

CAPITAL UNIVERSITY OF SCIENCE AND
TECHNOLOGY, ISLAMABAD



**Impact of Virtual Collaboration
on Project Success with the
Mediating Role of Task
Complexity and Moderating Role
of Trust**

by

Bushra Yaseen

A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

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Department of Management Sciences

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*Dedicated to my father and siblings for their never-ending love and support and
to my honorable supervisor Dr. Mueen Aizaz Zafar.*



CERTIFICATE OF APPROVAL

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Then which of the Blessings of your Lord will you deny.

(Surah Ar-Rehman)

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Abstract

The focus of this study is to demonstrate the effectiveness of high levels of virtual collaboration and task complexity with the moderating role of trust to improve the incidence of effective project management (PM). The aim of this research is to inspect the connection between the impacts of virtual collaboration (VC) on project success (PS) introducing task complexity (TC) as a mediator which clarifies the impact of team work on project outcome. The moderating role of trust in the relationship between virtual collaboration and task complexity is considered in current study. Total data were collected from 170 respondents that were employed in different project-based organizations. The results scientifically substantiated that virtual collaboration has a positive and significant impact on project success. The mediating role of task complexity is been tested and proved to be a potential mediator between collaboration and project success and have a positive and significant mediated relationship between the two variables. Trust acts as a moderator between task complexity and virtual collaboration such that it is weakening the relationship instead of strengthening the relationship between virtual collaboration and task complexity during any successful project. The study contributes towards the literature, specifically towards project management literature. The study also significantly towards the project-based firms primarily within the context of Pakistan.

Keywords: Virtual Collaboration; Task Complexity; Project Success; Trust.

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List of Abbreviations

PM	Project Management
PS	Project Success
SD	Standard Deviation
SE	Standard Error
TC	Task Complexity
VC	Virtual Collaboration

Chapter 1

Introduction

Virtual collaboration is outlined as a sharing of information through completely different individuals to achieve a common goal. Virtual Collaboration allows sharing the data between completely different parties whose information cannot be exchanged because of the physical separation. Virtual collaboration gives employees the chance to join projects in which their expertise can be advantageous. Compared to face to face meetings with geographically distributed group members, online collaboration is less expensive. Through creating optimum relations, the competitive advantage is gained.

“Success” is that the most important word of any project professional. There are differences and similarities within the two projects success dimensions. The main difference links the results of achievement and evaluation of overall project goals to project success whereas project success relates to traditional measurements of project performance and quality, time and cost. Project success studies usually fall in to two broader categories: addressing project success criteria or examining critical success factors. The project success measurement criteria have three components: time, cost and quality. Although these three metrics are the most cited indicators, Scholars argue that the best measure of project success is whether the project achieves its goals or by evaluating cost and margin variations. Although there is no debate on the success of the project, researchers believe that project success can be achieved by good project management actions (M. Radujkovic & M. Sjekavica, 2017). Several authors state that the interpretation of project success

by investors is of primary importance, especially for international development or social uplifting projects. Project success associates to things related criteria that include budget, quality and schedule of project deliverables and other people related criteria like virtual collaboration, trust and communication that measure the morale of the team and satisfaction of stakeholders in project (Koelmans, 2004). In inter organizational projects staff have lots of opportunities and need to face several challenges because of task complexity and virtual collaboration (Xian & Xidian, 2001). To know Project complexity and the way it will be managed by the project managers incorporates a significance importance as a result difference associated with virtual collaboration and project success that seems to be related with task complexity. In project success the importance of task complexity is acknowledged for several reasons, within the major projects its hinds' objectives and identification of goals. Project outcomes include time, quality, cost, safety etc. In previous papers the most models of project complexity are given and also the idea of project complexity is analyzed (Elsevier, 2014).

1.1 Definitions of Variables

1.1.1 Virtual Collaboration

“Virtual teams are groups of geographically, organizationally, and/or time dispersed workers brought together by information technologies to accomplish one or more organizational tasks”. (Powell et al., 2004).

1.1.2 Task Complexity

“Task complexity is the degree of complicated actions needed to complete a task.” (N., Pam M.S, 2013).

1.1.3 Trust

“Trust is defined as a function of certainty and expectations of others behaviors or belief on others competencies, that affects performance from activation of collaboration”. (Tyler, 2003)

1.2 Theoretical Background

Virtual Collaboration may be a sort of platform through which we tend to transfer the knowledge of various type of work to attain a common goal. It is simpler once its face to face interaction in between the contextual information is transferred through the members of team, however limits of technology have to be compelled to share some information prevent. It is effective as face to face interaction is effective (Steinfeld, Ben, & Yang, 2005). Virtual Collaboration is employed for distributed groups through the knowledge transfer that is present in conferences, through written, visual, digital and verbal suggests that like just about communication (Linda, Charles, & Peters, 2018). There are two forms of collaboration.

It is a type of collaboration which occurs in team members who are able to share ideas and information instantaneously (Yang, 2005). E.g. Videos and audios conference, quick messages and chats. It is a type of collaboration which occurs when the members of teams communicate with each other without having the ability of instance response to different ideas or messages (Yang, 2005). E.g. Emails, databases, discussions, applications. Virtual teams scattered and asynchronous nature also means that computer mediated contact as the primary means of building relationships will replace face to face communication.

Now a day in many organizations, different teams are commonly located in different geographic locations, time zone, and even countries. Collaboration of virtual teams are important for many organizations as they respond to changing markets and political circumstances such as corporate sourcing. It remains unclear how virtuality, or the conditions under which virtual collaboration works, affects performance despite research and investment in technologies that support virtual

work. Previous research indicates the virtual team performance that runs from failure to success. A worldwide understanding of the specific performance impacts of virtual work, positive or negative, remains uncertain as researchers have still not determined which key elements of virtuality are particularly important in a given setting.

Project success will be measured before throughout and when project completion. In easy terms, project success will be outlined as achieving project objectives among schedule and within budget, to satisfy the stakeholder and learn from expertise. The project success criteria confer with measurable terms of what should be the end result of the project that's acceptable to the end user, customer, and therefore the stakeholders. In different words, the project success factors contain activities or components that are needed to make sure successful completion of the project (Cooke & Davies, 2002). The success of a project isn't solely dependent on however the project performs in terms of its success criteria however it's conjointly dependent on the stakeholders.

The analysis also observed that project success is less in empirical and theoretical perspectives as it is easy to measure the hard aspect of the project but soft aspect is intangible and hard to measure. The softer side of the project is given significant avenue in research because softer aspects conduct the projects together. Moreover, the effectiveness of project success is linked to the soft aspect of the project in which project team is involved and the performance leads towards project success (Ika, 2009) and need more effective and efficient performance of team members toward the success of the project.

What will project success mean? In an era once projects became progressively common in organizations, this question is a lot of relevant than ever. In the majority cases projects are initiated to produce modification to develop new product, establish new producing processes, or produce a replacement organization. While not projects, organizations would become obsolete and impertinent, and unable to deal with today's competitive business surroundings.

Thus, regardless of what the motivation for the project, the question of project success is powerfully joined to an organizations effectiveness and to its success

within the future. Yet, ironically, the abstract understanding of project success remains in its time period project success has not been usually joined to competitive advantage and winning within the market-place; and different people still understand project success in several ways (Shenhar, Dvir & Maltz, 2001).

Task complexity may be a collection of properties inheritable by a task. These properties (like priority, due date, duration, and urgency) outline the problem of this tasks and its significance to a performing artist (a one that ought to do the task). Definition of the construct, Human decision processes and structure behavior, Task complexity. Its the degree of actions or tasks that are difficult and that we must complete those tasks. It's called task complexity.

Because definition of complexity is appropriate for any dimension of the project related to the project management process, it includes company, technological innovations, policy making, business environment, data and programs. In project management complexity maturity is low and has not been highly advanced compared to other parts of project management knowledge It is a construct that in broader term explains the characteristics of impact on tasks and therefore the demand placed on task performer. Its largely utilized in the fields of psychological science and management and this term is outlined for over 20 years previous. Complexity is a determining indicator of the success rate of the projects and must be handled according to the level of criticality of the undertaking and can lead to a reduction in project performance or even loss of the latter (Benbya and McKelvey, 2006). A recent study finds thirteen completely different definitions that fell into five categories (Gill, William & murphy, 2007). It may be a source of problem. It results lacking of task structure. It's a source of data requirement method. It measures characteristics of the problem space. Its a perform of task characteristics.

Trust is outlined as a function of certainty and expectations of others behaviors or belief on others competencies, that affects performance from activation of collaboration (Tyler, 2003) and cooperation processes (Chiocchio, Forgues & Lordanova, 2011). If there's trust, people provoke help, speak honestly and openly, settle for

new challenges, take risks and perform their activities with less stress and anxiety (Carvalho, 2008; Fox, 2001). A comprehensive literature review, which is determined to specialize in the subsequent factors that influence trust, namely, risk managing uncertainty, the degree of knowledge exchange, and meeting team members expectations.

1.3 Research Gap

Virtual collaboration is considered to be one of the most important variables in project success which shows the significant impact on project success (Radujkovic & Sjekavica, 2017). Project success is that the ultimate desired objective of every project-based organizations. Studies found various important success factors that absolutely have an effect on project success. The present literature is studying team's trust on supervisor (e.g. project manager) (Rodwell, McWilliams & Gulyas, 2017). Other empirical studies suggest that project failure is also due to the deficiency of the "human" project success factors among collaboration and trust. Studies on project management principally indicate a priority about analyzing factors that are affecting successful completion of project. Therefore, in this study, Trust act as moderator. Projects have their own specifications and complexities which require to be lessen to execute the type of project needed by the customers.

By working on the cause's task complexity increase the possibilities of success of the project. And it is used as mediator in some previous studies. One of the tactics to reduce the complexity of the task is segmentation methods because in this method task is divided in to different parts to reduce complexity and it had been recommended for the long run research that there's still need to study that how task complexity impacts the success of the project. Whenever it's utilized in industry to search out the link between partnering success and trust (Cheung & Wong, 2005) and project success and trust (Weiping, le & Lu, 2016). Rolfsen & Buvik (2015) and Henderson, Stackman & lindekilde (2016) identified that project team, trust and collaboration have an intervening relationship with project

success, which can be studied as these case studies present Inherent limitations of generalizability.

1.4 Problem Statement

Even though an important analysis has been conducted on project success factors, many projects continue to fail due to task complexity. As various factors are connected with one another so uncertainty, change will occur at any stage of the project. Managing such factors is very critical in complex projects. Different researches have been conducted on the task complexity; still there are areas that need to be explored. Investigating impact of those variables can facilitate the project to be managed in better approach. Literature on project success indicates that uncertainty needs to be recognizing early in order to be properly managed. There are still issues that need to be discussed due to the changes to working conditions and specifications.

Finally, this research explored how task complexity mediates between virtual collaboration and project success.

1.5 Research Question

On the basis of the problem statement following questions have been derived which will fulfill the research objectives.

Research Question 1

Does virtual collaboration have an impact on project success?

Research Question 2

Does task complexity mediate between virtual collaboration and project success?

Research Question 3

Does trust moderate the relationship between task complexity and virtual collaboration?

1.6 Research Objective

Generally objective of the study is to develop and test projected model to explore the relationship between virtual collaboration, project complexity, and trust and project success.

In order to discuss the research problem following research objectives have been derived.

Research Objective 1

To investigate the impact of virtual collaboration on project success.

Research Objective 2

To investigate the mediating role of task complexity between virtual collaboration and project success.

Research Objective 3

To investigate the moderating role of trust in the relationship between task complexity and virtual collaboration in projects.

