Problems:** Despite the availability of technology in many parts in the world; some people are still living in areas and regions that may have access for that specific technology or there is no digital network infrastructure to run or operate particular technologies. Internet service may not be available at all or available with bad quality that cannot help in video-conferencing services or download requirements. Such poor technical infrastructure can impact the team collaboration, communication and effectiveness.
- **Lack of Trust:** Normally, people in virtual teams do not know each other's so they have low levels of trust. There is always fear that other members will not be capable to their tasks in a way that can improve the performance. People in virtual teams should work on

building and developing their relationships and start to share knowledge, information and even some personal-level stories to gain more trust and team collaboration.

- ***Lack of Sufficient Training***: Some technologies need intensive training that may not be available for all team members or other partner organizations. It is not easy to train people online and ensure that they can usefully and correctly use the communication tools or any other required applications.
- ***ICT Problems***: Virtual teams face many issues because of the wrong choice of technology communication tools or the wrong time to use that technology tool which may affect the whole performance of the team.

## Chapter 3 Methodology

This chapter will describe in details the research methodology that was used to conduct this study and clarify the approach and techniques that were used to collect data, factors and study variables.

### Research Approach and Used Techniques

The study relied on various techniques to collect data, ideas and hypotheses before heading into the analysis section. The used techniques contain the following:

- **Literature Review:** Since coming-up with recommendations to build an effective model for virtual teams is the key goal for this study, the study started with exploring related work and studies about virtual teams, their benefits, faced challenges and factors that affect the effectiveness level of virtual teams to do their tasks and achieve the required objectives.
- **Pre-Survey:** During the literature review, it was found that there are many factors and challenges need to be considered and observed. These factors and challenges were classified into five key categories: Trust, technology, culture, language and time-zone. A pre-survey with Likert-based scale was directed to collect data and different views. The objective of the survey is to verify that these factors are valid and prioritize them as per their impact on the effectiveness and performance of virtual teams. The collected data and views about the factors will be formatted and analyzed later on as explained in the next chapter.
- **Observations:** The objective behind the observations was collecting a real-time views and witness-eye that can see how people act and perform in virtual teams.
- **Interviews:** The objective of interviews was to collect the qualitative data from personal opinions about the virtualization model, benefits and faced challenges.

### Data Collection

The survey was designed and has been distributed to collect data and generate statistics from the views of people, who are currently working as virtual team members or former members

of virtual teams. The sample consisted of people who are located in Jordan, UAE, KSA and India and work for different multi-national organizations that have operational offices all over the world.

Regarding the observations, they were about two different teams with two observation sessions for each team. The first company is a Japanese company “X” which has a virtual IT team that works in a project to implement a reporting system in a government entity in Dubai. The virtual team members work in different time-zones from different offices that located in Dubai and Bangalore in India.

The other team was also IT virtual team that works for a Jordanian-Emirati company “Y” to build a Queue Management Solution in a government entity in Abu Dhabi. The team is working from Amman, Riyadh, Dubai and Abu Dhabi.

Four different interviews took a place with senior employees who work in different virtual teams. One of these employees works in a virtual team for Microsoft, one employee works for Company “X” and the other two employees for Company “Y”.

# Chapter 4 Analysis and Hypothesis Testing

## *Interviews Analysis*

As mentioned earlier, four interviews took a place in order to collect qualitative data from different point of views. The interviews were used as a source to identify conflicts, causes, and resolutions, four open questions were asked that are meant to be answered as an essay instead of “Yes” or “No” answers. One of these interviews was with a senior consultant who works for IBM Corporation in Dubai, the other participant is working in Microsoft Corporation in Jordan as a team leader while the other two participants are working as a project manager and junior consultant in a Jordanian-Emirati company “Y”.

All of those participants are working mainly within virtual teams and dealing on a daily basis with members that are working from different locations with different time-zones include: UAE, Jordan, KSA and India. All the participants agree that working in a virtual team is challenging into some extent but these challenges can be transformed into opportunities and benefits if there will be practical solutions for the various conflicts or issues.

For instance; M.T from Microsoft stated that working as a member in a virtual team is challenging and useful in at the same time, he confirmed that it gave him a great experience in building his own career path and know more about what is going on in other countries. M.T said “I faced some problems at the beginning with trusting people that I never met before, it is difficult to work within a team that have people who are working across distance, time zones, cultures. M.T sees that using technology to communicate with people is a challenge that any leader will face. People use different technologies to communicate which means more load to finish tasks and need extra training.

On the other hand, M.T could not deny the benefit of different time zone to serve his clients, and the enjoyment that he feels because of having flexible working hours despite the difficulties with the asynchronous replies, especially when he needs a quick reply from one of his employees who works in a different time zone. Similarly; T.D from IBM confirmed that he enjoys to work as a part of virtual team but he mentioned that is not easy also. T.D said that “virtualization has been always a way of life for me, it’s already widespread and will be more so in the years forward, usually our workplace consisted of cell phones, emails and frequent meetings in hotel lobbies where there is no time to build trust and relationships, communicating

using technology can be hard sometimes. Using email and messages without expressing real emotions and verbal cues, the large bulk of e-mail communication resulted in information excess among team members.

M.T declared the difficulty that he faced of understanding the various accents in both: Arabic and English languages since he has team members from different countries and backgrounds. M.T as a team leader sees that there is huge effort needs to be placed by team leaders to encourage people to communicate effectively and openly to ensure the consistency and the effectiveness within the team. It was impressive to know that one of the team members is pregnant and cannot come daily to the office but still she can work in flexible hours and helps the team to accomplish its tasks. Also, M.T himself said that he can perform the role of babysitter for his baby-girl while he works from home especially that his wife is a worker and this helps him to maximize his income and save the baby-sitting expenses.

Z.N who is working as a junior consultant in company “Y” has a different experience with virtual teams since he is still junior, he said “being a virtual team member added a value to my life and career, I could know more about other cultures and learnt new skills although it was hard at the beginning since I was fresh-graduated with less experience and knowledge, especially that I need more help from experienced team members which was hard to find it all the time because of the asynchronous communication tools”.

Z.N shared his own story during his recruitment process by saying: “I live with my family in a place in Jordan that is far from the city, it takes too long to use transportation to reach the city center and it was hard to rent a house alone there with low-scale salary as per my inexperienced professional profile. Working in virtual team helped me to solve the transportation issue and now I can work from home with skilled people and various clients who are located in Dubai and Abu Dhabi without being there and paying the high accommodation fees”. On the other hand, Z.N mentioned the difficulties that he faced when he started to deal with people from other nationalities, cultures, languages and accents. Also, Z.N struggled at the beginning because of the bad internet connection in his living area since it is far with a lack of infrastructure and this issue was solved by providing his company an internet USB with 4G connection.

In contrast, O.S who works as a project manager in company “Y” focused in his answers on the effective organizational interactions in building virtual teams. He stated that building an

effective virtual team needs to have a level of personal knowledge, familiarity and trust among the team. Management should encourage team members to listen each other's with respect and understanding, he sees that the right usage of technology is a fundamental to communicate effectively since technology heavy force behind the existence of successful virtual teams and critical to its survival specially that the business is moving more into the globalization. He believes that rapid pace of globalization and the increased collaboration between organizations are reasons from several ones which led to the boom in the use of virtual teams.

As per O.S, such boom generated many issues and difficulties for the management and the team members and these difficulties are concerned about the trust within the virtual team especially when it is composed of people from different countries with various cultures, using the right technology and the right utilization of technology in order to achieve the effective communication with regards to the different time zones, cultures and locations. Virtual environment provides various benefits for both: corporations and individuals, such as flexibility in work hours, increased communications and collaboration across organizational boundaries, lower operational costs when it comes to offices, no rental costs and utility costs and of course having a wider talent pool, some people are not available to relocate so you can use them without having them in place such as housewives who can at least be involved as part time employees.

Furthermore, O.S highlighted that there are many solutions for the difficulties in virtual teams. O.S said "one of the solutions is to engage people in more face-to-face meetings especially at the beginning of projects in order to build trust and relationships, having training and guidelines courses to use the appropriate technology and tool to communicate, I recommend to engage people in some team building activities and training for technology and communication, for example: Email mechanisms and how to write them".

The above interviews were conducted with people who were carefully selected to cover all the seniority levels in different teams. It seems that all of them agreed that there is a huge impact from different factors on the success and effectiveness of virtual teams. The results of the analysis for these interviews briefed that *trust*, *technology*, *culture gap*, *language gap* and *different time-zones* are variables "factors" that have some kind of impact on the team effectiveness. Also, Leadership can be considered as a latent variable that can become a risk if there was no encouragement and support for the team.

## ***Analysis for Observation Sessions***

As declared previously, two observation sessions were conducted through this study, the first session was with a team that is a part of multiple teams that are working virtually in company “X”. Also, the other session was with a team that work in company “Y” with another two teams in a virtual environment. The aim from the observation sessions was to monitor, detect and watch people in a live virtual environment which will help to address the difficulties, come up with recommendations and solutions for these difficulties and to confirm the results of both: the literature review and the previous conducted interviews.

The analysis and results were as the following: for the after attending 11 observation sessions in a total:

### **Observed Challenges:**

- *There was a clear lack of trust against some team members because of their age, low-level of experience or gender especially females.*
- *Some team members do not trust people from specific nationalities, particular cultures or backgrounds.*
- *A team member needs to switch back and forth between different application in order to communicate with different team members which take longer time to achieve and make more pressure on him/her.*
- *Not all the team members are familiar with using the various communication technologies.*
- *Some people are not familiar with the communication skills when they deal with clients or colleagues.*
- *Some team members could not understand the heavy English or Arabic accents. Also, some team members cannot communicate properly because of the language.*
- *Some team members struggle because of the asynchronous reply from their colleagues.*
- *Some technical issues were observed with the lack of quick technical support.*
- *An observed lack of understanding by some team members without getting the necessary nonverbal cues.*
- *Some team members suffered from the un-productive state because of waiting reply from other team members who work in different time zone.*



### **Observed Benefits:**

- *Many members are interested with talking to colleagues from different backgrounds.*
- *Many members are interested with the flexibility of working time.*
- *Some members work from home. Ex: Handicapped, Housewives and freelancers.*
- *Apart from the officially assigned team leader, there is a high-skilled person in each team who everyone trusts him and listens to his guidance.*
- *Different time zones helped team members to serve clients from various regions.*
- *Video-conferencing helped team members to talk through 10 minutes- meeting at the morning or coffee break.*
- *Members are happy with the shifts and use the break-time to finish their personal stuff.*
- *Many team members share their personal stories with other members in audio/ video calls.*
- *Team members could build and maintain the relationship by creating a group in WhatsApp messaging application that helped them to communicate as group to share news, jokes and birthday wishes and holiday greetings: Holy Ramadan, Christmas and Diwali.*
- *Team members use a file sharing tool to ensure the right archiving and easy access for the different files.*
- *Team members use technologies with lower costs than phone by calling each other's and the clients through the Voice over IP (VOIP) technologies.*

Those observed challenges and benefits confirm the results of the analysis for the literature review and the interviews. Trust, Culture gap, language gap, technology and time zone are the key elements to be observed and studied as a core for the effective virtual team model.

### ***Pre-Survey Analysis***

### **Experimental Analysis**

As mentioned earlier, the pre-survey was designed after studying the related work, conducting various interviews and having an observation sessions. These activities provided the need to have a survey with five key challenge areas: trust, technology, culture, language and time-zone.

**TABLE 1: SHOWS THE TOTAL NUMBER VALID AND INVALID QUESTIONNAIRES TO BE ANALYZED**

Total Distributed	Total Answered	Status	No. of Questionnaires	Status/Distributed	Status/Answered
336	291	Valid	280	83.4 %	96%
		Not Valid	11	3.3 %	4%
		Totals	291	86.7%	100%

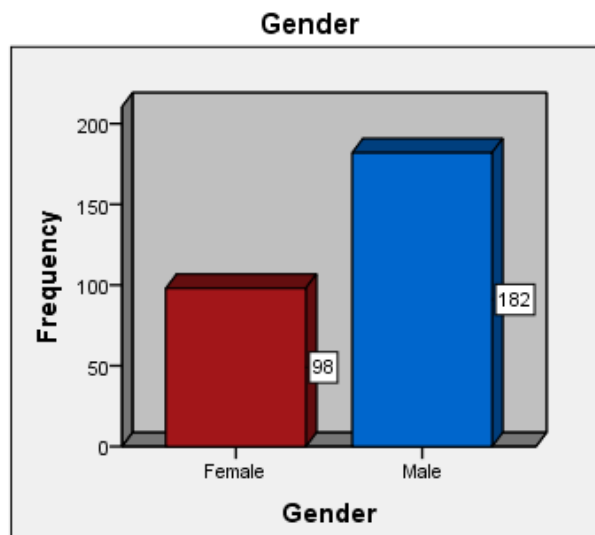
The unit of analysis for the pre-survey was composed of people who are currently working as virtual team members or former members of virtual teams. The sample consisted of people who are located in Jordan, UAE, KSA and India and work for different multi-national organizations that have operational offices all over the world.