1.7 Significance of Study

Significant analysis has been conducted on project success factors, many projects still fail, as proved by many studies. Several studies recommended a link between virtual collaboration, trust and project success (Bond, Fletcher & Steyn, 2014) Rolfsen & Buvik (2015) (Holton, 2001). Totally different approaches to modelling project success have additionally been used (White & Fortune, 2006) (Westerveld, 2003). Organizations ought to do important changes and implement new practices additional adjusted to reality, as well as the utilization of project and advantages management approaches, seeking a higher use and management of existing resources and capabilities (Gomesa & Mario 2016).

1.8 Supporting Theory

According to the theoretical framework two theories are supported to the model which is used in this study. One is Swift trust by (Brand & Jarvenpaa, 2013) which covers three variables the dependent variable project success, the independent variable virtual collaboration and the moderator trust while the second theory related to this framework is relational complexity theory by Andrew, Phillips & Hal ford (1998) which only covers task complexity because it only consists of two types of task complexity. One is segmentation and the second one is conceptual chunking. Practitioners only mention type one because according to the research model only type one is fitted in research work. Detail of the theories is given below.

1.8.1 Swift Trust Theory

In this study the 1st supporting theory is Swift Trust Theory which is based on trusting beliefs and normative actions which was published by (Brand & Jarvenpaa, 2013). The study is about the normative action processes of swift trust and their relationship to performance. Results provide support for our theory about how the normative action processes involve setting and monitoring performance norms that are supported by early trusting beliefs and that increase late trusting beliefs and consequently team performance in virtual teams (Brand & Jarvenpaa, 2013). They focus on swift trust's normative action processes and their relationship to success, and then report results from an experimental study of teams without face-to-face contact (Brand & Jarvenpaa, 2013). Theory stated that if trust increases in teams then there is a chance for project teams to collaborate ore virtually then its impact on project success is positive when trust increases, virtual collaboration between project teams also increases and project will be successful. However, not many studies are found related to task complexity with related to virtual collaboration. But according to theoretical frame work, I proposed that if

the level of trust increases then virtual collaboration also increases then a possibility is that less complexity will be found in projects and then project leads toward success.

1.8.2 Relational Complexity Theory

The 2nd theory related to this framework is Relational Complexity Theory by Andrew, Phillips & Hal ford (1998) which stated that we need a principle method to analyze tasks and quantify their complexity, which can be applied in various content domains. Relational complexity is the number of variables associated with a cognitive representation. Two strategies are used in this theory to reduce complexity, Segmentation and Conceptual chunking, Segmentation is defined as, complex tasks are broken down into less complex components that do not overload capacity Andrew, Phillips & Hal ford (1998). It means that in every project, complexity is found at certain levels, so to reduce complexity sometimes management needs to make segments. Variables can be chunked or segmented only if the relations between them need to be processed. Through this process complexity can be removed easily than the project will be completed in given time limit. It shows that after removing complexity employees can perform in a better manner through which project leads to be successful. Similarly, according to the frame work, task complexity links between the relationship in between independent variable virtual collaboration and dependent variable project success.

Chapter 2

Literature Review

Is that there any way to verify or measure the success or failure of a project? Success is perceived in several ways in which by all stakeholders concerned Shenhar & Dvir (2007). Atkinson notes that, while there might exist differences within the project success definition, authors agree on the inclusion of the triple constraint, in an effort to define the achievement or fulfillment of project objectives. The project success definition has been studied and developed from the easy completion of price, time and quality criteria, additionally called the “iron triangle”, or triple constraint. However, these criteria are a part of a multi-dimensional variable, which incorporates factors involving not individually the project results, however additionally the customers satisfaction and, ultimately, the organization. The definition of success is therefore broad which differ across the various communities or cultures. Shenhar & Dvir (2007) claimed that no conclusive proof or common agreement has been reached to this point to see whether or not a project may be a success or failure. Meredith & Mantel (2009) argue that what seems to be complete as failure during a certain project; will be perceived as a success in another. Project success became a relevant project management topic, and is one among the foremost frequently debated problems. However, there’s an absence of agreement relating to the standards by that success is evaluated Meredith & Mantel (2009).

There’s a significant positive relationship between project management practices and project success. Project management success is one among the elements of

project success, as a result of the latter is hardly possible without it (Holton, 2001; Kalkman & Waard, 2016). Study focuses on the factors of project success that are trust, task complexity and virtual collaboration. Some attention has received in literature within the interaction between trust and collaboration (Holton, 2001; Kalkman & Waard, 2016). However, the link between the amount of trust and virtual collaboration, and also the contribution that these two constructs makes the project success, is remains unclear in literature.

2.1 Virtual Collaboration and Project Success

Although we understand the key role of technology in virtual collaborative teams, study focuses on additional relevant contexts to virtual collaboration that are significantly affected by communication technologies themselves.

Now a day in many organizations, different teams are commonly located in different geographic locations, time zone, and even countries. Collaboration of virtual teams is important for many organizations as they respond to changing markets and political circumstances such as corporate sourcing (Cooke & Davies, 2002). It remains unclear how virtuality, or the conditions under which virtual collaboration works, affects performance despite research and investment in technologies that support virtual work. Previous research indicates the virtual team performance that runs from failure to success (Cooke & Davies, 2002). A worldwide understanding of the specific performance impacts of virtual work, positive or negative, remains uncertain as researchers have still not determined which key elements of virtuality are particularly important in a given setting.

Moreover, relatively limited research work on geographically dispersed team members (often referred to as virtual collaboration teams) has been carried out to date. With the improvement of technology and the development of collaborative software, virtual collaborative teams members are distributed across various physical places are becoming increasingly popular. It is possibly the software that makes the idea of Virtualities unique (Handy, 1995).

Without it, we are faced with little more than the idea of employees working individually in scattered locations, which for some time has been common place. Enabled by the ever-expanding technologies of communication, virtual collaborative teams can overcome time and space to a large extent, connect people across professions, geographic areas and corporations, combine their different skills to work together temporarily and accomplish a successful task or successful project (Cohen & Mankin, 1999; Yager, 2000).

Motivating employees to work collaboratively is not a new concept. Moreover, in business practice, the period of empowerment and team-based work is well known. The example of virtually collaborative work in organization is the creation of group of workers assigned tasks that were previously part of the role of the external manager (Lawler et al., 1995; Kirkman and Rosen, 1999).

Furthermore, the differentiation of circumstance-appropriate teamwork, communication, strangeness, and cohesion was also found to improve cooperation in the project that is a factor in team success. High-quality project virtual collaboration is distinguished by unity, described as the spirit of virtual collaboration amongst members and the subsequent fall that forces participants to stay in the team (Peng, 2010). We found that cooperation is one of the main issues which decide the determination of the person to collaborate.

Project success will be measured before throughout and when project completion. In easy terms, project success will be outlined as achieving project objectives among schedule and within budget, to satisfy the stakeholder and learn from expertise (Cooke & Davies, 2002). The project success criteria confer with measurable terms of what should be the end result of the project that's acceptable to the end user, customer, and therefore the stakeholders. In different words, the project success factors contain activities or components that are needed to make sure successful completion of the project (Cooke & Davies, 2002). The success of a project isn't solely dependent on however the project performs in terms of its success criteria however it's conjointly dependent on the stakeholders.

The analysis also observed that project success is less in empirical and theoretical perspectives as it is easy to measure the hard aspect of the project but soft aspect

is intangible and hard to measure (Ika, 2009). The softer side of the project is given significant avenue in research because softer aspects conduct the projects together. Moreover, the effectiveness of project success is linked to the soft aspect of the project in which project team is involved and the performance leads towards project success (Ika, 2009) and need more effective and efficient performance of team members towards the success of the project.

A virtual collaboration is described as a group of employees who work together over a given period of time and communicate with one another to achieve a common and accepted goal which cannot be managed by an individual employee and research suggests that the functional team climate shifts to an unpredictable pattern and allows participants to adjust according to the new circumstances and its efficiency depends upon how the group works together, adapt and responds to the specific unstable situation (Gorman, Dunbar and Grimm, 2018), together with the evaluation and understanding of the situation in order to deal with the dynamic and unpredictable situations in which the current study emphasizes on the method of virtual collaboration and it is characterized because all practices linked to the obligations to be carried out for the effective completion of the project, such as sharing of information, pre decision maker and benefit alignment (Gorman et. al., 2018).

Virtual teams have modified the 25th century organizational environment, transforming traditional teams and encouraging corporations to engage in more diverse and complex projects (Townsend et al, 1998; Oakley, 1998).

Virtual collaborative teams are more diverse than traditional teams because of different geographical positions and operational roles of most of their members. Virtual team members also need to be more experienced in interacting with peoples from different cultures and backgrounds (Townsend et al, 1998).

Therefore, virtual group environment, which appear to be described as boundless, provide a more dynamic and elusive platform for their members (Oakley, 1998).

Consequently, a variety of studies has given a framework for virtual collaborative interactions and project success has proven that inter team relations support

team members to manage them effectively and engage effectively in planning and decision making to improve project success (Um and Kim, 2018).

The exchange of information is focused on the cooperation and willingness of the employees of the group to efficiently cooperate to improve project efficiency's information sharing and coordination between project team members has an interpersonal relation with the projects output as successful project implementation involves collaborative communication and understanding to convey all necessary information in a timely manner and to comply with the projects inventive nature in order to increase the likelihood of the project success.

Based on the studies stated above, it can be described that strategic policy making is needed to improve the efficiency of the projects. Different ideas are needed to resolve the complicated problems, so mutual decision making is preferred (Yan and Wagner, 2017).

Through sharing ideas, most of those business issues can be resolved, while the latter makes a positive contribution to the success of the project and improved performance.

As information sharing and decision making are the constructs of collaboration and the latter contributes positively towards the better performance of the project and meet the success criteria While exchange of information and coordination, these are the forms of virtual collaboration whereas the latter make a positive contribution to the projects improved results and achieve the success goal of the project (Um and Kim, 2018; Yan and Wagner, 2017).

Motivation relates to the balancing allowance and responsibility within the functional team and allows participants to coordinate with their specific goals and objectives with the overall goal and objectives of the project in order to achieve the collective benefit (Simatupang and Sridharan, 2002) because the reward alignment rate would be greater, the positive and effective interaction between the individuals would be higher to improve the project efficiency and the specific project objective (Simatupang and Sridharan, 2002). Studies have also shown that the mismatched rewards come in to effect if the organization fails to help their workers to meet

their aims according to their goals and have impact on the success of the project (Simatupang and Sridharan, 2002).

In this current study the next source of virtual team collaboration is motivational coordination. Incentive cooperation is perhaps to which the group member belonging to a particular team to share their risks, benefit and cost and loss and gains, and strongly support to their contribution to the project (Um and Kim, 2018) and let everyone operate towards to achieve the mutually identified goals and objectives and serves as a way for members to continue on the path to achieving the mutually identified targets (Um and Kim, 2018).

It can be convincingly argued on the basis of the afore mentioned literature that the strong virtual collaboration seems to be the key towards success while new project is being implemented.

The research would support project-based organizations, project managers, consultants, students and practitioners. Study will be beneficial for project based organization, for training project managers and team members, for consultant, student and practitioner because the current study provide information about the project management environment, the researchers concentrated on project success in the management literature and found many important factors for the success of the project, the research also relates to the critical success factors for project success in which the main component of critical factor is virtual collaboration. (Ika, 2009)

According to the above-mentioned literature it is concluded that increase in virtual collaboration among team members have a strong positive and significant impact on the project success, as it can say that if there is a strong bond of communication in between virtual team members then team can perform well and share problem to the other member of the group which they are facing during the completion of the project. If they have a strong bond in between their team members team can share their risks, profit and losses together and the best way for strong bounding in virtual collaboration is to communicate well whether on calls or on video conferences or via mailing, through this virtual collaboration team leads the project towards success.

Therefore, it is suggested from the above discussion that

Hypothesis 01:

There is a positive impact of virtual collaboration on project success.

2.2 Task Complexity and Project Success

When provokes the literature to confirm the link among task complexity and project efficiency, the need occurs to identify what the project involves generally. The concept reveals as: “A project is an undertaking in which individuals, economic and technical assets are coordinated in a new way to execute a particular scope of the project, requirements within cost and time limits, in order to accomplish the significant changes described by the theoretical and practical objectives” (Turner, 1999).

Task complexity is an unclear concept and is difficult to measure completely. Complexity includes a large number of interconnected components, multidimensional project design often to lead to keeping it complicated, multidimensional nature is difficult to assess, multiple scholars have leading different studies to identify its estimate and order variables (Thomas & Mengel, 2008). It's critical for both practitioner and scholars to understand the task complexity of a project. Practitioners need to learn how to deal with uncertainty and what effect it will have on people or industries (Thomas & Mengel, 2008). Various studies have also based on defining the features of complex projects and how corporations and their leaders are coping with them (Williams, 2005; Shenhar & Dvir, 2007).

Task complexity of dynamics is necessary for change in the system. Dynamics complexity is relevant to the changes made in the system. Changes in layout, requirements, preparations, team (Maylor et al., 2008), investors (Hobday, 1998), and climate etc. May be produced, but these improvements may cause an increase in project risk levels. Pace is linked to timely expectations that have a strong impact on the project due to the interconnectivity of various parts (Shenhar & Dvir, 2007). Pace generally relates to the frequency at which analysis is conducted with in specified period of time. There is a concern from various stakeholders while

the project is being carried out (Maylor, 2001). These external pressure causes the task more complex and restricts the achievement of defined objective. Task complexity of the project is seen as a critical element in the area of project management (Tatikonda & Rosenthal, 2000). Throughout any situation, unpredictability of the features and structure of the task seems to be an unclear state problem. It is discussed from the analysis that some factors are recognized as a contributors of task complexity, which include uncertainty and risk. On the other side, the multi-dimensional existence of the project is often seen as a primary factor in the uncertainty of tasks that researchers also proposed that we have to pay more attention to describing and engaging with complex projects (Maylor, 2001). The initiative performance is also seen and to be related to the inter dimensional nature of the project.

This innovative and restrictive scale of the project success causes it more complicated and lowers the project efficiency (Yang et al., 2014; Tatikonda and Rosenthal, 2000).

Many of the projects became ineffective in terms of the requirements specified due to the interconnectedness among them (Baccarini, 1996; Yan and Nair, 2016; Yan and Dooley, 2013, 2014). Such interconnectedness could be individuals administrative, mission or specific location; most of which create confusion in the specific task (Yan and Nair, 2016), yet instability is considered to become one of the most complex forms (Williams, 1999; Yan and Wagner, 2017) which prevents the project's success (Tatikonda and Rosenthal, 2000; Um and Kim, 2018).

There's no commonly accepted description of the task complexity, while each work has shown a negative correlation among the task complexity of the projects and their actual performance in accordance with the appropriate accepted criterion.

Complex systems are hard to understand and to work with. Just like the project industry some of the projects fail due to task complexity and technology specifications that are complex and difficult to understand. Some of the projects faced failure just because of the task complexity in a project. Task complexity is negatively related with the success of the project (Tatikonda & Rosenthal, 2000).

It is important to find the causes through which project gets more complex and as a result project lead towards failure. Task complexity is such type of difficulty in which we are not able to meet with the project goals, implementations and strategies etc. And these task complexities are difficulties to recognize hence such complexities truly leads towards the failure of the project, if we work on the causes task complexity can be removed and there is a chance of the project to be successful (Gidado, 1996).

Here is no need of authority to execute and perform the project and the power must be provided to the top level managers and the directors to understand the task complexity of the projects then it will be easy for project team to understand that what they have to do and if the project managers are able to deal with the task complexity then success can be achieved (Thomas & Mengel, 2008).

So, the project team have to deal with the task complexity and try to reduce it in possible manners. The utmost difficult condition in the projects is to cope up with the complexities in the projects which are increasing challenging situations for the project managers and the task complexity is increasing due to the aspects of the project if team members handle those aspects of the task complexity which a project team faced in the project then a success can be achieved easily. Aspects of project complexity improve project success (Xia & Lee, 2004).

Projects generally have features of novelty and complexity so it is required to be tackled in a way to accomplish the desired goal of the project, such as relating the features of novelty and complexity specific goals of the project is measured by measuring the employees performance by allowing them to tackle the complexity along with novelty which directly leads to the success of the project and if all the procedure is done by active monitoring of performance through dealing with the complexity (Tatikonda & Rosenthal, 2000). Study shows that the task complexity has the important point of consideration because in starting the project and formerly, the problem of complexity was not resolved or taken under less consideration. Therefore, the obstructions in project were faced and project lead to failure, therefore task complexity is one the main fundamentals of the project features which is needed to be accurately ignored in order to keep cost and time

baselines with opposing the market tendencies which obviously explains that task complexity directly have an impact on project success (Gidado, 1996).

Another element of task complexity that decreases projects output is inter connectedness of tasks, that can lead the project to over budget and delay. Since no function could be achieved unless each component of the task is performed independently by the associated project leader, although equality and the temporal existence of the activities demand that each participant involved, perform the assigned work on time because practical delay will cause the entire task to be delayed (Bailey, Leonardi, P. M., and Chong, J. 2010), ultimately, the proposal got delayed. Relation among the objects and methods and also the degree of the task complexity and cooperation among the both often increase the task complexity of the project and affect the output of the project or activity in terms of delayed, beginning and exaggerated, respectively (Bailey et al., 2010).

By explaining the complex nature of the projects which includes innovation and creativity, it concludes that theoretically the task complexity in the project has a negative relation with the performance which affects the project success negatively as task complexity increases the competition and complications even in the significant phases of the project, particularly during the management of cost related transaction to manage the task complexity of the project and by encouraging the collaborative communication, scientifically task complexity also affects project result to gain success in the strategic network (Moore, Payne, Autry, & Griffis, 2016).

Studies has also found that task complexity may have integrated effects through direction, communication and power, which have commonly used to manage the project management process but affect the project objectives in a negative way so in order to determine the high and lower levels of complexities, the project manager needs to be effective and efficient because the task complexity is very significant because it is strongly related to the output parameters of project team in a project management process when generalizing the progress of the project success (Abdou, Yong, & Othman, 2016).

If the projects are complex, and we find many task complexities in a project we need top management to support and to deal with the task complexity. Only the manager or leader of the team handle complexities and difficulties in a project which the employees face during working. Task complexities can be of many types, but its top management responsibility to tackle with such type of circumstances and provide easiness to their teams so that they can work hard and try to complete their work in given time so the project leads toward success. So according to the above-mentioned research task complexity act as mediator because in every type of project whether its big project or small complexity lies. As it is written in literature where there is a higher risk there is a higher return so higher complexity leads project towards success because team members put more effort to complete their work as it is positively associated towards the project success whenever, decrease in task complexity also leads project towards success and have significant impact according to the given model.

It is therefore suggested from the above discussion that

Hypothesis 02:

Task complexity is positively and significantly associated with the success of the project.

2.3 Virtual Collaboration and Task Complexity

One important trend throughout the place of employment is that the use of technologies to coordinate virtual space experiences and activities. The adoption of virtual communications provides companies and their workers several benefits, including linking skilled employees to particular tasks avoiding restrictions about certain positions and providing consistency in work hours; it therefore increases productive capacity, the efficiency of both the decision-making phases as well as the spontaneous storage of a various information ranges. It may also decrease-operating expenses by reducing a need to create individuals departments and assign members of the team to a particular location (Mehta, 2016). In reality, task

performed out during virtual environment between groups are becoming more and more popular.

A group is described as a bunch of individuals who operates together for a specified time period and coordinate with one another to accomplish a mutual and concurred goals which can never be gained by the individual and researcher has suggested that even the functional team climate shifts onwards an unpredictable sequence and allows participants to deal with different circumstances and its success depends on how the team works together, adapts and responds to the specific unpredictable situation (Gorman, Grimm, and Dunbar, 2018) together with the examination and understanding of the relationship in order to deal with the complicated and ambiguous circumstances. In which the current study reflects on method coordination and is characterized like all items related to an activity needed for the productive completion of the project, such as decision making, information sharing and motivational cooperation (Gorman et al., 2018).

Team and good teamwork throughout the task growth cycle is becoming the requirements to accomplish institutional targets and needs collaborative efforts from each participant because even if participants seem unable to establish shared understanding between teams otherwise the process will take time and it is not successful for project success (Peng et al., 2014). It has also been proven specificity between the participants as well as the method helps the respondents of the team competing to get a well-coordinated management structure in which teamwork also depends on the existence and amount of task complexity (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000). Subsequently the project success antecedents, as so many studies have shown, the dynamic existence of the tasks obstructs project success (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000; Peng et al., 2014). The partnership has demonstrated to become the backbone of product design. Team virtual collaboration allows team members address the unclear and unpredictable world in the same form that the negative effect of task uncertainty on results is minimized. Increasing market dynamics and competitive market in this technological world have strengthened consumer awareness and desire, but the need to undertake the expected projects has arisen; despite increased

complexity throughout the project due to the unpredictable and constantly changing climate. Many new projects introduced include an intrinsic feature of task complexity, ambiguity, mission dependency and technical variance, allowing the appropriate group members to work together to cope up with the task complexity and instability appropriately (Peng and Heim, G. R., and Mallick 2014). (Peng et al., 2014).

Observed that team collaboration can also be improved through using IT resources to promote and improve collaboration among team members. The developed stage of task complexity directs to inaccurate information interpretation, particularly at the beginning of the new program while information is only vague and big-level; And therefore, this misunderstanding may lead to inaccurate trend analysis and inadequate project efficiency, but needs appropriate cooperation by the entire project team to reduce the long-term danger. (Um and Kim, 2018).

It can be convincingly argued on the basis of the above-mentioned findings that collaboration seems to be the secret to success when new venture is initiated (Peng et al., 2014). But they have also explained that difficult problems have always been overcome by stronger virtual team collaboration (Peng et al., 2014) and thereby demonstrated through their specific analyses how unpredictable and dynamic circumstances encountered all through the development of the project can also be reduced by working together to leverage one another's experience and expertise to identify market opportunity and patterns in order to manage accurately with unexpected and contradictory circumstances.

"Environmental dynamism" is a major factor affecting performance of the team including task connectedness of the members of the team participating in performing the related tasks Requesting employees to take organized and instead of decentralized decision making so that each individual's task depends explicitly or implicitly on one another and calling on people to take decisions by barring each other with the order to improve the team's performance and therefore the project's performance. It's said that rational and collaborative decision-making plays a significant role in improving the performance of the project and it can lead to contradictory circumstances when a conflict arises, However, a certain condition

can also be managed to avoid if there is a high level of reward orientation among employees, so that both concepts of collaboration contribute to better project success.

Based on the literature examined above it can still be explained that intentional decision-making is necessary to improve the efficiency of the projects (Um and Kim, 2018; Yan and Wagner, 2017). Various options are needed to resolve the complicated issues, hence mutual decision-making is encouraged. The exchange of information will solve several of the specific problems (Yan and Wagner, 2017), While the latter makes a significant contribution to task progress and performance improvement (Um and Kim, 2018). The foundations of collaboration are almost as sharing of information and decision making, while the latter make a positive contribution to the overall project improved results and achieve the goals and objectives (Um and Kim, 2018; Yan and Wagner, 2017).