After distributing (336) questionnaires, a total of 291 were answered and sent back but with 11 questionnaires that are invalid to be analyzed because of some missing answers. Therefore, 280 responses were valid to be analyzed during this study as shown in Table1.

Regarding the characteristics of the respondents, Table2 and Table3 show the gender and working Countries respectively. Also, the same can be shown in Graphs 1 and 2.

**TABLE 2: SHOWS THE GENDER FOR THE RESPONDENTS**

Variable	Categorization	Frequency	Percentage	Mean	Standard Deviation
Gender	Female	98	27.96 %	1.65	.478
	Male	182	72.04 %		
Totals		280	100%		



**FIGURE 4: SHOWS THE GENDER FOR THE RESPONDENTS**

**TABLE 3: SHOWS THE WORKING COUNTRY FOR THE RESPONDENTS**

<b>Variable</b>	<b>Categorization</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Mean</b>	<b>Standard Deviation</b>
<b>Country</b>	UAE	98	35 %	<b>2.23</b>	<b>1.15</b>
	Jordan	84	30 %		
	KSA	35	12.5 %		
	India	63	22.5 %		
<b>Totals</b>		<b>280</b>	<b>100%</b>		

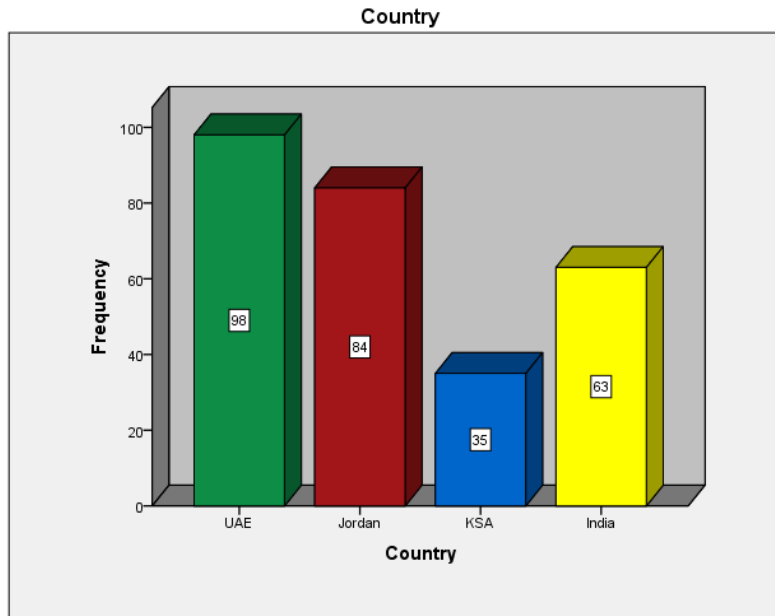
The pre-survey was divided into five key sections, each section contains different questions and represents the key challenge areas that impact the effectiveness and performance of the virtual teams. The sections were designed as the following:

**TABLE 4: SHOWS THE KEY CHALLENGE AREAS WITH THE NUMBER AND ARRANGEMENT OF QUESTIONS**

<b>Challenge Area</b>	<b>No. of Questions</b>	<b>Questions Arrangement</b>
<b>Trust</b>	7	1-7
<b>Technology</b>	6	8-13
<b>Culture</b>	6	14-19
<b>Language</b>	5	20-24
<b>Time Zone</b>	4	25-28

### ***Reliability***

To decide that these actual challenge areas (variables) can be utilized in this study, a pilot study was done using a suitable sample. (Sekaran, Bougie 2016) specified that such pilot study can help to solve any weaknesses in the tool prior to actual data collection. A discussion took a place with the participants after the pilot study in order to discuss any conflicts they felt through filling the questionnaire and to identify difficulties to understand the used term. The reliability test for each variable was measured using the pilot study data as shown in Table 5.



Therefore, the questionnaire was given to 30 participants from UAE who are working in multi-national organizations in Dubai and Abu Dhabi in UAE. Then, the questionnaire was revised to examine any weakness that maybe have been occurred during the process to answer the questions. After that, the set of data was analyzed, evaluated and studied using SPSS for reliability. Table (5) below represents the coefficient of reliability -Cronbach's Alpha- for various items in the pilot study.

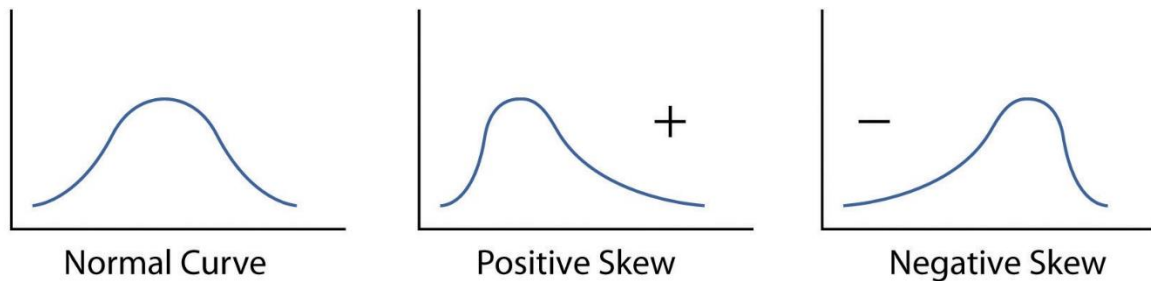
As shown in the Table below, each construct shows Cronbach's alpha readings of tolerable values that above 0.60 (Hair et al. 2006). The reliability value for all constructs range from 0.771 to 0.903. Such result indicates that all constructs have inner acceptable consistency. So, the actual distribution was accomplished with no modifications as clarified later in the section of the distribution method.

Variable name	No. of items	Cronbach's Alpha Pilot/30
Trust	7	0.903
Technology	6	0.866
Culture	6	0.883
Language	5	0.771
Time Zone	4	0.819

**TABLE 5: RELIABILITY COEFFICIENT FOR MULTIPLE ITEMS IN PILOT STUDY (N = 30)**

### *Normality*

A normality test was conducted to determine if the collected data set is well modeled and follow a normal distribution within each studied variable. As per (Hair, et al. 2006), normality is the shape of data distribution for the individual metric valuable along with its correspondence to the normal distribution and non-normal data that can be detected in several ways. For example, (Hair, et al. 2006), verified the detection of the univariate normality (variables normality) using Z-skewness and Z-kurtosis where Skewness represents the irregularity of distribution by observing the variable whose mean doesn't place in the center of the distribution. Kurtosis depicts the peakedness of distribution. A normal distribution can take a place when the value of its skewness and its kurtosis are both equal to zero (Tabachnick & Fidell, 2001).



**FIGURE 5: CLARIFIES THE NORMALITY THEORY AS PER SKEWNESS**

Skewness is explained by comparing the distribution to the normal distribution. If it has a few large values and tails off to the right, then distribution is considered as positively skewed. Conversely, if the distribution has relatively few small values and tails off to the left then the distribution is negatively skewed. According to (Hair, et al. 2006), if the Z-skewness of distribution falls outside of the range of -1 to +1, then it is substantially skewness. In contrast, Z-Kurtosis is the measure of the peakedness or flatness of a distribution and similar to skewness it is clarified by compare it with a normal distribution while Z-Kurtosis ranged to 3 to +3. Table 6 below shows the Normality value for each studied variable in this study.

**TABLE 6: NORMALITY VALUE OF DATA**

<b>Variable name</b>	<b>Skewness</b>	<b>Kurtosis</b>
Trust	-0.613	-0.030
Technology	-0.217	-0.358
Culture	0.545	-0.491
Language	0.854	0.638
Time Zone	-0.738	0.431

### ***Structural Equation Modelling (SEM)***

Structural equation modelling (SEM) is a statistical technique that used to test and estimate the structural causal relationships by having a mixture of statistical data and qualitative causal assumptions. The definition of SEM was confirmed by the (Wright 1921), (Haavelmo 1943), (Simon 1953), and officially defined by (Pearl 2000) using a calculus of counterfactuals (Bagozzi & Yi, 2012).

SEM is largely confirmatory than exploratory but it allows both modelling which means that it is suited in theory testing and theory development. Confirmatory modelling starts with having hypotheses that get represented in a base model. The concept that is used in the model must then be activated in order to test of the relationships between the constructs in the model. The model will be tested in contradiction of the obtained measurements to determine how well the model will fit the data. The base assumptions that are embedded in the model often have falsifiable implications which can be examined in contrast to the data (Kline, 2015).

The original theory of SEM can be used inductively through specify a consistent model and using data to estimate the values of free parameters. Often the original hypotheses require changes in light of model evidence. When SEM is used completely for examination, this is typically in the context of exploratory factor analysis as in psychometric design. Amongst the strengths of SEM is the capability to construct latent (hidden) variables: variables which will not be measured directly but are estimated in the model from other several measured variables that are predicted to tap-into the latent variables. This allows to explicitly detect the unreliability of measurement in the model itself, so the theory will allow the structural relations between latent variables to be estimated more accurately. Factor and path analyses along with regression all represent special cases of SEM (Jöreskog & Yang, 1996).

This study will consider two special cases of SEM: confirmatory factor analysis and regression analysis along with the examination for the overall model fit. SEM helped to test the good fit for the endogenous variables and exogenous variables where endogenous variables are equivalent to dependent variables and are equal to the independent variable.

### ***Confirmatory Factor Analysis***

Confirmatory factor analysis (CFA) is a statistical method that used to examine a pre-specified relationship between observed measures. CFA allows to examine whether the measures assumed for the same construct are consistent, and measures the construct itself as well. As per (Kline 2011), CFA usually used to validate the hypothesized theoretical constructs. Also, CFA measures to which extent that the observed variables can represent the hypothetical construct they supposed to measure.

According to (Hair et al., 2006), results of CFA can be combined with construct validity tests for better understanding of the quality of the measures. CFA purposes to identify the number of items that can clarify the theorized constructs. Each item can be defined by the same construct that represents it, and can be expressed through the supposed path loading.

The construct structures were defined and each of these structures was subject to alteration and confirmation using the CFA, so therefore, it is used to gather data in the study. After that, the measurement model was developed to address the relationships between the observed variables and latent variables or hypothetical constructs. The gap levels in reliability and validity of the observed along with latent (hidden) variables were also recognized. All of that were completed before testing model fit for the structural equation where relations between the latent (hidden) variables were stated (Webster and Fisher, 2001).

## ***Over all Model Fit***

Goodness of fit is "the degree to which the actual or observed input matrix (Covariance or correlation) is forecasted by the estimated model" (Hair et al., 2006). According to (Bollen 1989), the  $\chi^2$  likelihood ratio test, the Standardized Root Mean Residual (SRMR) and the Goodness-of-Fit Indices (GFI, CFI, and IFI) are the most frequently achieved measures. The next section will give an overview of each of the achieved measures to explain why the decisions were obtained with regards to the studied model.

The crucial "badness-of-fit" test, is one of the most recognized and apparent measure that is correlated with CFA. The proposed model will not meet the requirements of the collected data exactly if the p-value of  $\chi^2$  is significant (i.e.,  $<0.05$ ), whereas it meets the demands of the collected data if p-value is  $>0.05$  is achieved. According to (Byrne 2001), there is progressing argument on whether a model that has a significant  $\chi^2$  statistic can be considered as valid result.

Measuring data through SEM needs to deploy goodness-of-fit (GOF) measures. The CFA has various functions to be deployed. These functions include:

- *Examine the load of factors in each construct to form a variance.*
- *Examine to which level the instrument is linked to the latent variables.*
- *Estimate the errors in the measurement in the framework itself.*
- *Validate and generate the final framework.*

Consequently, CFA is mostly deployed to determine if the factors and the loading of construct items can confirm the expected requirements that are needed to measure the scale itself.

There are many key terms of SEM to measure the exogenous variables and endogenous variables such as Absolute fit index, Incremental Fit Level and Parsimonious Fit Level as shown in Table 7. *Amos solution* version 21.0 was used in this study.