In specific, previous studies has also shown that extent about a company's independent decision-making awards its participants (i.e., autonomy culture) influences the nature of the relationship and interpersonal attitudes toward one another, along with ability to use technologies and share information (Kirkman & Rosen, 1999). In particular, the degree by which a task involves a specific task performer's experience, expertise, and abilities (e.g. task complexity) also has been suggested as an important factor affecting the relations and connections around members of the team .Because of developed market patterns and technological innovation, the idea of a virtual collaboration have gained enormous significance because team members are neither non-located to learn the best available expertise for project and process improvement. The members of the virtual collaborative team are far from one another and will only coordinate by using the technical means e.g. software-mediated communications.

(Berry, 2011) has also shown that virtual collaborative teams have become the greatest way to counter the talents of peoples around the world today, although they are complex in nature and face difficulties in collaborating due to lack of time among them; To this extent, it needs strong communication mechanisms including networks in order to develop maximum performance of the team, thus allowing

communication are among the requirements needed for the team to be successful and achieve the objectives set.

So, considering the literature and all the previous researches related to task complexity and virtual collaboration, it is concluded that if there is a strong communication in virtual collaborative team then it will be easy for team members to cope up with all the complexities which they may face while completing the project .If a virtual team does not collaborate properly they will not lead toward the project success and another thing is that if a project may face some task complexities during the completion, a manager or team leader must divide those complexities among all the member of the team not only burdened a single member as single person will not resolve it while a team effort could resolve issues.

Then it is stated that,

Hypothesis 03:

There is a positive and significant association between virtual collaboration and task complexity.

2.4 Task Complexity Mediates the Relationship Between Virtual Collaboration and Project Success

Project is shown to be a special and temporal existence and is always undertaken in terms of achieving a limited set of parameters (Hobday, 2000), often experiencing complexity and instability in the context of the task and objectives to be accomplished while responding to the project performance , thereby making complexity the essential aspect of the project and reducing project output (Tatikonda and Rosenthal, 2000; Yang et al., 2014).Coordination is necessary to handle the dynamic and unpredictable aspects of the programs, which requires for group people to work together to achieve higher results (Chiocchio, Forgues, D., Paradis and Iordanova 2011).

Empirical recognition is among the crucial and essential activities while working on projects and serves as a considerable measurement of project success; in which the reliability of the whole teamwork depends about how successful the collaboration between the participants was and thus contributes to the project's improved performance with respect to the triple constraint of the project (Hogl and Parboteeah, 2003).

Task complexity may be a collection of properties inheritable by a task. These properties (like priority, due date, duration, and urgency) outline the problem of this tasks and its significance to a performing artist (a one that ought to do the task). Definition of the construct, Human decision processes and structure behavior, Task complexity (Wood, 1986). It's the degree of actions or tasks that are difficult and that we must complete those tasks. It's called task complexity.

Comprehensively, authors suggested that project team members ' job description (primarily task complexity) has encouraged everyone to share their experience with one another, demonstrating that sharing of information demands strong communication platforms in order to communicate effectively the necessary information within members of the team. (Wood, 1986) Justified that the complicated system and tasks required involve collective decisions to determine each alternative. Difficult decisions have to be made in companies, and integrity is the basis for taking such actions and decisions for that purpose.

In so many organizations the main component of employment is a team (Philips, Dunford, & Melner, 1999; Rousseau et al., 2006). Group members cooperation is a core component of performing a mission within an organization. Virtual collaboration relates to "a method in which two or more parties work attentively together to obtain mutually benefited results," and plays an important role in interpersonal results (Phillips, Lawrence, & Hardy, 2000).

In today's world, this need for inventive and sudden developments is going to increase at the greatest intensity as the sustainable market grows, with complexity becoming the inbuilt function, Yet convincing the company to move through operational to projected organizations and requiring efficient virtual collaboration across management team members to meet massive market demands (Pinto and

Pinto, 1990). It was also stated well-coordinated and virtual collaborative teams are leading to successful projects and also that the teamwork and virtual collaboration are also being strengthened in teams (Pinto and Pinto, 1990) Who interacted efficiently, including formally and informally, in addition to share the useful and necessary facts whenever necessary and important information followed to the optimum medium (Pinto and Pinto, 1990).

Although virtual collaboration is sometimes viewed to be a one-dimensional phenomenon in several other scientific studies, scholars suggested that virtual collaboration is a multi-dimensional phenomenon comprising of fairly unique, but linked, aspects of group member attitudes, which are communication, interaction, and information sharing (or exchange of ideas) (Rousseau et al., 2006). Team collaboration relates to "external effort's willing commitment to the execution of interlinked tasks" (Wagner, 1995), and is expressed by activities and procedures needed to work together while performing duties. Team cooperation is the gesture of "trying to integrate the activities of the members of the team to make sure that the task fulfillment within the time limits maintained" (Rousseau et al., 2006), That is involved in completing a task over a specified time period without wasting energy. Information transfer (as well as exchange of information) shows the level at which members of the team communicate and gather task-related data and information across others, therefore that the team's logical thinking, common interest as well as other task-related abilities (Baruch & Lin, 2012). Baccarini (1996) recommended that taking into consideration uncertainty in addition to task complexity and advancement may help tackle the highly complex nature of projects. Tatikonda and Rosenthal (2000) said the difficulty of the project is clearly associated with the interactions between hierarchical aspects and sub goals.

The project's unpredictable nature is also an unfortunate reality of the estimated groups; however, the latter's pessimistic significance can also be stopped or diminished in team-work. The positive correlation between team work and project success was established while working in teams (Yang et al., 2011). (Yang et al., 2011) has specified team work in the favor of coordination between teammates, virtual team collaboration and consistency; from which virtual team collaboration

is among the most crucial elements that defines good teams' success and is the obvious result of the unique nature of the task of the project. In addition, several authors identified a strong link between successful virtual collaboration and its effects on project success compared to the effective frequency of the virtual team's collaborative efforts (Um and Kim, 2018; Dyer, 1997).

Team and coordination throughout the project development became the need to attain strategic outcomes and demands virtual collaborative efforts on the part of each participant because if employees are unable to establish general understanding between teams then the process takes hours and is not successful towards project success (Levesque, Wilson, J. M., and Wholey, 2001). It has also been shown that specificity among all the employees and task enable the individuals of the team competing and have a well-coordinated defensive system at which communication also depends on the existence and level of task complexity. Hence being the back-drop to project success. Since many authors have shown, the unique nature of the tasks prevents the performance of the project (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000; Peng et al., 2014), the virtual collaboration has proven to be the basis for new product design. Virtual collaboration encourages group members to tackle with the unclear and unpredictable situation in this kind of context that the negative effect of task complexity on results is minimized.

According to the discussion above it is stated that,

Hypothesis 04:

Task Complexity mediates the relationship between virtual collaboration and project success.

2.5 Trust moderates the relationship between virtual collaboration and Task Complexity

Scholars claimed that trust is a significant component to figure out and retain emotional agreement. When employees trust their manager or leader, they make an extraordinary worth relation with their managers or leader. In project based the

organizations trust is a significant variable (Argyris, 1962; Carter & Mossholder, 2015).

(Rousseau et. al., 1998) said that , trust is observed as a emotional state containing the purpose to admit exposure based on beliefs of positive aims or activities of other's, when we are linked with manager or leader trust so we assume McAllister's explanation of trust which is that "the range to which an employee is confident and enthusiastic to perform on the base of the arguments, activities, and results of other" (McAllister, 1995).

The enhanced sensitivity towards opportunistic conduct of such parties is the foundation to trust, meaning that another group cannot be monitored or regulated. Hence, trust could represent as just a substitute for influence then less manage there can be, the stronger a need for trust (Peters, 1988). Trust becomes a vital component for team efficiency in a virtual environment where traditional control mechanisms are minimal at best. Even if there are different types of trust, that the one that perfectly describes trust among employees of the virtual team is trust based on cognition. Cognitive-based trust is a random process and trust decisions are focused on rationally determined risks and benefits. When group members learn new things of other partners, they may implement cognitive schemes to stereotyping or categorizing participants, and interpret their actions with confidence. Moreover, cognitive belief mechanisms cannot probably explain the actual formation of trust. Developing trust between virtual collaborative team members who have no previous work experience with each other will depend on many factors. Some aspect is the tendency of an individual to trust, classified as trust based on personality. The above type of trust defines the determination of an individual to rely onto others (Mayer, Davis, & Schoorman, 1995; McAllister, 1995).

Based on whether there is a conscious or unconscious grouping, level of trust is set appropriately. Meyerson et al. (1996) classified this type of trust "swift trust," to characterize the degree of trust which is taking place in unique and transitional associations. There is a certain empirical proof that trust impacts the average performance of the team but little studies comparing trust to the levels of virtual collaboration across group members. Furthermore, some study suggests that the

teams experiencing decreased level of trust between their participants are much less likely to associate information and opinions that leads to lower results. As for task-related characteristics, we identified task complexity as a key variable affecting trust relationships in a virtual team. Tasks complexity refers the relationships between task inputs, such as require acts and information cues (Wood, 1986). Interconnectedness of tasks (e.g. the amount of communications needed by members of the team to perform the task) is also a feature of the task complexity, influencing the project practices and results of a task performed through a team. Larger task complexity resulted in increased pressures for different types as well as the deep experience, financial resources than decreased task complexity would (Wood, 1986). Despite greater task complexity, groups of people were less secure from their own abilities, and appeared to focus mostly on concerted and mutual actions from another group for their task output (Yan & Dooley, 2013). Those kind of specific circumstances increase the amount of unpredictability in performing a task, which then in turns demands and increases the criticality of positive relation between group members. The virtual collaborative team performing a task with wider interconnectedness would have greater trust between the members of the team than a team trying to manage a lower level of interconnectedness of tasks. Therefore, analysis have also shown that task complexity has a significant impact on the success of the project development aspect, which contains subtask delegation, employee output integration, and scheduling of groupmates coordination (Yan & Dooley, 2013). Apart from these individual inherent properties, the assessment of interpersonal reliability will also require objective coherence among participants. Previous studies have shown that when a mission is conducted as a team, a major antecedent of trust is the level to which one imagines that other participants have similar beliefs and correlated expectations on what to accomplish (i.e., objective congruence).

If people decide that members of the team have correlated task objectives, that they think they can focus on one another and are receptive and open to each other (Chen, Tjosvold, & Liu, 2006). In reality, authors have emphasized the importance

of acknowledging community as a separate dimension of reliability in a virtual collaborative team, that mostly relates to features the executor would have important with the creditor, including a fully consistent or shared vision.

In certain words, trust is everyone's belief in the other's advantageous efforts even though the others are given the chance to do so. Team trust is therefore described as a mutual and accumulation view of trust which members of the team to each other. We therefore characterize virtual team trust (VTT) as a common belief in the specific actions of the members of the virtual team coping with team members' ambiguity or insecurity. Trust has been well established which effects the results of team activities. The meta-analysis showed that the group trust has considerable universal applicability on performance of the team. In specific, trust improves particular risk-taking activities, but this enhances wider collaboration and cooperation team processes. On the other hand, a team lacking confidence will also have serious virtual collaboration issues with higher risk, including hindered exchange of information, misconceptions or personal dispute. Researchers have suggested that the position of trust in teamwork is more prominent in virtual collaborative teams as virtual experiences lacks personal and social contextual signs, such as face expressions, verbal context and vocal inflection, that people have to rely on reading the intentions of others (Cheng et al., 2016). In reality, (Baruch and Lin, 2012) observed that trust in virtual collaborative teams has a more important impact on sharing knowledge than other human capital, like social relationships, and a shared understanding.