**TABLE 7: RECOMMENDATION VALUES OF MEASUREMENT ALL EXOGENOUS AND ENDOGENOUS VARIABLES**

<b>Measures</b>	<b>Threshold Values</b>
<b>Absolute Fit Level</b>	
RMSEA	Less than 0.09
GFI	0.90 and Above
P- Value	P- Value $\geq 0.05$
<b>Incremental Fit Level</b>	
AGFI	0.90 and Above
CFI	0.90 and Above
TLI	0.90 and Above
NFI	0.90 and Above
<b>Parsimonious Fit Level</b>	
CMIN/df	Less than 5.0
SMC (R <sup>2</sup> )	Bigger better

Source: Hair et al. (2006)

As per to (Byrne 2001), structural equation modeling (SEM) can be split into two sections: measurement model and structural model. the measurement model measures the relationship between both: observed and unobserved variables. Similarly, structural model measures the relationship between unobserved variables themselves.

As shown in the table above, (Hair et al. 2006) pointed out that the recommended values of fit model as the following:

- *Absolute Fit Index (AFI) evaluates whether a specific model leaves appreciable unexplained variance. (Alkhaldi and AL-Faoury 2007) Specify such as Chi-square ( $\chi^2$ ) accompanied by the model's level of freedom and the related probability, goodness of fit index (GFI), and the root mean square error of approximation (RMSEA) are usually utilized here. As following: RMESA <0.09, GFI > 0.90, P-value > 0.05.*
- *Incremental Fit Index (IFI) compares the Generated specific model to any possible baseline or null models that are estimated using the same data. Some indices such like: the incremental fit index (IFI), Tucker-Lewis index (TLI) and comparative fit index (CFI), (IFI) are normally consider GFI > 0.90, CFI > 0.90, TLI >0.90, NFI >0.90.*

- *Parsimonious Fit Index (PFI) is considered as adjusted measure to examine how the model can measure both fit and parsimony, bearing in mind the degree of freedom that is used in the model specification. Other indices such like: Normed fit index (the adjusted chi –square by the degree of freedom) can use  $CMIN/df < 5$ ,  $SMC (R^2) > 0.00$ .*

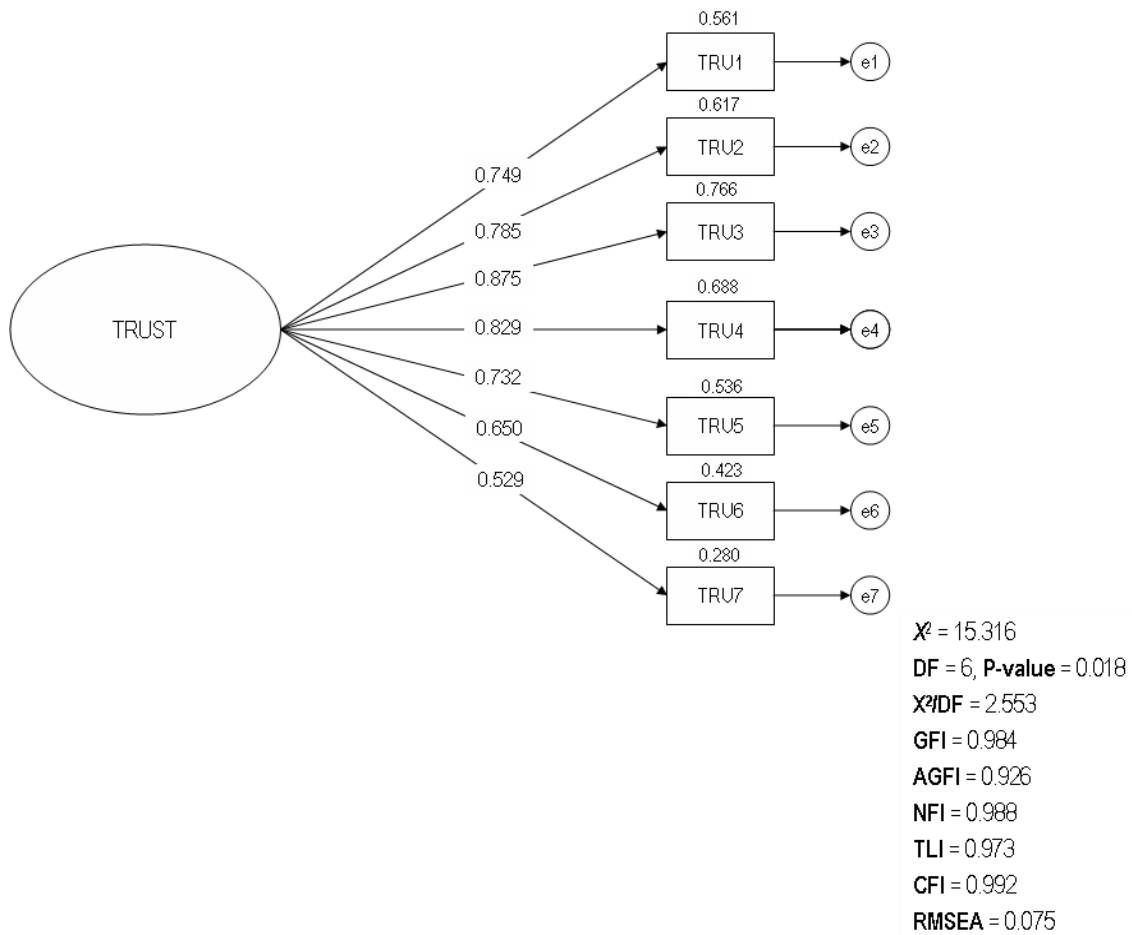
The key goal of this section is to investigate and observe the relationships between: exogenous variables and the endogenous variables. So, the individual variable which is related to the measurement model was calculated.

### ***Instrument Refinement and Validation***

Since the survey composed of 28 item scales that were developed from the literature review, observations and interviews, another attempt at alteration and validation of the factor structure has been occurred using CFA for each construct. This attempt will provide a better understanding to know which items truly can examine the factors that are identified in the research model. CFA was done on all the variables to test if all items can be loaded significantly to their hypothesized variable. Also, to examine if they give more acceptable results of the model fit. Some items were removed and dropped because the variance that has been explained, the factor structure, path loading and the standardized residual value were gradually refined and reviewed based on significant findings from the multiple model results.

### ***Confirmatory Factor Analysis for Trust***

A total of 7 items were identified to measure the Trust construct. After finishing the first analysis, the model fit showed good ranges for fit indices. The RMSEA value was 0.075, which means good fit. Also, CMIN/DF indicated a good fit model with a value of (2.553). In contrast, GFI and AGFI values were 0.984 and 0.926, respectively. The values were within tolerable limits. As well, NFI, TLI and CFI values were 0.988, 0.973 and 0.992, respectively. All values were within tolerable limits. All the factor loadings were above 0.50 and all critical ratios were upper than 1.96. Figure 6 shows the results for the confirmatory factor analysis for Trust construct.



**FIGURE 6: CONFIRMATORY FACTOR ANALYSIS MODEL OF TRUST**

As per the overall model fit, the values were acceptable for Trust construct as shown below in table 8.

**TABLE 8: OVERALL FIT INDICES OF TRUST**

Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.075	2.553	0.984	0.926	0.988	0.973	0.992
Saturated model			1.000		1.000		1.000
Independence model	0.458	59.422	0.329	0.105	0.000	0.000	0.000

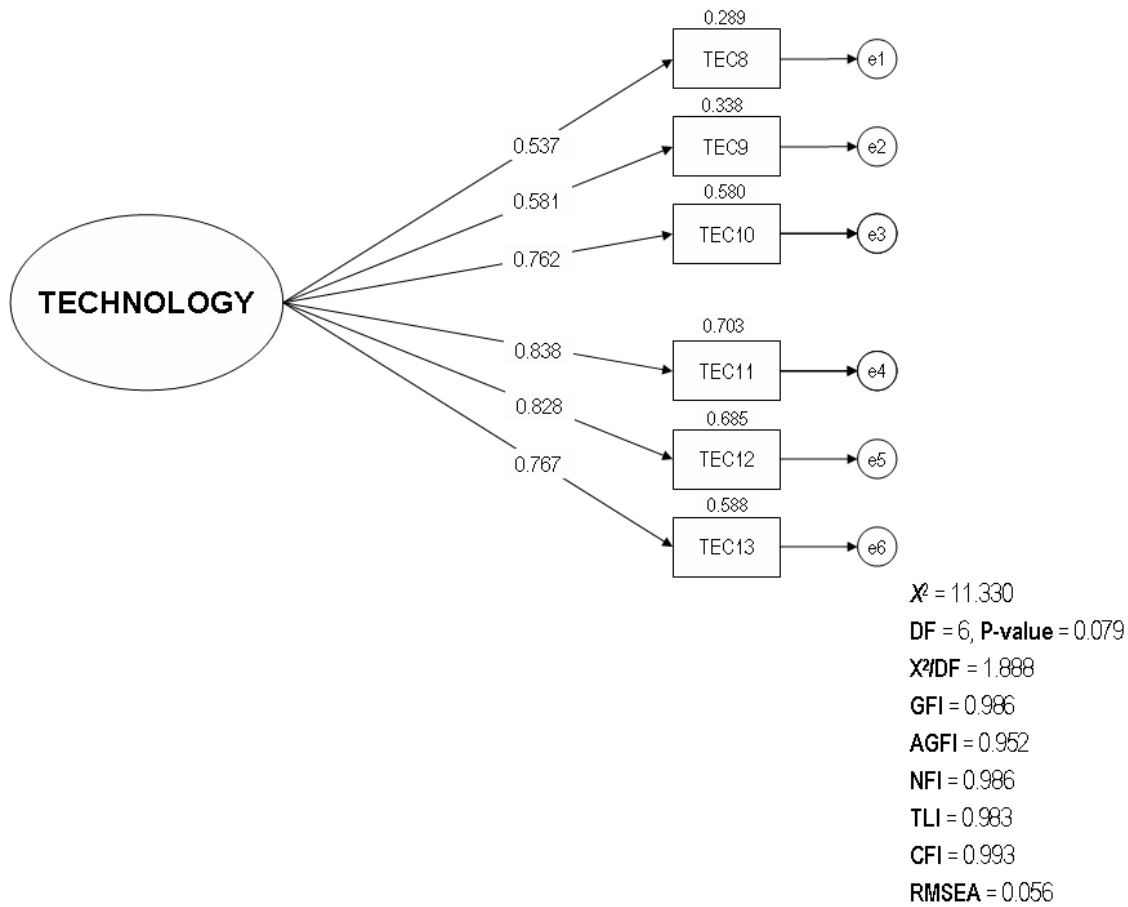
All of the conducted standardized loadings were above 0.50, and all critical ratios have results more than 1.96, as shown in table 9.

**TABLE 9: ESTIMATED VALUES OF TRUST CONSTRUCT**

Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
TRUST → TRU1	1.000				0.749	0.561
TRUST → TRU2	1.018	0.070	14.460	***	0.785	0.617
TRUST → TRU3	1.097	0.076	14.495	***	0.875	0.766
TRUST → TRU4	0.928	0.070	13.252	***	0.829	0.688
TRUST → TRU5	0.859	0.078	11.074	***	0.732	0.536
TRUST → TRU6	0.785	0.076	10.325	***	0.650	0.423
TRUST → TRU7	0.662	0.080	8.277	***	0.529	0.280

### *Confirmatory Factor Analysis for Technology*

A total of 6 items were identified to examine the Technology construct. After finishing the first analysis, the model fit showed good ranges for fit indices. The RMSEA value was 0.056, which means good fit. Also, CMIN/DF indicated a good fit model with a value of (1.888). In contrast, GFI and AGFI values were 0.986 and 0.952, respectively. The values were within tolerable limits. As well, NFI, TLI and CFI values were 0.986, 0.983 and 0.993, respectively. All values were within tolerable limits. All the factor loadings were over 0.50 and all critical ratios were higher than 1.96. Figure 7 shows the confirmatory factor analysis for Technology.



**Figure 7: Confirmatory Factor Analysis Model of Technology**

As per the overall model fit, the values were acceptable for Technology construct as shown below in table 10.

**TABLE 10: OVERALL FIT INDICES OF TECHNOLOGY**

Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.056	1.888	0.986	0.952	0.986	0.983	0.993
Saturated model			1.000		1.000		1.000
Independence model	0.433	53.314	0.416	0.182	0.000	0.000	0.000

All of the conducted standardized loadings were above 0.50, and all critical ratios have results more than 1.96, as shown in table 11.

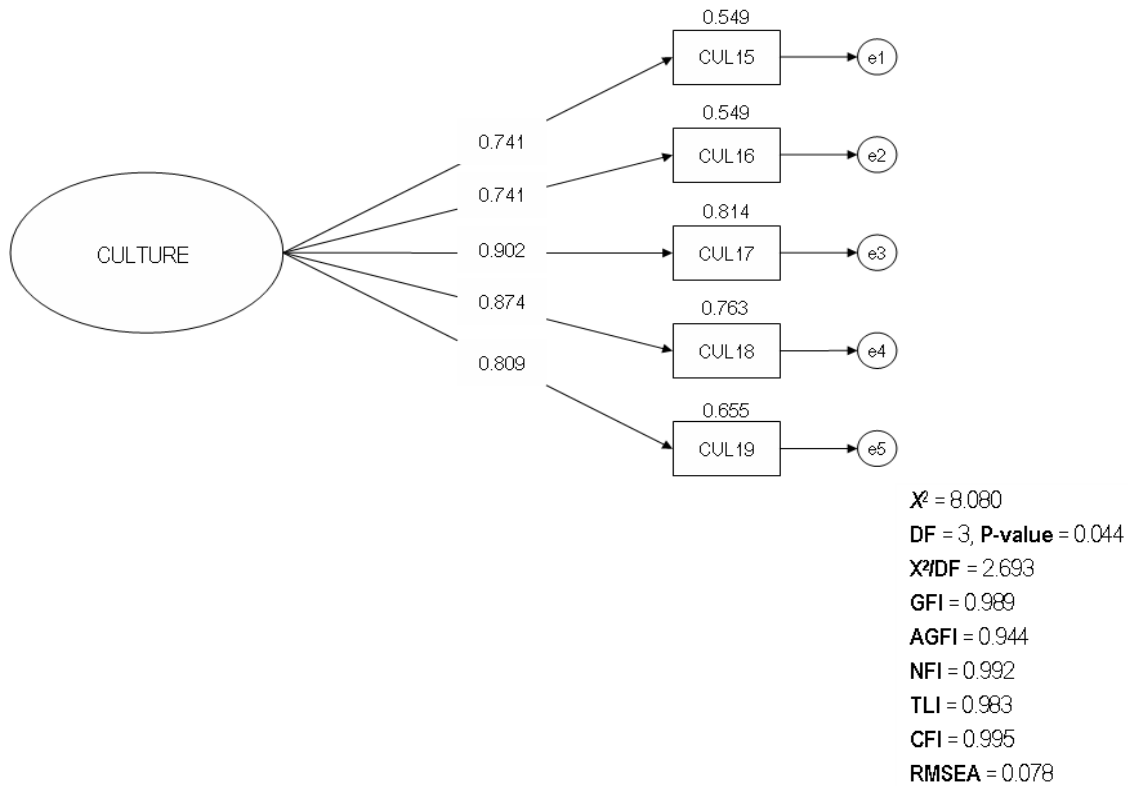
**TABLE 11: ESTIMATED VALUES OF TECHNOLOGY CONSTRUCT**

Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
TECHNOLOGY → TEC8	1.000				0.537	0.289
TECHNOLOGY → TEC9	1.160	0.122	9.527	***	0.581	0.338
TECHNOLOGY → TEC10	1.528	0.177	8.625	***	0.762	0.580
TECHNOLOGY → TEC11	2.091	0.241	8.667	***	0.838	0.703
TECHNOLOGY → TEC12	2.021	0.226	8.946	***	0.828	0.685
TECHNOLOGY → TEC13	1.940	0.226	8.595	***	0.767	0.588

### *Confirmatory Factor Analysis for Culture*

A total of 6 items were designed to examine the Culture construct. After finishing the first analysis, the model fit showed poor ranges for some fit indices. The RMSEA value was 0.108, which indicated poor fit. Also, CMIN/DF indicated a poor fit model with a value of (4.273). on the other hand, GFI and AGFI values were 0.954 and 0.894, respectively. The values were within tolerable limits.as well, NFI, TLI and CFI values were 0.962, 0.951 and 0.971. All item loadings were over 0.50, with the exception of one item (14) which had factor loadings less than 0.50 (0.332).

After removing the item number (14) and conducting the second round of analysis, the model fit resulted a good fit model. RMSEA and CMIN/DF values were 0.078 and 2.693, respectively. The two values were accepted. GFI and AGFI values were 0.989 and 0.944, respectively. The two values were acceptable. NFI, TLI and CFI values were 0.992, 0.983 and 0.995, respectively. The values were within the tolerable limits. All the factor loadings were above 0.50 and all critical ratios were greater than 1.96. Figure 8 shows the confirmatory factor analysis for Culture construct.



**FIGURE 8: CONFIRMATORY FACTOR ANALYSIS MODEL OF CULTURE**

As per the overall model fit, the values were acceptable for Culture construct as shown below in table 12.

**TABLE 12: OVERALL FIT INDICES OF CULTURE**

Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.078	2.693	0.989	0.944	0.992	0.983	0.995
Saturated model			1.000		1.000		1.000
Independence model	0.590	98.053	0.352	0.028	0.000	0.000	0.000

All of the conducted standardized loadings were above 0.50, and all critical ratios have results more than 1.96, as shown in table 13.

**TABLE 13: ESTIMATED VALUES OF CULTURE CONSTRUCT**

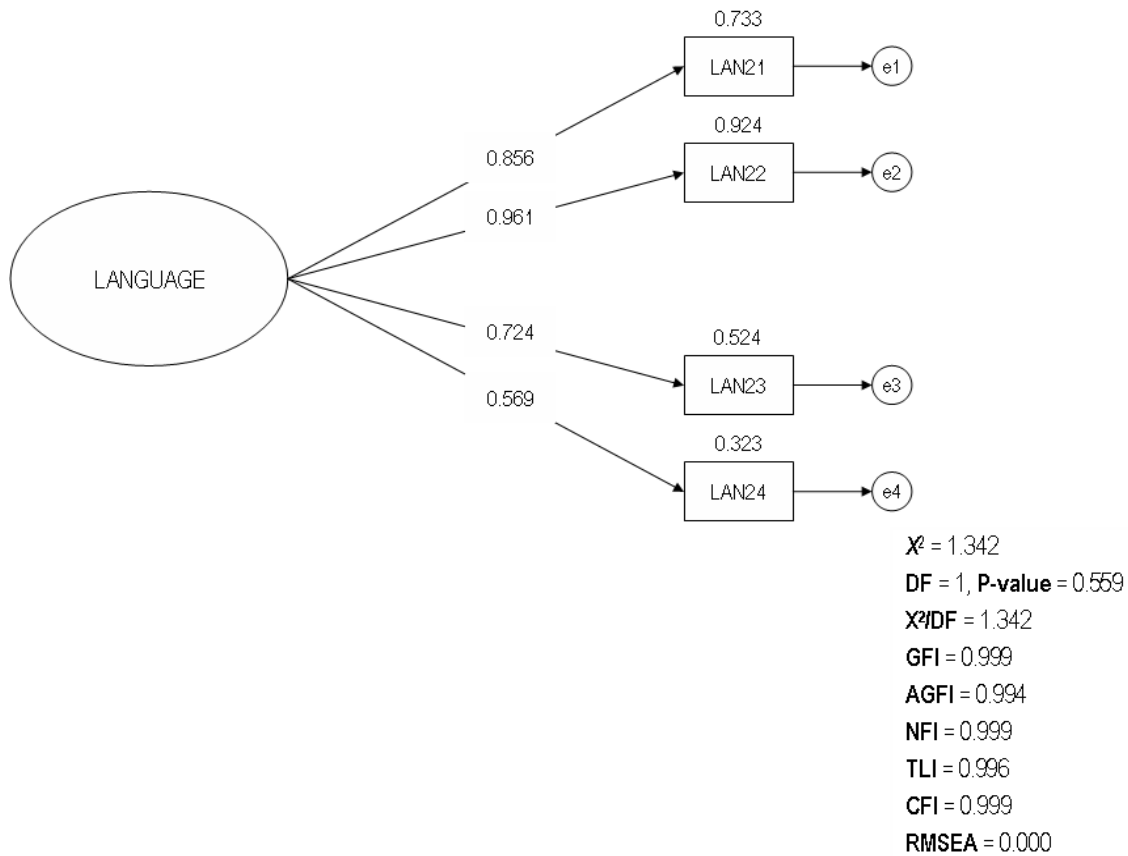
Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
CULTURE → CUL15	1.000				0.741	0.549
CULTURE → CUL16	1.016	0.086	11.793	***	0.741	0.549
CULTURE → CUL17	1.259	0.087	14.528	***	0.902	0.814
CULTURE → CUL18	1.207	0.084	14.288	***	0.874	0.763
CULTURE → CUL19	1.155	0.088	13.063	***	0.809	0.655

### *Confirmatory Factor Analysis for Language*

A total of 5 items were designed to examine the Language construct. After finishing the first analysis, the model fit showed poor ranges for some fit indices. The RMSEA value was 0.187, which indicated poor fit. Also, CMIN/DF indicated a poor fit model with a value of (10.776). On the other hand, GFI and AGFI values were 0.928 and 0.785, respectively. The values were in tolerable limits. Also, NFI, TLI and CFI values were 0.921, 0.854 and 0.927. All item loadings were over 0.50, with the exception of one item (20) which had factor loadings less than 0.50 (0.171).

After removing the item number (20) and conducting the second round of analysis, the model fit showed a good fit model. RMSEA and CMIN/DF values were 0.000 and 1.342, respectively. These two values were accepted. GFI and AGFI values were 0.999 and 0.994, respectively. The two values are tolerable. NFI, TLI and CFI values were 0.999, 0.996 and 0.999, respectively. The values were within the tolerable limits. All the factor loadings were above 0.50 and all critical ratios were greater than 1.96. Figure 9 below shows the confirmatory factor analysis for Language construct.





**FIGURE 9: CONFIRMATORY FACTOR ANALYSIS MODEL OF LANGUAGE**

As per the overall model fit, the values were acceptable for Language construct as shown below in table 14.

**TABLE 14: OVERALL FIT INDICES OF LANGUAGE**

Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.000	1.342	0.999	0.994	0.999	0.996	0.999
Saturated model			1.000		1.000		1.000
Independence model	0.625	109.968	0.446	0.077	0.000	0.000	0.000

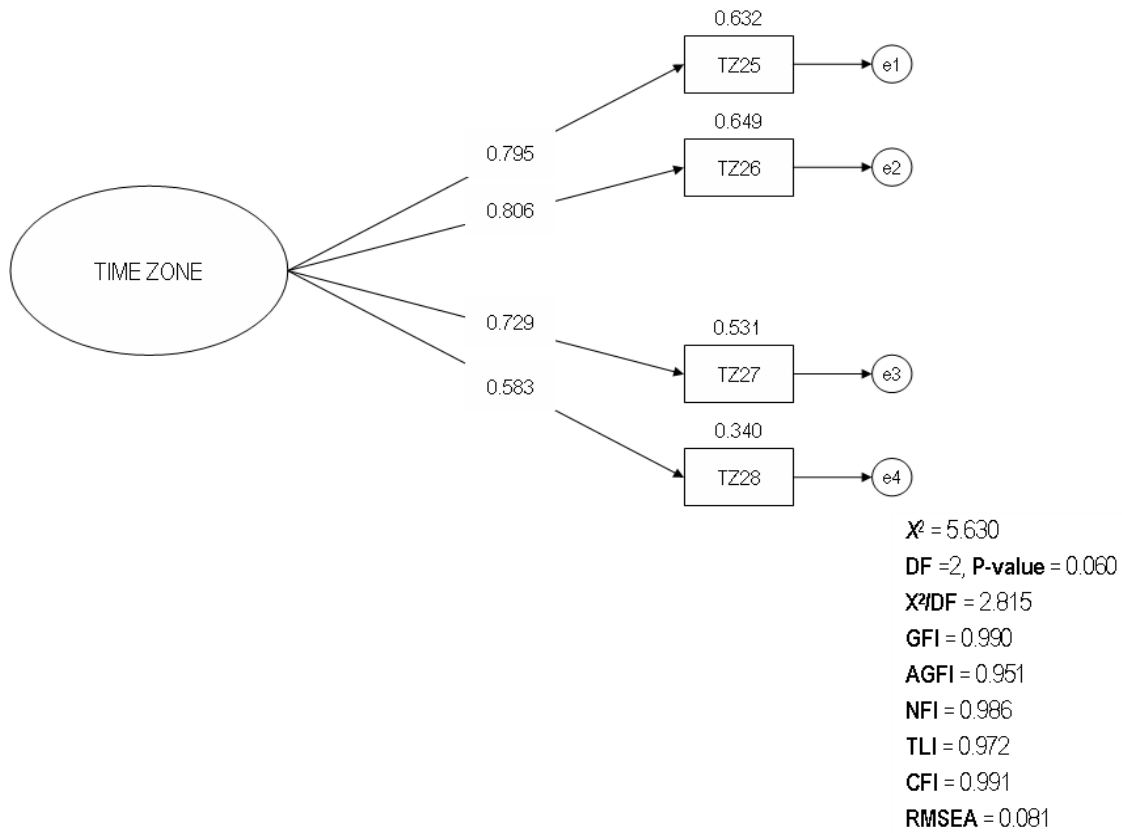
All of the conducted standardized loadings were above 0.50, and all critical ratios have results more than 1.96, as shown in table 15.