The employee's trust on supervisor to reduce the social unpredictability, increasing job satisfaction, operational costs, and rising administrative commitment. So that trust on manager or leader gives self-actualization to the employees which grows self-assurance and creativity in the performance during work (Li & Tan, 2013). Social exchange theory (SET; Blau 1964) refers that, as there is a strong leader and member relation occurs then employees' trust on their manager or leader maintains a long-term relation with the interpersonal contract this shows that trust act as moderator in this connection.

In Kahn's principle (1990), the emotional perception of employees strongly affects employee attitudes with the corporation and its relation with the manager to create employees trust perception and the self-confidence manager plays a vital role in allowing employees to establish better working relationships. the employees' trust in their manager creates a strong emotional connection between both the employee and their manager and increases the relation between the leader and their employee and leads to better results of the subordinates and the institution. Jong and Elf ring (2010) explored that group members' relationship with their managers requires mediation of the team dedication and team communication that results in trust building in group members, and this trust level leads to active performance. Earlier research has shown that subordinate managerial trust has a positive impact on performance of the team, emotional protection, self-actualization, and self-confidence and self-expression during working on project (Li & Tan,2013). So, we expect that the task complexity will influence the degree of trust in a virtual team and the aspects of collaboration. In particular, a team with a higher task complexity will also have a higher degree of team's trust and team's virtual collaboration than a team with low task complexity.

So, the discussion above it is concluded that trust act as a moderator in current study as it strengthens the relationship. Study shows that due to trust a strong relationship build in between virtually collaborative teams and If there is a higher level of trust in these teams then it will be easy for team members to tackle with the task complexities while completing the project. Hence, it is stated that

Hypothesis 05:

Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project.

2.6 Research Hypothesis

H₁: There is a positive impact of virtual collaboration on project success.

H₂: Task complexity is positively and significantly associated with the success of

the project.

H₃: There is a positive and significant association between virtual collaboration and task complexity.

H₄: Task Complexity mediates the relationship between virtual collaboration and project success.

H₅: Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project.

2.7 Frame Work

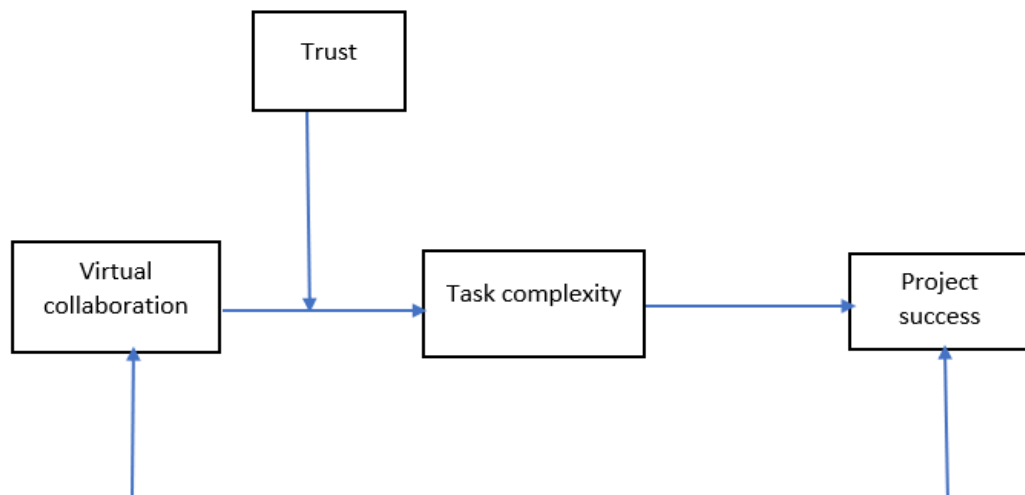


FIGURE 2.1: Impact of Virtual Collaboration on Project Success with the Mediating Role of Task Complexity and Moderating Role of Trust

Chapter 3

Research Methodology

Details on the methodology and measures used to obtain valid results are provided in the following chapter. The claim covers all the details regarding study form, unit of analysis, population and sampling data, measurements and their respective indexes of the reliability along with the items involved in the research being performed.

3.1 Introduction

In chapter three methodology is explain, which is used to find the link between virtual collaboration and project success with the mediating role of task complexity and moderating role of trust in projects. Methodology is the method of data collection and the description of analytical techniques. It also describes the calculation of variables and instruments used to analyze data.

3.2 Research Design

Research design is the description that refers to the combination of different aspects of the study in order to effectively address the research problem Zikmund (2003), identifies that research design is a structure that describes the process and method of evaluating and collecting the information needed for research. Research design

involves the time horizon, setting form, analytical unit and context of the study that are discussed below.

The resulting research's the positivist method which follows the hypothetical deductive method (scientific) which is established on thinking of result the certainty using information, in which earlier study and present philosophies is used to support the expected hypothesis which is then verified empirically for validation of the hypothesis. Scientific method states that, testable declarations i.e. hypothesis outlined based on the present literature which can be approved or rejected by relating various arithmetic results on the gathered data beside the items take to measure the given statements. If the results of statistical checks are different towards suggested hypothesis, the hypothesis is supposed to reject otherwise accepted according to the supported concept and theory. Then it is offered to link the descriptive significance of opposing hypothesis through the analysis that how strongly these hypotheses are valid according to their expectations.

3.3 Type of the Study

This research work is a causal study in which impact of virtual collaboration on project success with the mediating role of task complexity and moderating role of trust in a given project between employees is measured.

3.4 Study Setting

The participants of this study were from various projects and some were freelancers, which include the employees of those organizations, who are working in a public, private and semi government project-based organizations and were contacted to fill up the survey in their natural work ambiance.

3.5 Time Horizon

For this study, the data in nature was cross sectional which were collected at time and data was collected in a round about two months. This research was not much time consuming.

3.6 Unit of Analysis

Unit of analysis deals with what's being studied or who's being studied. Unit of analysis involves people, organizations business, industry or companies etc. It determines the person or an objects character or feature to be evaluated. For the unit of analysis, some students who are working as freelancers and all those employees, who are working in a project-based organization in different cities, are involved in this research.

3.7 Population

Questionnaire is adopted for respondents to measure the level of trust, task complexity, virtual collaboration and project success who have experience in the project teams they had participated in. Respondents were asked to rate their response, on a five-point Likert scale, includes (strongly disagree, disagree, neutral, agree, strongly agree) regarding the relevant factors impacting the constructs and overall success of a project. Practitioner adopts items from the previous researches which were related to variables. Practitioner has not made any change in adopting items. For current study project-based organization's employees are taken as population from various cities and some freelancers. This target population is chosen to ensure that respondents having detailed knowledge of projects and position of responsibility within a project environment.

3.8 Sample Size

While aware of the fact that data collection methods are complicated and it is understood that data collection from the entire population is not possible due to certain constraints such as limited time and lack of resources, sampling is the widely used data collection method. A unique group of people who are the true representations of the entire population are selected for this survey. In general, only project-based organizations have been approached for the present study such as construction projects, telecommunications industry projects. The sample mainly consists of various organizations functional level as well as the partners who actually benefited from the project. The data on independent variable virtual collaboration, moderator trust, and the mediator task complexity was identified by the project team members have direct impact on project success including employees, freelancers who opted to work on any project and consultants etc. 400 questionnaires were distributed to the members of different project-based organizations and to current students who are currently working online on any project or working as a freelancer. Among 198 questionnaires were collected back. In which 28 questionnaires are partially filled while the rest of 170 questionnaires are completely and correctly filled which has been used to find results. The data is collected through adopted questionnaires from both manual and online sources by using Google docs. The procedure of collecting data is somehow difficult and it takes some time. In almost two months we are able to collect relevant and meaningful data. Those questionnaires which has sent through online sources (i.e. e-mails, WhatsApp groups and other social media groups) took some time to be filled whenever manual doesn't take much time practitioner personally visit organizations or industries and fill questionnaire while take some help from her references and through friends and family members to fill forms manually. Convenient sampling technique is used to collect data. Questionnaires will be sent to the public and private sector for data collection. The survey will be conducted by visiting organizations and by some sources i.e. some of the questionnaires would have sent by those who knew some employees who are working online on any project and then it would have been filled those questionnaire by those employees.

3.9 Sample Characteristics

The data of the demographics tested in the current study are; age, gender and qualification of the employees in the project-based organizations and for freelancers who worked on any project.. Questionnaires were rotated to the public and private project-based organizations. The detailed characteristics of the samples are given below:

The valid data set was analyzed using IBM SPSS Statistics 21. Following table measure the frequencies and percentage of gender, age and qualification

3.9.1 Age

First demographic is age in the current study, and respondents sometimes doesn't feel appropriate to reveal their ages. The range was given to the respondent for their ease in collecting the data about their age.

TABLE 3.1: (Demographic) Age

Age	Frequency	Percent
18 -25	65	38.2
26 35	57	33.5
36 50	43	25.3
51 and above	5	2.9
Total	170	100.0

Out of 170 respondents some were those who had the age between 18-25, so it clarifies that the 38.2% majority of the respondents were those who work as freelancers and they had to complete their task on a given period of time had the range of age between 18-25 mostly fill-up the questionnaires , 33.5% were the respondents who had the age range between 26 - 35, and there were only 25.3% of the respondents who have the age range between 36 50 were filled questionnaire completely and only 2.9% of the respondents who have filled questionnaires are the those whose age range lies in between 51 and above.

3.9.2 Gender

Gender is also an important target factor and this category may easily be used to demonstrate the actual value or gender status among respondents. A lot of efforts had been made to ensure equality between men's and women's, but it could be noted that there is still a lot of differences between male and female ratios. Mostly women's are now working as freelancers which have been shown in the table given below.

Table shows the ratios among the females and males. We can clearly see that there are a majority of females in respondents, which are 64.7% and there were 35.3% of males only.

TABLE 3.2: (Demographic) Gender

Gender	Frequency	Percent
female	110	64.7
male	60	35.3
Total	170	100.0

3.9.3 Qualification

The wealth of the entire nation depends upon the level of literacy and is also every person's enormous need, which is why it is perceived the most important demographic of the analysis. Therefore, qualification is one of the essential demographics of any research after all other aspects.

In the Table given below, it is shown that there are huge number of respondents who have the qualification of graduate which include the degrees of bachelors and masters and they have the percentage of 67.1% among the total number of respondents, 31.73 % respondents were those who have the qualification of post graduate 1.17% respondents were those who have the qualification of intermediate.

TABLE 3.3: (Demographics) Qualification

Qualification	Frequency	Percent
Intermediate	5	1.17
Graduate	114	67.1
Post-Graduate	51	31.73
Total	170	100.0

3.10 Data Collection Techniques

3.10.1 Measurement of Variables

Questionnaire for all variables are adopted from previous researches, which are developed by known researchers. They develop these questionnaires after following a proper method of research. The questionnaire which is used in this research have two sections one is based on demographics includes, (age, gender, experience and job experience) and the second one based upon variables of the study which includes (independent variables, dependent variable, mediator and moderator) During the collection of data researcher had faced many problems many people are not willing to fill up the questionnaires some of them argued a lot that they have no time some people fill up blindly. English language is used as a medium to collect data for research study by various project-based organizations. All the information, which is collected during the fulfillment of questionnaires, is only used for academic purpose and will be kept confidential. All the items were self-evaluated by the respondents without the help of researchers. Variables are measured on a five-point Likert scale, includes (1: strongly disagree 2: disagree 3: neutral 4: agree 5: strongly agree).but this scale is only used in dependent variable project success (PS) mediator task complexity (TC) and trust .Similarly the independent variable virtual collaboration (VC) also measures on five point Likert scale which includes (1: strongly dissatisfied 2: dissatisfied 3: neutral 4: satisfied 5: strongly satisfied) the change in scale is depend on the nature of questionnaires.