**TABLE 15: ESTIMATED VALUES OF LANGUAGE CONSTRUCT**

Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
LANGUAGE → LAN21	1.000				0.856	0.733
LANGUAGE → LAN22	1.109	0.060	18.452	***	0.961	0.924
LANGUAGE → LAN23	0.775	0.054	14.262	***	0.724	0.524
LANGUAGE → LAN24	0.621	0.060	10.263	***	0.569	0.323

### *Confirmatory Factor Analysis for Time Zone*

A total of 4 items have been identified to examine the Time-Zone construct. After finishing the first round of analysis, the model fit showed good ranges for fit indices. The RMSEA value was 0.081, which indicated good fit. Also, CMIN/DF indicated a good fit model with a value of (2.815). In contrast, GFI and AGFI values were 0.990 and 0.951, respectively. The values were within tolerable boundaries. As well, NFI, TLI and CFI values were 0.986, 0.972 and 0.991, respectively. All values were within tolerable limits. All the factor loadings were above 0.50 and all critical ratios were greater than 1.96. Figure 10 below shows the confirmatory factor analysis for Time Zone construct.



**FIGURE 10: CONFIRMATORY FACTOR ANALYSIS MODEL OF TIME ZONE**

As per the overall model fit, the values were acceptable for Time Zone construct as shown below in table 16.

**TABLE 16: OVERALL FIT INDICES OF TIME ZONE**

Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.081	2.815	0.990	0.951	0.986	0.972	0.991
Saturated model			1.000		1.000		1.000
Independence model	0.481	65.648	0.538	0.231	0.000	0.000	0.000

All of the conducted standardized loadings were above 0.50, and all critical ratios have results more than 1.96, as shown in table 17.

**TABLE 17: ESTIMATED VALUES OF TIME ZONE CONSTRUCT**

Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
TIME ZONE → TZ25	1.000				0.795	0.632
TIME ZONE → TZ26	1.036	0.081	12.749	***	0.806	0.649
TIME ZONE → TZ27	0.846	0.073	11.538	***	0.729	0.531
TIME ZONE → TZ28	0.667	0.074	9.009	***	0.583	0.340

***Scale Reliability Testing: Second round***

The Cronbach alpha was calculated to examine the internal consistency among the items in the measurement model as shown in Table 18.

**TABLE18 : RELIABILITY TEST FOR ALL MEASUREMENT ITEMS**

Variable name	No. of items	Cronbach's Alpha
Trust	7	0.903
Technology	6	0.866
Culture	5	0.912
Language	4	0.874
Time Zone	4	0.819
Total	28	

Reliability analysis presented that all items were greater than the tolerable level of 0.60, with others reaching more than 0.80 which is good and more than 0.90 as excellent (George and Mallery, 2003). Which is considered reliable results for the purpose of this study. All these results provided acceptable to good level of internal consistency.

**Measurement Model for Effective Platform for Virtual Teams (All Constructs)**

After completing the confirmatory factor analysis for each individual variable that impact building the Effective Platform for Virtual Teams, there will be an estimation for the confirmatory factor analysis for the whole model as one unit, called the measurement model for Effective Platform for Virtual Teams. The measurement model will be for all the latent variables.

The overall measurement model tested through combined data (N=280). According to Kline (2011), values indicating ideal fit for overall measurement model are:  $\chi^2/df$  ratio should be less than a value (5); “GFI” value upper than (0.90); “CFI” value upper than (0.90) and “RMSEA” value less than (0.09). The first order confirmatory factor analysis to overall measurement model result clarifies that the chi-square value equal to ( $\chi^2= 492.774$ ), DF = 267 and  $p < 0.000$ . The minimum discrepancy  $\chi^2/df$  ratio having a value of (1.846), which indicating good fit according to Arbuckle (2008) that emphasize the minimum discrepancy value should be less than a value (5). However, the goodness fit index “GFI” and AGFI values were 0.886 and 0.850, In addition, NFI, TLI and CFI values were 0.902, 0.924 and 0.952, respectively, all values were within acceptable limits. The next set of fit statistics focus on the “RMSEA” which holding a value (0.055) which is lower than 0.09 indicating good fit.

Respecting to factor loadings, the values for the item (TEC8) was below than acceptable level (0.50) (0.342) as (Janssens, et..al. 2008) noted that the factor loading for each latent variable must be equal to or higher than (0.50). Based on this situation, it is suggested to remove this item, before running the second order confirmatory factor analysis. Table 19 shows the overall fit indices for measurement model with all construct after the second round of confirmatory factor analysis.

**TABLE 19: OVERALL FIT INDICES OF EFFECTIVE PLATFORM FOR VIRTUAL TEAMS MEASUREMENT MODEL WITH ALL CONSTRUCTS AFTER THE SECOND ROUND OF CONFIRMATORY FACTOR ANALYSIS**

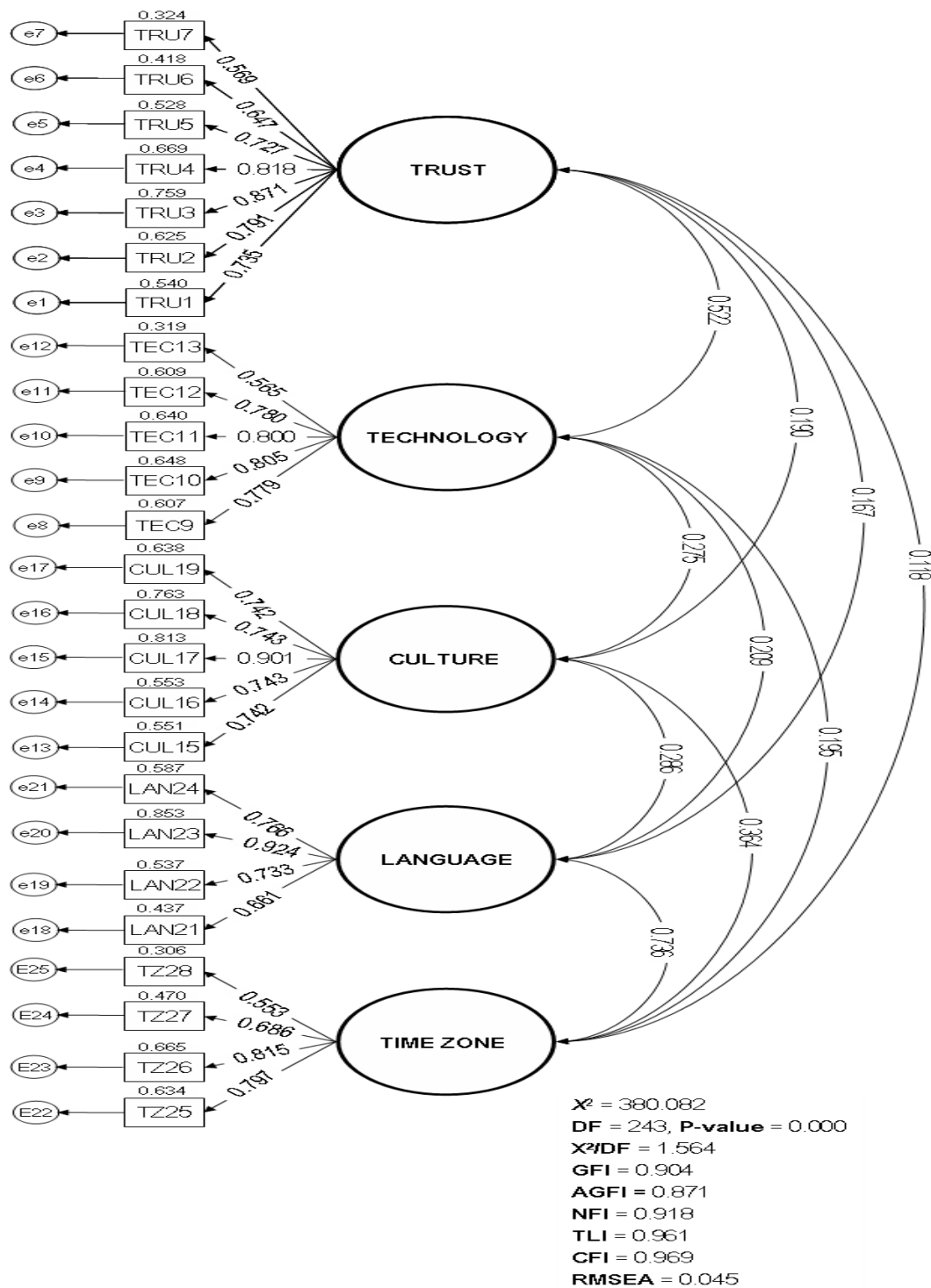
Model	RMSEA	CMIN/DF	GFI	AGFI	NFI	TLI	CFI
Default model	0.045	1.564	0.904	0.871	0.918	0.961	0.969
Saturated model			1.000		1.000		1.000
Independence model	0.228	15.536	0.292	0.233	0.000	0.000	0.000

The above table shows the measurement model for all constructs with good fit for all indices. Table 20 shows the path loading, critical ratios (C.R), and R square values in the Effective Platform for Virtual Teams as a measurement model for all Constructs.

**TABLE 20: ESTIMATED VALUES OF FOR EFFECTIVE PLATFORM FOR VIRTUAL TEAMS**

Structural Relation	Regression weight	Standard Error (SE)	Critical Ratio (C.R.)	P	Standardized regression weights	Squared multiple correlation (SMC)
TRUST → TRU1	1.000				0.735	0.540
TRUST → TRU2	1.097	0.081	13.514	***	0.791	0.625
TRUST → TRU3	1.168	0.086	13.630	***	0.871	0.759
TRUST → TRU4	0.978	0.078	12.536	***	0.818	0.669
TRUST → TRU5	0.911	0.085	10.700	***	0.727	0.528
TRUST → TRU6	0.834	0.083	9.991	***	0.647	0.418
TRUST → TRU7	0.768	0.089	8.631	***	0.569	0.324
TECHNOLOGY → TEC9	1.000				0.779	0.607
TECHNOLOGY → TEC10	0.997	0.084	11.902	***	0.805	0.648
TECHNOLOGY → TEC11	1.012	0.082	12.401	***	0.800	0.640
TECHNOLOGY → TEC12	0.795	0.071	11.151	***	0.780	0.609
TECHNOLOGY → TEC13	0.550	0.066	8.384	***	0.565	0.319
CULTURE → CUL15	1.000				0.742	0.551
CULTURE → CUL16	1.014	0.085	11.969	***	0.743	0.553
CULTURE → CUL17	1.255	0.086	14.620	***	0.901	0.813
CULTURE → CUL18	1.205	0.084	14.402	***	0.874	0.763
CULTURE → CUL19	1.130	0.087	13.005	***	0.799	0.638
LANGUAGE → LAN21	1.000				0.661	0.437
LANGUAGE → LAN22	1.096	0.061	17.880	***	0.733	0.537
LANGUAGE → LAN23	1.282	0.127	10.122	***	0.924	0.853
LANGUAGE → LAN24	1.070	0.125	8.581	***	0.766	0.587
TIME ZONE → TZ25	1.000				0.797	0.634
TIME ZONE → TZ26	1.045	0.079	13.247	***	0.815	0.665
TIME ZONE → TZ27	0.800	0.070	11.495	***	0.686	0.470
TIME ZONE → TZ28	0.639	0.072	8.814	***	0.553	0.306

All the standardized regression weight values were above (>0.5) and all the critical ratios (C.R.) were (>1.96). (Janssens et al. 2008) claimed that the factor loading each studied latent variable should be equal to or higher than (0.50), and should also be significant (C.R. = t-value > 1.96). Figure 11 shows the confirmatory factor analysis for Effective Platform for Virtual Teams (All Constructs).



**FIGURE 11: CONFIRMATORY FACTOR ANALYSIS FOR EFFECTIVE PLATFORM FOR VIRTUAL TEAMS (ALL CONSTRUCTS)**

All items were within tolerable levels and could confirm the convergent validity by compute the average variance extracted (AVE) and construct reliability by compute the composite reliabilities (CR). Table 21 shows AVE and CR.

**TABLE 21: AVERAGE VARIANCE EXTRACTED AND FOR MEASUREMENT ITEMS**

Construct	Factor Loadings	Squared Multiple Correlations (R <sup>2</sup> )	1 - Squared Multiple Correlations (R <sup>2</sup> )	Average Variance Extracted (AVE)*	Composite Reliability (CR)*
<b>TRUST</b>					
TRU1	0.735	0.540	0.460		
TRU2	0.791	0.625	0.375		
TRU3	0.871	0.759	0.241		
TRU4	0.818	0.669	0.331	0.826	0.894
TRU5	0.727	0.528	0.472		
TRU6	0.647	0.418	0.582		
TRU7	0.569	0.324	0.676		
Σ	5.158	3.863	3.137	-	-
Squared (R <sup>2</sup> )	-	14.928	-	-	-
Σ Factor Loadings <sup>2</sup>	26.605	-	-	-	-
<b>TECHNOLOGY</b>					
TEC9	0.779	0.607	0.393		
TEC10	0.805	0.648	0.352		
TEC11	0.800	0.640	0.360	0.785	0.864
TEC12	0.780	0.609	0.391		
TEC13	0.565	0.319	0.681		
Σ	3.729	2.823	2.177	-	-
Squared (R <sup>2</sup> )	-	7.969	-	-	-
Σ Factor Loadings <sup>2</sup>	13.905	-	-	-	-
<b>CULTURE</b>					
CUL15	0.742	0.551	0.449		
CUL16	0.743	0.553	0.447		
CUL17	0.901	0.813	0.187	0.907	0.867
CUL18	0.874	0.763	0.237		
CUL19	0.799	0.638	0.362		
Σ	4.059	3.318	1.682	-	-
Squared (R <sup>2</sup> )	-	11.009	-	-	-
Σ Factor Loadings <sup>2</sup>	16.475	-	-	-	-
<b>LANGUAGE</b>					
LAN21	0.661	0.437	0.563		
LAN22	0.733	0.537	0.463		
LAN23	0.924	0.853	0.147	0.875	0.786
LAN24	0.766	0.587	0.413		
Σ	3.084	2.414	1.586	-	-
Squared (R <sup>2</sup> )	-	5.827	-	-	-
Σ Factor Loadings <sup>2</sup>	9.511	-	-	-	-
<b>TIME ZONE</b>					
TZ25	0.797	0.634	0.366		
TZ26	0.815	0.665	0.335		
TZ27	0.686	0.470	0.530	0.808	0.691
TZ28	0.553	0.306	0.694		
Σ	2.851	2.075	1.925	-	-
Squared (R <sup>2</sup> )	-	4.305	-	-	-
Σ Factor Loadings <sup>2</sup>	8.128	-	-	-	-

\* Average Variance Extracted (AVE) =  $\Sigma (\text{Squared Multiple Correlations}) / \Sigma (\text{Squared Multiple Correlations})^2 + \Sigma (1 - \text{Squared Multiple Correlations})$ .

\* Composite Reliability (CR) =  $\Sigma (\text{Factor Loading})^2 / \Sigma (\text{Factor Loading})^2 + \Sigma (1 - \text{Squared Multiple Correlations})$ .



Table 21 shows that the values of AVE for constructs within the measurement model are higher than (0.50) as suggested by (Malhotra, Stanton 2004) whom clarified that the Average Variance Extracted should be higher than (0.50) to validate engaging a construct. Furthermore, a composite reliability (CR) index for constructs in the measurement model should be higher than (0.70) which provides satisfactory internal consistency as endorsed by (Hair, et..al. 2006).

## Descriptive Analysis of Studied Variables

### *Trust - Level of prioritization*

Arithmetic mean, one sample t-test, standard deviation and prioritization level were used as shown in Table 22 to clarify the level of priority for the variables within the trust construct where the arithmetic mean for these variable ranges between (3.4821 - 3.8143) compared with General Arithmetic mean (3.595). It was observed that the highest mean for "***I share my personal-life details with my team members***" with arithmetic mean (3.8143) and (1.08483) as a standard deviation. The lowest arithmetic mean was for the "***My team is committed to accomplish the project goals on time and it is critical to the team***" With mean (3.4821) and standard deviation (.95398). Thus, it seems that *trust* has a high priority in the virtual teams from the point of view of this study.

**TABLE 22: LEVEL OF PRIORITY - TRUST CONSTRUCT**

Item	Trust	Mean	St. D	t-calculated	Sig	Priority
TRU1	<b>I share my personal-life details with my team members</b>	<b>3.8143</b>	<b>1.08483</b>	<b>12.560</b>	<b>.000</b>	<b>1</b>
TRU2	I can depend on my team members to do their part of work	3.5536	1.05612	8.771	.000	5
TRU3	My Team members take individual responsibility for their work	3.5929	1.01879	9.737	.000	3
TRU4	Frequent face-to-face interactions are important to me	3.6393	.90907	11.767	.000	2
TRU5	<b>My team is committed to accomplish the project goals on time and it is critical to the team</b>	<b>3.4821</b>	<b>.95398</b>	<b>8.457</b>	<b>.000</b>	<b>7</b>
TRU6	I trust the accuracy of information-flow within the team	3.5000	.98009	8.537	.000	6
TRU7	I rely on the opinions that other team members bring to the discussions	3.5893	1.01559	9.709	.000	4
<b>General Arithmetic mean and standard deviation</b>		<b>3.595</b>	<b>0.797</b>	<b>12.501</b>	<b>0.000</b>	<b>-</b>

t- Value Tabulated at level ( $\alpha \leq 0.05$ ) (1.650)

t- Value Tabulated was calculated based on Assumption mean to item that (3)

N=280, DF=279

### ***Technology - Level of prioritization***

Table 23 also shows the level of priority for the variables within the technology construct where the arithmetic mean for these variable ranges between (3.4036- 3.8250) compared with General Arithmetic mean (3.540). It was observed that the highest mean for **Using web conference technologies help to enhance the communication in my team ”** with arithmetic mean (3.8250) and (.75355) as a standard deviation. The lowest arithmetic mean was for the **New technologies help to apply synchronous communication concept”** With mean (3.4036) and standard deviation (1.02197). Thus, it seems that *technology* also has a high priority in the virtual teams from the point of view of this study.

**TABLE 23: LEVEL OF PRIORITY - TECHNOLOGY CONSTRUCT**

<b>Item</b>	<b>Technology</b>	<b>Mean</b>	<b>St. D</b>	<b>t-calculated</b>	<b>Sig</b>	<b>Priority</b>
TEC8	<b>Using web conference technologies help to enhance the communication in my team</b>	<b>3.8250</b>	<b>.75355</b>	<b>18.320</b>	<b>.000</b>	<b>1</b>
TEC9	I face some technical and connectivity issues when communicate with my team members	3.6536	.80633	13.563	.000	3
TEC10	Instant messaging and chat is less intrusive than a phone call	3.6536	.81076	13.489	.000	2
TEC11	It was difficult to learn and use new communication technologies within my team	3.4500	1.00768	7.473	.000	5
TEC12	Using new communication technologies help to cut the cost within my team (ex: Phone bills and petrol cost)	3.5393	.98659	9.147	.000	4
TEC13	<b>New technologies help to apply synchronous communication concept</b>	<b>3.4036</b>	<b>1.02197</b>	<b>6.608</b>	<b>.000</b>	<b>6</b>
<b>General Arithmetic mean and standard deviation</b>		<b>3.540</b>	<b>0.748</b>	<b>12.080</b>	<b>0.000</b>	<b>-</b>

t- Value Tabulated at level ( $\alpha \leq 0.05$ ) (1.650)

t- Value Tabulated was calculated based on Assumption mean to item that (3)  
 $N=280, DF=279$

### ***Culture - Level of prioritization***

Table 24 shows the level of priority for the variables within the technology construct where the arithmetic mean for these variable ranges between (2.7071- 2.9821) compared with General Arithmetic mean (2.821). It was observed that the highest mean for **“There is racism level in perspective to race or gender in my team ”** with arithmetic mean (2.9821) and (1.21948) as a standard deviation. The lowest arithmetic mean was for **“I can understand others without getting the necessary nonverbal cues”** With mean (2.7071) and standard deviation (1.20034). Thus, it seems that *culture* has a medium priority in the virtual teams from the point of view of this study.

**TABLE 24: LEVEL OF PRIORITY - CULTURE CONSTRUCT**

Item	Culture	Mean	St. D	t-calculated	Sig	Priority
CUL15	I can understand others without getting the necessary nonverbal cues	2.7071	1.20034	-4.083	.000	5
CUL16	There is racism level in perspective to race or gender in my team	2.9821	1.21948	-.245	.807	1
CUL17	I could learn new beneficial habits and skills from other cultures that are not available in my culture	2.7571	1.24072	-3.275	.001	4
CUL18	My colleagues able to step outside of their own cultural frame of reference and trying not to use their cultural norms to influence the behavior in the team	2.8536	1.22839	-1.995	.047	2
CUL19	The nature of work in my team is more professional-wise instead of cultural wise	2.8071	1.26942	-2.542	.012	3
<b>General Arithmetic mean and standard deviation</b>		<b>2.821</b>	<b>1.059</b>	<b>-2.820</b>	<b>0.005</b>	<b>-</b>

t- Value Tabulated at level ( $\alpha \leq 0.05$ ) (1.650)

t- Value Tabulated was calculated based on Assumption mean to item that (3)  
 $N=280, DF=279$

***Language - Level of prioritization***

Table 25 shows the level of priority for the variables within the language construct, the arithmetic mean ranges between (2.1929- 2.4750) compared with General Arithmetic mean (2.358). It was observed that the highest mean for “**Team effectiveness is affected by the language gap into some extent**” with arithmetic mean (2.4750) and (.94248) as a standard deviation. The lowest arithmetic mean was for “**sharing a common business language (ex: English) increases communication frequency**” With mean (2.1929) and standard deviation (1.00818). So, it seems that *Language gap* has a low priority in the virtual teams from the point of view of this study.

**TABLE 25: LEVEL OF PRIORITY – LANGUAGE CONSTRUCT**

Item	Language	Mean	St. D	t-calculated	Sig	Priority
LAN21	sharing a common business language (ex: English) increases communication frequency	2.1929	1.00818	-13.396	.000	4
LAN22	it is important to have a proficient clear accent when communicate within my team and with clients	2.3393	.99599	-11.100	.000	3
LAN23	My colleagues and clients misunderstand me because of my sound of word	2.4250	.92443	-10.408	.000	2
LAN24	Team effectiveness is affected by the language gap into some extent	2.4750	.94248	-9.321	.000	1
<b>General Arithmetic mean and standard deviation</b>		<b>2.358</b>	<b>0.825</b>	<b>-13.020</b>	<b>0.000</b>	<b>-</b>

t- Value Tabulated at level ( $\alpha \leq 0.05$ ) (1.650)

t- Value Tabulated was calculated based on Assumption mean to item that (3)  
 $N=280, DF=279$

***Time Zone - Level of prioritization***

Table 26 shows the level of priority for the variables within the language construct, the arithmetic mean ranges between (3.3893 - 3.5321) compared with General Arithmetic mean (3.445). It was observed that the highest mean for “**It is hard to communicate with my geographically-dispersed team members because of different time-zones**” with arithmetic mean (3.5321) and (1.01901) as a standard deviation. The lowest arithmetic mean was for “**My team members are not always available because of the different time-zones**” With mean (3.3893) and standard deviation (1.04138). So, it seems that *Time Zone* has a high priority in the virtual teams from the point of view of this study.