3.11 Description of Variables

3.11.1 Project Success

To measure Project success a five-item questionnaire is adopted. A five-point Likert scale is used to gather responses includes (1: strongly disagree 2: disagree 3: neutral 4: agree 5: strongly agree). Slevin & Pinto (1986) developed this questionnaire. Practitioner adopted items because these items are related to the current study.

3.11.2 Virtual Collaboration

To measure virtual collaboration a three-item questionnaire is adopted. Practitioner adopted items which are related to the current study. A five-point Likert scale is used to gather responses which includes (1: strongly dissatisfied 2: dissatisfied 3: neutral 4: satisfied 5: strongly satisfied) the change in scale is depend on the nature of questionnaires. This questionnaire was developed by Valacich, J.S (1992).

3.11.3 Task Complexity

To measure task complexity a seven-item questionnaire is adopted. A five-point Likert scale is used to gather responses includes (1: strongly disagree 2: disagree 3: neutral 4: agree 5: strongly agree). Basically, the questionnaire was developed by Goodhue, Dale (1995), Practitioner adopted items because these items are related to the current study.

3.11.4 Trust

This variable has seven items which will be measured on five Likert scale includes (1: strongly disagree 2: disagree 3: neutral 4: agree 5: strongly agree). Practitioner adopted items which are related to the current study. Schoorman, F. D. (1996), developed this measure.

TABLE 3.4: Description of Variables

Variables	Instruments	No.of items
Virtual Collaboration	Valacich, J.S. (1992)	03
Task Complexity	Goodhue, Dale (1995)	07
Trust	Schoorman, F. D. (1996)	07
Project Success	Slevin & Pinto (1986)	05

3.12 Statistical Tool

In order to analyze the correlation between the independent variable Virtual collaboration and the dependent variable Project success, a single linear regression analysis is performed. If multiple factors are present and you have to analyze their effect, the study of regression is used. So, this study clearly shows that the previous research towards these variables is still rejecting or approved the hypothesis.

After the linear regression, the Andre F Hayes (2013) analysis of three phases is used to evaluate the further measures. In the first step, we put our dependent variable project success in outcome column. In the second step, we put our independent variable virtual collaboration in the independent variable column, and after that in third step, we place all the demographics in the covariant column. Therefore, according to Preacher and Hayes, we pick our model number to perform moderation and mediation.

3.13 Pilot Testing

If we decide to carry out any experiment on a big scale, before that it can be a useful technique to carry out a pilot testing because we could confound various types of risks and excessive of time and resources. Therefore, in the beginning there were about 40 questionnaires selected for a pilot test which has been sent to respondents to ensure that the findings are accordance to our hypothesis or not. It is obvious when the pilot testing was done that there was no problem with the measurement and the variables.

3.14 Reliability Analysis

Reliability testing is used in research to verify the accuracy of the data generated by any measurement technique. Individual reliability means that all objects should be calculating the same things in order to correlate all items with each other. If there are factors, measurements and number of items that have been checked over and over again or many times before your analysis, then there is a reliability method that is used to verify the same consistent results for such cases. Reliability of scale describes the scales ability to deliver the same results when it is experienced for many times. Practitioner conducted the reliability analysis through Cronbach alpha, as it actually indicates individual reliability against each variable and also proves that there is a link between them or not.

The value of Cronbach alpha lies between 0 to 1. While the value of Cronbach's alpha 1 is perceived as higher. If value is higher than these two digits it shows higher reliability of the variable. If the values are above than 0.7 of alpha, then these are known as a reliable but if these values of alpha is less than 0.7 then it is known as less reliable.

TABLE 3.5: Reliability Analysis

Variables	Cronbach's Alpha	No of Items
Project Success	0.709	5
Task Complexity	0.831	7
Virtual Collaboration	0.987	3
Trust	0.580	7

In Above mentioned table we see that values of Cronbach's alpha of all variables through which we get to know how reliable our all variables are. If the values are greater than 0.70, so the variables are reliable and consistent. As we can see that the value of Cronbach alpha for independent variable Virtual collaboration is 0.98 which means it is greater than 0.7 it shows that independent variable is reliable. While the value of Cronbach alpha for dependent variable Project success is 0.70 which lies in the range so this variable is also reliable. Then the value of Cronbach alpha for mediator which is task complexity have a reliability of 0.83

and moderator trust is 0.58 it is also reliable and we consider all variable are reliable because sometime number of items matter if number of items increased the reliability can also increase and if the number of items are less then reliability is also less so this value can be considered. To have good and consistent reliability values always choose a questionnaire with more than ten number of items.

3.15 Data Analysis Tools and Iechniques

The valid data set was analyzed using IBM SPSS Statistics 21. This software is used to collect results for Reliability, descriptive frequency, correlation and liner regression. The reliability test is used to measure the consistency for the data, the correlation is used to measure the connection between variables and the analysis of liner regression is used to measure the reliance of the variables. To measure the regression analysis for mediation and moderation we used (Preacher and Hayes) method.

3.16 Analytical Techniques

1. Those questionnaires were selected to collect the result which was filled completely and appropriately.
2. For each variable practitioner assigned a code which was used to the analyze the data.
3. Frequencies tables were used to illustrate the properties of the sample.
4. There was descriptive statistics was performed, by using numerical values.
5. By using Cronbach alpha, the reliability of every variable was tested.
6. Analysis of Correlation was executed to analyze the significance context between variables.
7. Linear regression was performed to test the relationship between the independent and dependent variable.

8. (Preacher and Hayes) method is used to examine mediation and moderation.
9. All the hypothesis were accepted and rejected by using Preacher and Hayes method.

Chapter 4

Results

4.1 Descriptive Statistics

Standard deviation (abbreviated as Std. Dev or SD) refers to the computed value that helps to understand the extent to which the data is spread from or concentrated around the average (mean). In research, standard deviation is calculated by the researchers to know how spread the responses are and either the respondent's rate mostly in the middle of the scale i.e. 'Neutral' or did some opt for 'strongly agree' or 'strongly disagree' too. A low standard deviation implies that most points of data are close to average value while high value shows that data points, on average, are far from average and looks spread out. Generally, standard deviation does not indicate 'better' or 'worse', 'acceptable' or 'unacceptable', it is used purely as descriptive statistics describing the distribution in relation to the mean.

D.S makes the list of the results. This shows clearly the value of standard deviation (SD) of variables, then tell us about the minimum and maximum value of all variables and also calculate the mean of all variables.

In the table 4.1, the mean, standard deviation and correlation between the factors used in the recent research is also shown. The correlation describes the dimensions and existence of the relationship between the variables.

TABLE 4.1: Descriptive Statics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Project success	170	2.60	5	4.1459	0.47607
Task complexity	170	2.29	5	3.8630	0.59531
Trust	170	2.57	5	3.4353	0.50161
Virtual collaboration	170	3.00	5	4.3392	0.50046

Project success is a dependent variable which has a standard deviation of 0.47 and has a mean value of 4.14. Virtual collaboration is an independent variable and have a standard deviation of 0.50 and have a mean value of 4.33. Task complexity play a role of mediator in between independent variable virtual collaboration and dependent variable project success which have a standard deviation of 0.59 and a mean value of 3.86. Trust act as a moderator in between independent variable virtual collaboration and dependent variable project success which have a standard deviation of 0.50 and have a mean value of 3.43.

4.2 Control Variables

In order to measure the impact of demographic variables on dependent variable (Project success), one-way ANOVA test was conducted for covariates impact. One-way ANOVA test is used for analysis of variance by comparing means of two or more independent groups to determine the significant difference associated with population means. The F test in one-way ANOVA indicates whether or not there is any significant difference in the means while p-value shows significance level upon which the acceptance or rejection of null hypothesis is established. If p-value is less than 0.05 then a significant impact of demographic variable on independent variable is considered while if it is more than 0.05, then the impact is comparatively insignificant. In case of significant impact, the demographic variable is to be controlled in rest of the computations. It is identified from ANOVA's findings that all demographics variables gender, age and qualification are significant so they are monitored.

TABLE 4.2: Control Variable

Demographics	F	Sig.
Gender	1.024	0.384
Age	0.908	0.438
Qualification	1.182	0.318

4.3 Correlation Analysis

Correlation refers to the bi-variate analysis used for investigating and measuring association and strength of relation between two variables range that is from -0.1 to 0.1. The relationship is checked for its linearity by using a scatter plot of the variables where independent variable is plotted on x-axis and dependent variable is plotted on y-axis. The strength of association is higher if scatter of points is nearer to a straight line. The perfect degree of association is indicated by 1. Whereas the intensity of the relationship between two variables can be determined by magnitude value, and the magnitude value can generalize by the distance of the correlation from the zero. If the correlation is significant from zero, the relationship between the two variables will be strong, and vice versa. The value of zero correlation implies the two variables are unrelated to each other. Positive and negative sign represents the relationship's existence, i.e. the positive sign of correlation coefficient describes the direct relationship among two variables and is clarified as the increase in one variable contributes to an increase in the other and vice versa; Therefore, in the same way, the negative co-efficient sign represents the indirect relation among variables, such as the increase in the first variable, which in the second variable has a decreasing effect. Pearson's correlation analysis was carried using SPSS to find the association between the independent variable Virtual collaboration (VC), dependent variable Project success (PS), mediating variable Task complexity (TC) and moderating variable trust. The table below shows the correlation between the variables under study. In addition, the correlation values represent the nature and frequency of the relation between the variables.

TABLE 4.3: Correlation Analysis

Variables	PSDV	TCMED	VCIV	Trust Mod
PSDV	1			
TCMED	.468**	1		
VCIV	.079**	.037 **	1	
Trust Mod	.390**	.353**	.038**	1

*Alpha reliabilities are given in parenthesis **Correlation is significant at the 0.01 level (2-tailed). N=170. *P < 0.05, P < 0.01, P < 0.001. (Project success (PS), Virtual collaboration (VC), Task complexity (TC) and Trust).*

Task complexity is significantly and positively correlated with Project success ($r = .468$) whereas correlation is significant at .01 ($p < .01$). Trust which act as a moderator in the study have a positive and significant correlation with Project success the value of ($r = .390$) and significant value is .01 such as ($p < .01$). Trust is positively and significantly correlated with Task complexity ($r = .353$) and significant interval is .01 ($p < .01$) Similarly, virtual collaboration with task complexity have a positive and significant relationship ($r = .037$) and significant at .01 interval ($p < .01$) whereas virtual collaboration is significantly and positively associated with the project success ($r = .079$) and significant is .01 interval ($p < .01$).

4.4 Regression Analysis

We have performed correlation analysis to explore the relation between variables so we have not just focused on correlation because it explains only the existence of variables however it doesn't indicate the informal link between variables. Thus, in order to further examine and investigate the relationship between virtual collaboration, which is independent variable in current study, and project success (dependent variable), the statistical method of regression analysis is used. Therefore, we perform regression analysis to know about the actual results of the variables depended upon each other. This technique of predictive modeling and analyzing data indicates the influence along with strength of impact and causal relationship

between independent variables on dependent variables and is used for forecasting. Regression analysis tells us about that variables depend upon one another that is Regression to an independent variable by which it is regressed. To measure and predict the extent of linear relationship between dependent and independent variables, the statistical data analysis technique of linear regression is used. In single linear regression, relationship between one independent variable and one dependent variable is predicted while in multiple linear regression two or more independent variables are used instead. In this current study, Process by Andrew F Hayes (2013) analysis is used for moderation and mediation analysis.

For examining the effect of mediator, which is trust link between the virtual collaboration and task complexity, the mediation regression analysis is performed. To perform the mediation and moderation by Preacher and Hayes, we have to follow three steps and all steps must perform individually for moderation and mediation according to the model number, which is 14.

Hypothesis # 01

There is a positive and significant impact of virtual collaboration on project success.

TABLE 4.4: Simple Regression Analysis

Predictor	Project success			
	β	R^2	SE	Sig
Virtual collaboration	.079	.006	.043	.000

P<.05, **P<.01, *P<.001 significant level*

As above table shows the values of simple regression analysis for H1 in which table shows the direct relationship between independent variable virtual collaboration and dependent variable project success. In Hypothesis H1, we assumed that virtual collaboration is positively associated with project success. If we check the final results of this relationship, we can see that in the table of simple regression analysis the β coefficient value = .079, R^2 value is = .006, SE which shows the value of standard error is = .043, and the relation is significant at $p = .000$. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in virtual collaboration leads to a .079-unit

change in project success. The p value of 0.00 indicates that relationship is highly significant. So, in this case the 1st hypothesis is accepted on the base of simple regression analysis.

Hypothesis # 02

Task complexity is positively and significantly associated with the success of the project.

TABLE 4.5: Simple Regression Analysis

Predictor	Project success			
	β	R^2	SE	Sig
Task complexity	.468	.219	.055	.000

P<.05, **P<.01, *P<.001 significant level*

In H2 we assume that the task complexity is positively and significantly associated with the success of the project. If the projects are complex, and we find many task complexities in a project we need top management to support and to deal with the task complexity. Only the manager or leader of the team handle complexities and difficulties in a project which the employees face during working. As the table mentioned above it shows the positive value of $\beta = .468$, $R^2 = .219$, $SE = .055$ and $p = .000$. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in task complexity brings a .468-unit change in the project success. β is showing a positive value in results which indicates that the task complexity is positively related to project success and the relationship is significant at .000 interval. Task complexities can be of many types, but its top management responsibility to tackle with such type of circumstances and provide easiness to their teams so that they can work hard and try to complete their work in given time so the project leads toward success. So according to the above-mentioned research task complexity act as mediator because in every type of project whether its big project or small complexity lies. As it is written in literature where there is a higher risk there is a higher return so higher complexity leads project towards success because team members put more effort to complete their work as it is positively associated towards the project

success and have significant impact according to the given model. With the help of given model H2 is accepted by performing the simple regression analysis.

Hypothesis # 03

There is a positive and significant association in between virtual collaboration and task complexity.

TABLE 4.6: Simple Regression Analysis

Predictor	Project success			
	β	R^2	SE	Sig
Task complexity	.026	.001	.037	.000

P<.05, **P<.01, *P<.001 significant level*

In Hypothesis H3, we assumed that virtual collaboration is positively associated with task complexity. The regression results of this hypothesis are given in above Table. Results of regression analysis showed that there is positive and significant impact in between task complexity and virtual collaboration. The β co-efficient value is = .026, $R^2 = .001$, with the p value = 0.00. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in virtual collaboration brings .026 units change in the task complexity, which tells us that the relation among two variables virtual collaboration and task complexity are positive, and the p value of 0.00 indicates that relationship is highly significant. Therefore, it clearly shows that the hypothesis 3 is accepted.

4.5 Regression Analysis for Mediation

Hypothesis 4 was assumed that task complexity mediates the relationship between virtual collaboration and project success. To test the hypothesis of mediation, Model 4 of Process is used which was used by (Preacher and Hayes, 2004). As per Preacher and Hayes, the direct total and indirect effects have to be independently verified when a, b, c and c' paths is tested.

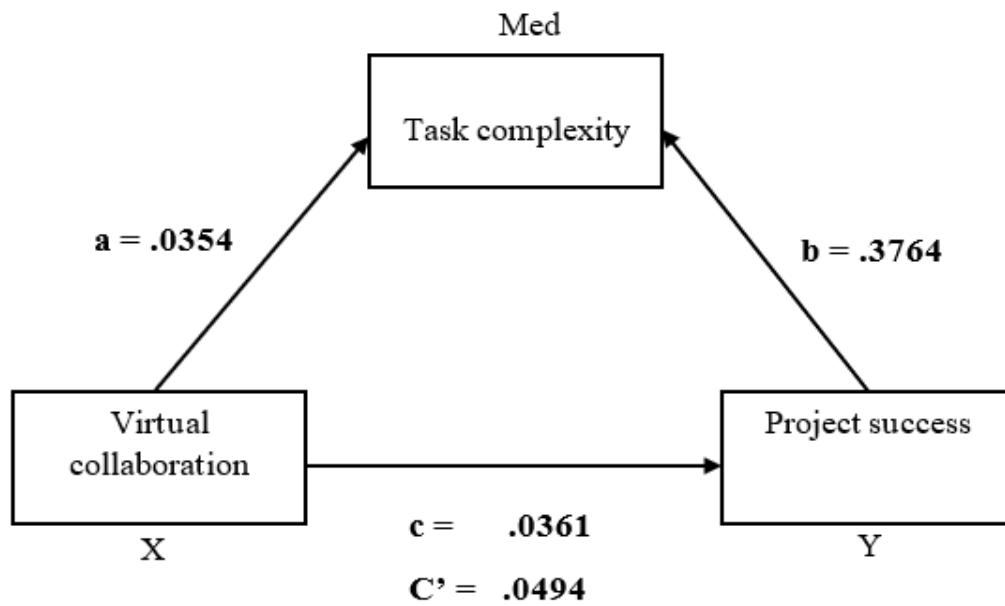


FIGURE 4.1: Mediation Analysis

As we can clearly see the path in the figure 2 which shows path a, b, c, c' and also shows their coefficient values.

TABLE 4.7: Mediation Analysis

IV	Effect of IV on M (a path)	Effect of M on DV (b path)	Direct Effect (c' path)	Total Effect (c path)	Bootstrapping results or direct effect	
					LL 95%	UL 95%
Virtual collaboration	0.0354	0.3764	0.0494	0.0361	0.0223	0.0550

Note: Bootstrap sample size 1000. LL = lower limit; CI = confidence interval; UL = upper limit. $N=170$, Control variables were, Gender, Age, Experience and Qualification, * $P < .05$; ** $P < .01$. Level of confidence for all confidence intervals in output: 95.00

Hypothesis 4 assume that task complexity mediates between virtual collaboration and project success. The results are shown in the table 4.7, which proves a strong justification. Table 4.7 explains that indirect effect of virtual collaboration on project success which have the LLCI lower level confidence interval and ULCI upper-level confidence interval of .0223 and .0550. Both the values of ULCI and

LLCI have the same positive signs and no zero is present between these two values which shows that mediation is present between the independent variable and dependent variable. So, we can conclude that task complexity mediates between virtual collaboration and project success is accepted.

4.6 Regression Analysis for Moderation

Hypothesis 5 was assumed that Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project. So, to test this relationship we have to run moderation analysis by using Process (Preacher and Hayes, 2004) and run model number 7 according to the theoretical framework.

TABLE 4.8: Moderation Analysis

	Co effs	SE	T	Sig	LLCI	ULCI
Trust MoD	0.3031	0.4126	0.7347	0.4636	-0.4636	1.0699

First, we check the impact of trust as a moderator, as we can see in the table 4.8 the value of beta co eff is .3031 and T =.7347 both values have positive sign but according to lower limit class interval LLCI and upper limit class interval ULCI values are (-.4636,1.0699) according to this criteria both the values have different signed and showing a zero lies in it which shoes that there is no regression coefficient present between these values so hypothesis is rejected.

TABLE 4.9: Virtual collaboration*Trust Mod

	Co effs	SE	T	Sig	LLCI	ULCI
VCIV *Trust MoD	.0500	.1246	.4011	.6889	-.1813	.2813

For the hypothesis of moderation. Hypothesis 5 states that Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project. Table 4.9, provide results for the explanation of hypothesis

5. The interaction term of “virtual collaboration independent variable and trust as a moderator” moderates the relationship. AS we can see in the above table that the lower level and upper-level confidence interval of $-.1813$ and $.2813$ and both have the different sign and values clearly shows that zero is present between two values. Likewise, the interaction term stated that there is no regression coefficient. However, we stated that trust as a moderator strengthen the relationship but results interpret that it weakens the relationship between variables Hence, we conclude that hypothesis 5 is not supported for moderation. So, hypothesis is rejected.

TABLE 4.10: Hypothesis

Hypothesis	Statements	Results
H1	There is a positive and significant impact of virtual collaboration on project success	Approved
H2	Task complexity is positively and significantly associated with the success of the project.	Approved
H3	There is a positive and significant association between virtual collaboration and task complexity.	Approved
H4	Task Complexity mediates the Relationship between Virtual Collaboration and Project Success.	Approved
H5	Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project	Rejected

Chapter 5

Discussion and Conclusion

5.1 Discussion

Previous studies are detailed in the field of virtual collaboration and project success and has justified their direct relationship between the two variables (Yang et al., 2014; Tatikonda and Rosenthal, 2000). Past research has experimentally shown that the complexity of the project must be reduced by using the collaborative tools together with the skilled and expert employees and give a positive contribution to the project success (Peng et al., 2014).

The main idea of the research is to study the relations between virtual collaboration and project success for the organizations which are project based only. This study also showed the mediating effect of task complexity between virtual collaboration and project success. The moderating effect of trust between task complexity and virtual collaboration is also studied in this research and as to know its combined impact on task complexity and on virtual collaboration.

This study analyses some results which indicates that virtual collaboration has a positive impact on project success whereas, task complexity has a positive impact on project success it explains that every time a complex situation is encountered during the life cycle of the project, this proves to be one of the reasons why project success is diminished. The study displays the positive impact of virtual collaboration on task complexity which further effect positively towards the project success.

Accordingly, accepting H1, H2, H3 and H4 while developing a positive relationship between virtual collaboration and project success via project complexity as a mediator.

This study highlighted trust as a moderator. The analyzed data of moderator positively moderates the relationship between task complexity and virtual collaboration in accordance with the project success i.e. trust doesn't play a strong role of moderator according to the results subsequently, it tends to reject the 5th proposed hypothesis i.e., H5. The inclusive discussion on each hypothesis is as following:

5.1.1 Hypothesis 01

There is a positive and significant impact of virtual collaboration on project success.

In this current study the next source of virtual team collaboration is motivational coordination. Incentive cooperation is perhaps to which the group member belonging to a particular team to share their risks, benefit and cost and loss and gains, and strongly support to their contribution to the project (Um and Kim, 2018) and let everyone operate towards to achieve the mutually identified goals and objectives and serves as a way for members to continue on the path to achieving the mutually identified targets (Um and Kim, 2018).

It can be convincingly argued on the basis of the afore mentioned literature that the strong virtual collaboration seems to be the key towards success while new project is being implemented.

The research would support project-based organizations, project managers, consultants, students and practitioners. Study will be beneficial for project based organization, for training project managers and team members, for consultant, student and practitioner because the current study provide information about the project management environment, the researchers concentrated on project success in the management literature and found many important factors for the success of the project, the research also relates to the critical success factors for project

success in which the main component of critical factor is virtual collaboration. (Ika, 2009)

we check the final results of this relationship, we can see that in the table of simple regression analysis the β coefficient value = .079, R^2 value is = .006, SE which shows the value of standard error is = .043, and the relation is significant at $p = .000$. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in virtual collaboration leads to a .079-unit change in project success. The p value of 0.00 indicates that relationship is highly significant.

According to the above-mentioned literature it is concluded that increase in virtual collaboration among team members have a strong positive and significant impact on the project success.

5.1.2 Hypothesis 02

Task complexity is positively and significantly associated with the project success.