**TABLE 26: LEVEL OF PRIORITY - TIME ZONE CONSTRUCT**

<b>Item</b>	<b>Time Zone</b>	<b>Mean</b>	<b>St. D</b>	<b>t-calculated</b>	<b>Sig</b>	<b>Priority</b>
<b>TZ25</b>	<b>It is hard to communicate with my geographically-dispersed team members because of different time-zones</b>	<b>3.5321</b>	<b>1.01901</b>	<b>8.738</b>	<b>.000</b>	<b>1</b>
<b>TZ26</b>	<b>My team members are not always available because of the different time-zones</b>	<b>3.3893</b>	<b>1.04138</b>	<b>6.255</b>	<b>.000</b>	<b>4</b>
TZ27	Different time-zones helped my team to provide 24/7 service for the clients	3.3964	.94090	7.050	.000	3
TZ28	I enjoy my flexible working hours because of the different time-zones	3.4643	.92679	8.383	.000	2
<b>General Arithmetic mean and standard deviation</b>		<b>3.445</b>	<b>0.791</b>	<b>9.421</b>	<b>0.000</b>	<b>-</b>

t- Value Tabulated at level ( $\alpha \leq 0.05$ ) (1.650)

t- Value Tabulated was calculated based on Assumption mean to item that (3)  
*N=280, DF=279*

*All Constructs - Level of prioritization*

Table 27 shows the level of priority for all the constructs in order to affect the virtual team effectiveness, the arithmetic mean ranges between (2.358- 3.595). It was observed that the highest mean for *Trust* then *Technology* with arithmetic mean (3.595) and (3.540) respectively. In contrast, the lowest arithmetic mean was for *Language* with mean (2.358) So, it seems that *Trust* has the highest impact on the level of effectiveness within the virtual teams from the point of view of this study.

**TABLE 27: LEVEL OF PRIORITY - ALL CONSTRUCTS**

<b>Item</b>	<b>Construct</b>	<b>Mean</b>	<b>St. D</b>	<b>t-calculated</b>	<b>Sig</b>	<b>Priority</b>
<b>TRU</b>	<b>Trust</b>	<b>3.595</b>	<b>0.797</b>	<b>12.501</b>	<b>0.000</b>	<b>1</b>
TEC	Technology	3.540	0.748	12.080	0.000	2
CUL	Culture	2.821	1.059	-2.820	0.005	4
<b>LAN</b>	<b>Language</b>	<b>2.358</b>	<b>0.825</b>	<b>-13.020</b>	<b>0.000</b>	<b>5</b>
TZ	Time Zone	3.445	0.791	9.421	0.000	3

## Testing Research Hypotheses

**Hypothesis (H1):** Trust has positive impact on virtual team effectiveness.

To test this hypothesis, One Sample T-test was used. As shown in Table 28.

**TABLE 28: ONE SAMPLE T-TEST RESULTS TO POSITIVE IMPACT OF TRUST ON VIRTUAL TEAM EFFECTIVENESS**

	N	Mean	Std. Deviation	DF	T Calculated	T Tabulated	Sig. (2-tailed)
positive impact of trust on virtual team effectiveness	280	3.595	0.797	279	12.501	1.650	0.000

Table 29 above shows that the t-table to look up a two-tailed test with (279) degrees of freedom and an alpha of (0.05) found a critical value of (12.501). Table 29 clarifies that Trust has positive impact on virtual team effectiveness, as the value of t calculated (12.501) as compared with the value of t tabulated (1.650) and it's a positive statistically significant at the level of ( $\alpha \leq 0.05$ ).

Following the earlier decision base accepts the hypothesis (H1) which states:

***Trust has positive impact on virtual team effectiveness at level ( $\alpha \leq 0.05$ ).***

**Hypothesis (H2):** Technology has positive impact on virtual team effectiveness.

To test this hypothesis, One Sample T-test was used. As shown in Table 29.

**TABLE 29: ONE SAMPLE T-TEST RESULTS TO POSITIVE IMPACT OF TECHNOLOGY ON VIRTUAL TEAM EFFECTIVENESS**

	N	Mean	Std. Deviation	DF	T Calculated	T Tabulated	Sig. (2-tailed)
positive impact of Technology on virtual team effectiveness	280	3.540	0.748	279	12.080	1.650	0.000

Table 29 above shows that the t-table to look up a two-tailed test with (279) degrees of freedom and an alpha of (0.05) found a critical value of (12.080). Table 29 clarifies that Technology has positive impact on virtual team effectiveness, as the value of t calculated (12.080) as compared with the value of t tabulated (1.650) and it is a positive statistically significant at the level of ( $\alpha \leq 0.05$ ).

Following the earlier decision base accepts the hypothesis (H2) which states:

***Technology has positive impact on virtual team effectiveness at level ( $\alpha \leq 0.05$ )***

**Hypothesis (H3):** Culture gap has negative impact on virtual team effectiveness.

To test this hypothesis, One Sample T-test was used. As shown in Table 30.

**TABLE 30: ONE SAMPLE T-TEST RESULTS TO NEGATIVE IMPACT OF CULTURE GAP ON VIRTUAL TEAM EFFECTIVENESS**

	N	Mean	Std. Deviation	DF	T Calculated	T Tabulated	Sig. (2-tailed)
negative impact of Culture gap on virtual team effectiveness	280	2.821	1.059	279	-2.820	1.650	0.005

Table 30 above shows that the t-table to look up a two-tailed test with (279) degrees of freedom and an alpha of (0.05) found a critical value of (-2.820). Table 30 clarifies that Culture gap has negative impact on virtual team effectiveness, as the value of t calculated (-2.820) as compared with the value of t tabulated (1.650) and it's a negative statistically significant at the level of ( $\alpha \leq 0.05$ ).

Following the earlier decision base accepts the hypothesis (H3) which states:

***Culture gap has negative impact on virtual team effectiveness at level ( $\alpha \leq 0.05$ )***



**Hypothesis (H4):** Language gap has negative impact on virtual team effectiveness.

To test this hypothesis, One Sample T-test was used. As shown in Table 31.

**TABLE 31: ONE SAMPLE T-TEST RESULTS TO NEGATIVE IMPACT OF LANGUAGE GAP ON VIRTUAL TEAM EFFECTIVENESS**

	N	Mean	Std. Deviation	DF	T Calculated	T Tabulated	Sig. (2-tailed)
negative impact of Language gap on virtual team effectiveness	280	2.358	0.825	279	-13.020	1.650	0.000

Table 31 above shows that the t-table to look up a two-tailed test with (279) degrees of freedom and an alpha of (0.05) found a critical value of (-13.020). Table 31 clarifies that Language gap has negative impact on virtual team effectiveness, as the value of t-calculated (-13.020) as compared with the value of t tabulated (1.650) and it is a negative statistically significant at the level of ( $\alpha \leq 0.05$ ). Following the earlier decision base accepts the hypothesis (H4) which states:

***Language gap has negative impact on virtual team effectiveness at level ( $\alpha \leq 0.05$ ).***

**Hypothesis (H5):** Time-Zone Difference has impact on virtual team effectiveness.

To test this hypothesis, One Sample T-test was used. As shown in Table 32.

**TABLE 32: ONE SAMPLE T-TEST RESULTS TO IMPACT OF TIME-ZONE DIFFERENCE ON VIRTUAL TEAM EFFECTIVENESS**

	N	Mean	Std. Deviation	DF	T Calculated	T Tabulated	Sig. (2-tailed)
impact of Time-Zone Difference on virtual team effectiveness	280	3.445	0.791	279	9.421	1.650	0.000

Table 32 above shows that the t-table to look up a two-tailed test with (279) degrees of freedom and an alpha of (0.05) found a critical value of (9.421). Table 32 clarifies that Time-Zone Difference has impact on virtual team effectiveness, as the value of t calculated (9.421) as compared with the value of t tabulated (1.650) and its statistically significant at the level of ( $\alpha \leq 0.05$ ). Following the earlier decision base accepts the hypothesis (H5) which states:

**Time-Zone Difference has impact on virtual team effectiveness at level ( $\alpha \leq 0.05$ ).**

## Chapter 5 Discussion

### *Analysis*

The study raised number of questions, and helped to develop multiple hypotheses that are related to each other and the studied variables. The results could answer the questions and came up with many conclusions as the following:

Regarding the results, they show that *Trust* is the most important factor in virtual teams from the analysis point of view. *Trust* was the highest arithmetic mean (**3.595**) which indicates that trust is very important for the members in the virtual teams to achieve their tasks. Virtual team members are facing a crucial challenge with working with people that they cannot trust which put more pressure on the management and team leadership to consider trust and find practical solutions for such challenge as it will be discussed later on. Also, within the trust factor itself, the participants consider sharing the stories of own life as the highest variable with the highest mean (**3.8143**) for **“I share my personal-life details with my team members”**. On the other hand, members in the virtual teams have an issue with trusting their team members to achieve the tasks and the team goals within the required time with the lowest mean (**3.4821**) for **“My team is committed to accomplish the project goals on time and it is critical to the team”**.

Also, the results show that *Technology* is the very important factor in virtual teams from the analysis point of view. *Technology* has the second highest arithmetic mean (**3.540**) which indicates that using communication technologies is very important for the members in the virtual teams to achieve their tasks. Virtual team members are facing many challenges with using different technologies to communicate with each other’s synchronously. Within the technology factor itself, the participants consider using the web conference tools are very important to communicate with other members with the highest mean (**3.8250**) for **“Using web conference technologies help to enhance the communication in my team”**. This result compatible with the trust results since people need to meet face to face even if it is virtually in order to analyze the body language and emotional signs which can help to enhance the trust factor within the team. Instead, members in the virtual teams still cannot rely on the current available communication technologies to reach the highest levels of synchronous communication and that results in giving the lowest mean (**3.4036**) for **“New technologies help to apply synchronous communication concept”** which is compatible with the results of the different time-zone factor and the challenge to have

the synchronous communication concept that will help to have integrated work and task in the virtual team.

The results show that *Culture* has an average impact in virtual teams from the analysis point of view and that can be seen in the arithmetic mean for *Culture* factor (2.821) which indicates that culture is important into some extent for some members in the virtual teams in order to achieve their own tasks. The participants believe that still people in their virtual teams suffer because of the racism level against race and gender with the highest mean (2.9821) for “**There is racism level in perspective to race or gender in my team**”. This result is compatible with the results of the conducted observation sessions as it was clarified earlier. Conversely, participants have an issue with understanding other members without the necessary nonverbal cues with the lowest with the lowest mean (2.7071) for “**I can understand others without getting the necessary nonverbal cues**”. This result is giving the same indication of the necessity to have a conference technology tools to communicate that can minimize the cultural gap and enhance trust between members in virtual teams.

As per the results, *Language* is the least important factor in virtual teams from the analysis point of view. *Language* was the lowest arithmetic mean (2.358) which indicates that language is not providing a huge barrier for the members in the virtual teams to achieve their tasks. Within the language factor itself, the participants confirmed that the team effectiveness can be affected because of the different language with the highest mean (2.4750) for “**Team effectiveness is affected by the language gap into some extent**”. This result can be clarified because of the popularity of the English language as a common business language so it is hard for people to decide if the level of effect of the language gap. On the other hand, using a common business language to communicate does not mean that the communication level will be higher because communication rely on other different factors like technology and trust, this gave the lowest mean (2.1929) for “**Sharing a common business language (ex: English) increases communication frequency**”.

*Results* show that *Time-zone* has a high impact in virtual teams from the analysis point of view. *Time-zone* factor with the arithmetic mean (3.445) indicates it is important for the members in the virtual teams to communicate and work in a synchronous concept to achieve their tasks. Virtual team members are facing a vital challenge with working with people from other countries, regions and time-zones because there will be a cut in the information and work flow. Within the

time-zone factor itself, the highest mean (3.8143) was for “**It is hard to communicate with my geographically-dispersed team members because of different time-zones**”. In contrast, participant see that the team members availability is not an issue that occurs because of the different time-zones is related to the lowest arithmetic mean (3.3893) for “**My team members are not always available because of the different time-zones**”.

## ***Recommendations***

Based on the results, many recommendations can be suggested as the following:

- Organization and team management should take care of building the required trust within the team.
- Since communication factor and the related tools are the core element to build trust within the virtual teams. Members in virtual teams need to be trained to use the effective communication tools that can help them to achieve their tasks.
- Virtual team members should be involved in the process to select the effective communication tool.
- Scheduling couple of monthly meetings will help to ensure that work is on the track.
- Scheduling quarterly meetings to review the past period and plan for the next stages in the project or operational activities will help to give a full overview for all the resources.
- Team members can arrange to have a weekly casual 20-minutes call that will help to enhance the trust level and build the relation within the team (virtual watercooler). Management should support the socialization activities to enhance the trust level within the team.
- Bonus/Rewards system can help to recognize the team and personal achievements within the team.
- Having a free messaging application can help to minimize the number of meetings and enhance the quick synchronous replies.
- Having a free messaging/call applications can help to minimize the operational and meeting costs.
- Self-confidence can be improved for a team member by letting him attend any local events to represent the company.

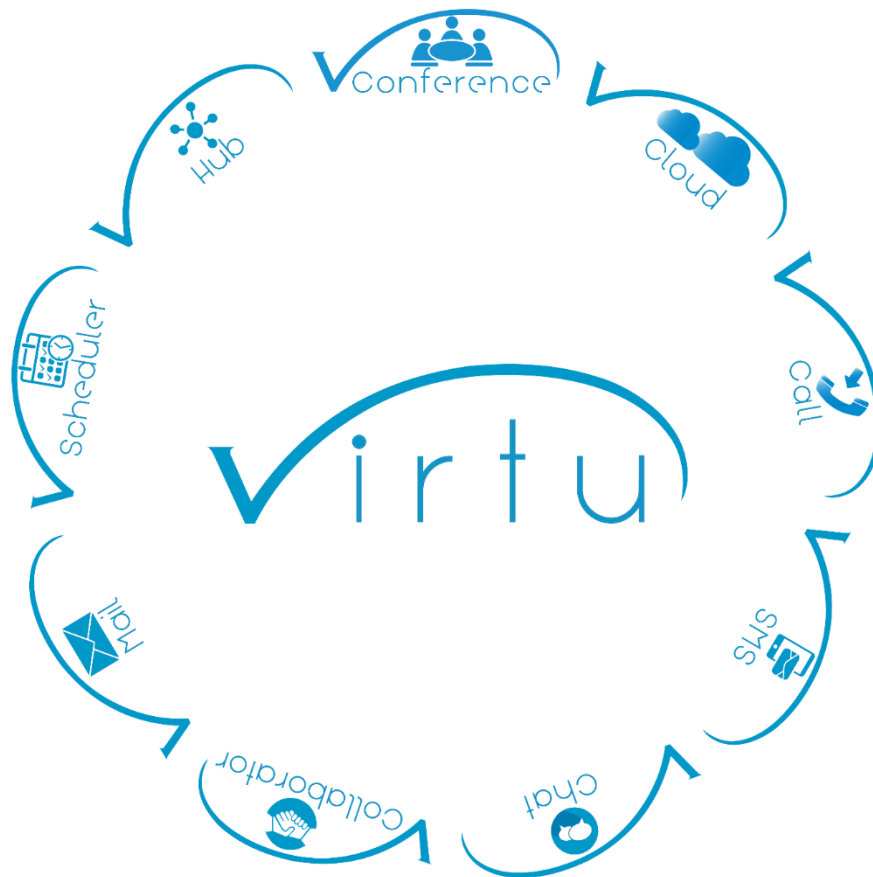
- Technical and managerial training courses are one of the best solutions to accelerate the achievement of work activities.
- Using super video/audio conferencing tools can help to finish the work faster.
- Virtual teams need to have a secured file sharing tool.
- Having a skilled technical support team is essential for the success of virtual team.
- Having a skilled technical support team is essential for the success of virtual teams.
- Having a mobile internet connection will help the virtual teams to finish their work faster.
- Management team has to put the ground rules for the relationships and interaction levels within the team.
- Mutual calendar for different holidays in different countries/religions can help to minimize the culture gap and enhance the relationships within the team.
- Short articles about the culture of different countries and nationalities can help the resources to understand other cultures, eliminate conflicts and promote their own cultures.
- Maintain the needed documentation can help the resources to work simultaneously to finish the required work.
- Maintain the needed documentation can help the resources from other working shifts to know what is going on and from where they have to continue the required work.
- Setting a standard time zone for the whole team can help to solve or minimize the time zone challenge.
- To have one unified solution that contains at least the following communication tools:
  - Email
  - Free Messaging App
  - Paid Messaging App
  - Free Voice/Conference Calls
  - Paid Voice/Conference Calls
  - Video Calls

## ***Key Solutions***

### ***Virtu Solution***

A prototype was designed represent a unified solution that can be used by the virtual team members in order to communicate and work collaboratively. The solution was designed to include multiple communication tools that can help members to work smoothly as illustrated below in figure 12. One of the key benefits of such solutions is eliminating the need to buy different solutions with different licenses which means more cost.

Also, using one unified solution can help to minimize the training time and the confusion for the users. The solution suggests to have a notification area that can include all the different notifications (missed call, email, message...etc.) from different embedded applications instead of checking different solutions to know what is going on with the various tasks or projects.



**FIGURE 12: VIRTU SOLUTION - KEY COMPONENTS**

**TABLE 33: VIRTU SOLUTION- KEY COMPONENTS**

<b>Application</b>	<b>Key features</b>	<b>Similar Application</b>
V-Call	<ul style="list-style-type: none"> <li>- Free Calls</li> <li>- Paid Calls</li> <li>- Call Recording</li> <li>- Leaving a voice message</li> <li>- Conference free/paid calls</li> </ul>	Skype
V-SMS	<ul style="list-style-type: none"> <li>- Paid messages</li> </ul>	Google Hangouts
V-Chat	<ul style="list-style-type: none"> <li>- Free messages include emoticons to for better understanding</li> <li>- Maintain chat history</li> <li>- Leaving a voice message</li> </ul>	WhatsApp
V-Collaborator	<ul style="list-style-type: none"> <li>- Help multiple members to work on the same task at the same</li> <li>- Screen Mirroring</li> </ul>	TeamViewer
V-Mail	<ul style="list-style-type: none"> <li>- Send/ Receive emails</li> <li>- Receive emails</li> </ul>	Outlook
V-Scheduler	<ul style="list-style-type: none"> <li>- Send/ Receive meeting invitations</li> <li>- Reminders</li> <li>- Task Scheduler</li> </ul>	Microsoft Task Scheduler
V-Hub	<ul style="list-style-type: none"> <li>- Include training material</li> <li>- Documentation repository</li> <li>- Training videos</li> </ul>	SAP Learning Hub
V-Conference	<ul style="list-style-type: none"> <li>- Video Conference Meetings</li> <li>- Record Meetings</li> </ul>	Skype (video Calls)
V-Cloud	<ul style="list-style-type: none"> <li>- Documentation</li> <li>- Version Control</li> <li>- Share folders/files Securely</li> <li>- Folders/files access control</li> </ul>	Dropbox



## Effective Virtual Team Platform (EVT)

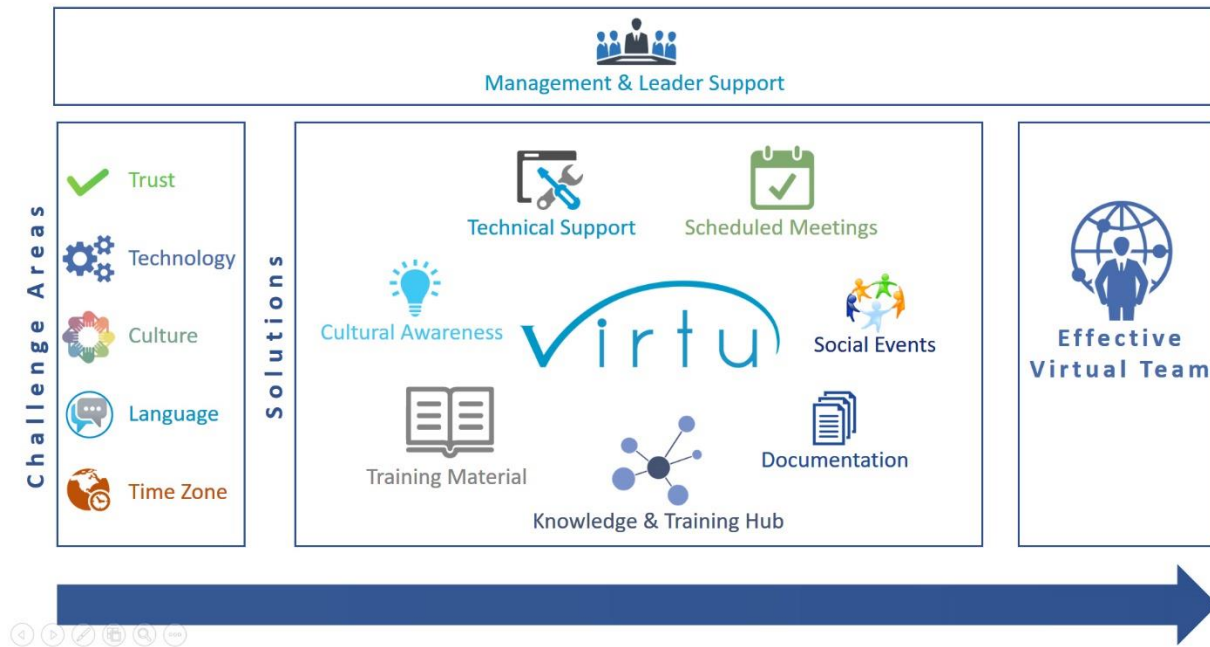


FIGURE 13: EFFECTIVE VIRTUAL TEAM PLATFORM (EVT)

The effective virtual team (EVT) platform is more into a conceptual platform that was designed depending on the different types of analysis and research methodologies that was used in this study. The EVT platform suggests that the leadership and management should have the supervision role to monitor and take care of the previously discussed challenge areas: Trust, Technology, Culture, Language and Time-zone. Also, EVT provides solutions and recommendations for these challenge areas in order to minimize the negative impact and raise the level of positive impact for each factor within these challenge areas. Such leadership monitoring, solutions and recommendations along with “*Virtu*” system as a core unified communication solution can lead to an effective virtual team as a final key result for this study.

One of the main components in EVT is the Knowledge and training hub that can include various video and study materials including different subjects such like: project management, procurement management, knowledge transfer techniques, tasks scheduling, IT skills...etc. the hub component can be aligned with some courses and exams to raise the level of positive competition between the virtual team members and let them work harder to improve their own

skills. Management should help by giving a weekly free time for the employees to read and go through the provided material which is one of the suggested solutions as well.

Moreover, the platform includes the culture awareness component that can include: awareness sessions, material about the different habits in different countries, regions and religions in order to help in minimizing the gap and set the right expectations for the members in virtual teams. On the other hand, the documentation component is responsible to archive and retrieve any required documents. Having the proper documentation along with versioning control can help to reduce the impact of different time-zones. Document the task goal, status and task specifications or requirements can assist members from different time-zones to continue working on tasks without the need to contact other members or setting idle waiting the response for specific clarification.

## Chapter 6 Conclusion, Future Work and limitations

As a conclusion, virtual team concept is a solution that can be applied at this time of rapid base of business in order to fulfill the customer needs, minimize the operation costs, enlarge the pool available expertise and help to save the environment. The conducted intensive analysis could prove that there are many challenges that face members in virtual teams to achieve their own tasks and prevent them to be effective. Those challenges mainly come below five key areas: Trust, Technology, Culture, Language and Time-zone.

Trust and technology challenges should be monitored and treated as risks that should mitigated. Management need to take care of the lack of trust situation and support the casual relationships within the virtual teams to improve the trust level. Virtual team members need to be trained to use communication technology tools which should be supported by a high-skilled support team to prevent any discontinuity in work. Culture gap has high average impact on virtual team effectiveness and that mainly because of the need to get body language and verbal cues to understand people especially who are from other cultural backgrounds. Also, different time-zones means different working time and asynchronous communication that may lead to a work-discontinuity and idle state which gave the time-zone difference high average impact in virtual team effectiveness. In contrast, language is a challenge that has a low impact on the effectiveness in virtual teams and the impact has been decreased because of the English language as a common business language.

Leadership and management can be more involved in future researches that are related to virtual teams. Management should be more considered in such studies because virtual team members need to be supported and motivated by the higher management in order to achieve the task on time, build the trust among the team and enhance the level of self-confidence for each member. Also, Documentation can be explored and the related impacts are discussed along with the field of knowledge management that include the knowledge transfer as a vital piece that can be resulted from the effective communication.

On the other hand, there should be an intensive efforts to analyze the benefits, risks and expected applicable features in *Virtu*. Also, there is a future plan to develop and build the *Virtu* solution and make it available to be tested by different virtual teams in various locations and regions. A proper feedback can be collected to help in the solution improvement process so the solution can be valuable, user-friendly and easy to maintain with no high costs.

Time to explore more ideas and studies was one of the key limitations that were faced through this study. It would more beneficial if there was more time to build the “Virtu” solution at least as Beta version that can be tested and used by members in a virtual team. Such kind of live-usage for the solution could help to address the weak points and what needs to be improved to get more benefits. Also, it would be better if there was more time to examine the EVT platform and observe the feedback from members in virtual teams which can help to highlight any possible gaps in the platform and how it can be enhanced.

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