Task complexity is positively associated with the success of the Project success. The hypothesis is approved because result shows the positive value of $\beta = .468$, $R^2 = .219$, $SE = .055$ and $p = .000$. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in task complexity brings a .468-unit change in the project success. β is showing a positive value in results which indicates that the task complexity is positively related to project success and the relationship is significant at .000 interval. Consequently the effect examined is supported by the previous literature and previous studies that suggest the decrease in task complexity is positively impact on the project success (Tatikonda & Rosenthal, 2000; Gidado, 1996; Thomas & Mengel, 2008; Xia & Lee, 2004; Moore, Payne, Autry, & Griffis, 2016; Abdou, Yong, & Othman, 2016). In this current period projects popularity has increased a lot and at the same period innovation and complexity has been gradually dilute as per

main features of the projects as the time passes in order to achieve the competitive benefit during the world for positive development and the project success but at the same period increase in the level of task complexity tends to decrease the significances of the success of the project because the level of complications is increases. Therefore, it is understandable that reducing task complexity will suddenly succeed and recruit comfort in the execution of tasks and actions of the given project to gain the required project goals to accomplish success in the project.

5.1.3 Hypothesis 03

There is a positive and significant association between virtual collaboration and task complexity.

Team and good teamwork throughout the task growth cycle is becoming the requirements to accomplish institutional targets and needs collaborative efforts from each participant because even if participants seem unable to establish shared understanding between teams otherwise the process will take time and it is not successful for project success (Peng et al., 2014). The β co-efficient value is = .026, $R^2 = .001$, with the p value = 0.00. The R^2 value indicates the determination coefficient while the β value reveals the rate of change showing the change of 1 unit in virtual collaboration brings .026 units change in the task complexity, which tells us that the relation among two variables virtual collaboration and task complexity are positive, and the p value of 0.00 indicates that relationship is highly significant.

It has also been proven specificity between the participants as well as the method helps the respondents of the team competing to get a well-coordinated management structure in which teamwork also depends on the existence and amount of task complexity (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000). Subsequently the project success antecedents, as so many studies have shown, the dynamic existence of the tasks obstructs project success (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000; Peng et al., 2014).

5.1.4 Hypothesis 04

Task Complexity mediates the Relationship between Virtual Collaboration and Project Success.

To test the hypothesis of mediation, Model 4 of Process is used which was used by (Preacher and Hayes, 2004). As per Preacher and Hayes, the direct total and indirect effects have to be independently verified when a, b, c and c' paths is tested. The LLCI lower level confidence interval and ULCI upper-level confidence interval of .0223 and .0550. Both the values of ULCI and LLCI have the same positive signs and no zero is present between these two values which shows that mediation is present between the independent variable virtual collaboration and dependent variable project success.

The project's unpredictable nature is also an unfortunate reality of the estimated groups; however, the latter's pessimistic significance can also be stopped or diminished in team-work. The positive correlation between team work and project success was established while working in teams (Yang et al., 2011). (Yang et al., 2011) has specified team work in the favor of coordination between teammates, virtual team collaboration and consistency; from which virtual team collaboration is among the most crucial elements that defines good teams' success and is the obvious result of the unique nature of the task of the project. In addition, several authors identified a strong link between successful virtual collaboration and its effects on project success compared to the effective frequency of the virtual team's collaborative efforts (Um and Kim, 2018; Dyer, 1997). It has also been shown that specificity among all the employees and task enable the individuals of the team competing and have a well-coordinated defensive system at which communication also depends on the existence and level of task complexity. Hence being the backdrop to project success. Since many authors have shown, the unique nature of the tasks prevents the performance of the project (Yan and Dooley, 2014; Tatikonda and Rosenthal, 2000; Peng et al., 2014), the virtual collaboration has proven to be the basis for new product design. Virtual collaboration encourages group members to tackle with the unclear and unpredictable situation in this kind of context that the negative effect of task complexity on results is minimized.

5.1.5 Hypothesis 05

Trust moderates the relationship between virtual collaboration and task complexity such that it strengthens the relationship between virtual collaboration and task complexity during the success of the project.

The lower level and upper-level confidence interval of $-.1813$ and $.2813$ and both have the different sign and values clearly shows that zero is present between two values. Likewise, the interaction term stated that there is no regression coefficient.

Earlier research has shown that subordinate managerial trust has a positive impact on performance of the team, emotional protection, self-actualization, and self-confidence and self-expression during working on project (Li & Tan, 2013). So, we expect that the task complexity will influence the degree of trust in a virtual team and the aspects of collaboration. In particular, a team with a higher task complexity will also have a higher degree of team's trust and team's virtual collaboration than a team with low task complexity. According to the previous researches trust plays a role of moderator between task complexity and virtual collaboration in foreign context but if we can see the results according to the Pakistani context we got negative results means hypothesis is reject that trust doesn't play a role of moderator because if we check the level of trust and virtual collaboration in Pakistani project based organization we got to know that people is more easy towards face to face interaction and trust develops between team member if they collaborate on daily bases or another possibility of rejection is that mostly people do not share their experience and accurate information due to some security reason.

5.2 Practical and Theoretical Implication

The study made important theoretical as well as realistic contributions in the literature. The research has supported literature on variables like task complexity, virtual collaboration, trust and project success. The knowledge available is relatively modest on virtual collaboration in relation with task complexity in projects

and project success. The research is contributed in a way that mediating relation of task complexity is not been tested between virtual collaboration and project success, but it had been tested as a mediating variable as well as tested as independent variable in some studies.

The study shows very important realities by defining the impact of virtual collaboration on project success with relating to task complexity, every time team work is preferred to improve the performance of the project. The study indicates that minimizing task complexity is necessary for better success of the project, and is minimized by team members' collaborative efforts. It is observed that the complexity of the tasks and goals creates a great deal of confusion among the participants and can be reduced by sharing of information and mutual decision-making among the members, which in effect is part of the team members' collaborative efforts (Yan and Dooley, 2013; Simatupang and Sridharan, 2002; Peng et al., 2014). Another leading factor is the moderating effect of trust between task complexity and virtual collaboration, Where the data suggest that trust in the complex situation breaks down the Member's collaborative efforts because complex situations can be viewed in the opposite manner. however, task complexity should have been reduced by exchanging the right information including trust and collective decisions, rather than engaging and building relationships between the participants. From all the results of this study, it is obvious that the task complexity of the project can be effectively coped up by improving the virtual collaborative efforts of group members to increase the project performance to get success in a project. It can also be justified that organizations must focus on helping individuals to virtually collaborate and have trust on other team members accurately in order to cope up with complex situations and promote project success.

In the strategic business environment, the study is important. In this era of globalization, in which the industry is moving quickly to globalization, task complexity and instability become one of the obvious characteristics of the projects, and the organizations need strategies to cope up with them. Time and creativity in the context of projected corporations tends to the task complexity of the project, making it one of the innate characteristics of the enterprise.

The study then makes a practical contribution to the industry, which requires virtual collaboration efforts by the entire team and have a strong level of trust among all members of the group in order to minimize complexity. Where the situation is more complicated to avoid misleading data, the necessary information with a shared decision-making approach must be implemented in order to enable the participants to cooperate and improve the project output. Eventually, the research supported the reason high complexity leads to high levels of collaboration that will improve project quality by reducing the direct and negative effect of complexity on project success whereas task complexity mediates the relationship and trust act as a moderator as it strengthen the relationship between complexity and collaboration because if a project team have a high level of trust between group members due to this, trust develops a positive relation among employees they will collaborate more to tackle with the complex situation and try to help each other because ambiguous situations are difficult to understand and interpret. Moreover, the strategy needed for increasing project efficiency is collaboration. The research then contributes effectively towards projected organizations.

5.3 Limitation of Research

There are always few limitations in research as it is not possible to cover all aspects in one study. This study has filled few research gaps by adding knowledgeable facts in literature. On the other hand, there are some limitations linked with this study because of time and resource constraints. The study is directed only to the project-based organizations and the results may not be generalized to other sectors. The target population of the study mainly was the accessible projectized firms leaving many other relevant project-based organizations. Moreover, it was practically not possible to encompass every dimension and abstraction of virtual collaboration and project success, therefore, generalizability of results is still a question. Additionally, we use convenient sampling method and choose the sample which was easily accessible to us which again narrow the probability of results

generalization. The results may be different because of strong contextual and situational factors.

5.4 Future Research Directions

Research related to this topic open many new opportunities for researches who wanted to work on this topic in future. In this current study we theoretically find the impact of virtual collaboration on project success but in the future researcher directions practitioners can examine the impact of virtual collaboration on specific team performance of the complex project with related variables or along with the other dimensions of collaboration and also used the related variables to find that how virtual collaboration can effect project planning activities and performance during the completion of a successful project. This study focused on project-based organizations only, this actually gives a way to the researchers forward to examine and replace the model in organizations including (both public and private sector) other than project-based organizations researchers have to examine similar impact with a larger sample size just to justified that is large sample size have any impact on the results or not. However, the relationship between virtual collaboration and project success may studied with other mediating and moderating variables such as training and performance which have positive impact on project success when encountered with complexity. Further researches can also focus on moderating role of other variables among the relation in between project complexity and team collaboration. On the other side, trust can be used as a mediation after moderation i.e. mediated moderation, because after virtual collaboration, communication can assist group members to have better team performance as a team to achieve a specific project objective. After that, leaving for future researchers they have to test the moderator in some other way or other moderators that can strengthen the virtual collaborative efforts. However, it is obvious that many researches know that time is the most crucial domain in the field of projects, therefore, deadline or time consciousness are some of the variables which may be utilized for further research studies in order to examine their impact to tackle the complex

situations and reactions on them within the given time limit. In order to future research direction, we also suggest that the future practitioners have to use some other data collected technique's, as this current research has some limitations with relating to these sampling techniques which are used to collect information from the targeted population. The outcomes and the level of significance towards the study will be helpful for the future practitioners to be focus on related area to link the relationship between virtual collaboration and project complexity to different other dimensions of the variables like staff development, commitment, performance and many others. And future researcher can Also increase the sample size of the study. If researcher used those ideas then the result may be changed or those hypotheses which rejects during this current study can be updated and retested, seems to have the possibility of getting different outcomes. As a result, future research may be able to develop the above guidelines in order to contribute to literature.

5.5 Contribution of Study

Previous researchers have explored that the project success becomes additional probably because the virtual collaboration will increase and therefore the virtual collaboration increases as the level of trust within the project increases. The degree of risk present within the project was found to own no important link with the amount of trust full-fledged in the project. This alters the wide accepted view that the link between risk and trust is reciprocal and contradicting the results revealed by (Daim, Ha, Pathak & Bynum, 2012) that contended that an appropriate degree of risk is liable for a rise within the level of trust during a project. Overall study predicts that project complexity and trust don't play a vital role in project success.

These findings address the gap in literature on the factors that verify trust, collaboration and project success and therefore the strength of the association/link between them. Some sensible insights for project management are that by promoting collaboration and trust during a project by taking knowing of every construct's factors, the chance of project success may improve. In line with previous researches

and current result there's need to study a lot of on this topic relating with task complexity and check the correct result with large sample size that whether or not the task complexity lies in project success in presence of virtual collaboration and trust?

5.6 Conclusion

The study is carried out to establish the link between the two variables which are virtual collaboration and project success. Data was collected from Project Based organizations through a questionnaire to associate the relationship between virtual collaboration and project success with a mediating role of task complexity and a moderating role of trust. At least 400 questionnaires were circulated to collect reliable data, whereas, only 170 were used to analyze the results, because all these questionnaires contained the most adequate and accurate information expected for the observation to be carried out in the current study. Statistical analysis shows the reliability, accuracy and relative fitness of the model variables. The model is endorsed by the concept of complexity which suggests that organizations have become the complicated adapted structures and must be controlled by cooperation and coordination.

All the hypothesis was accepted apart from for the moderation hypothesis which shows that trust does not positively moderates the relationship between task complexity and virtual collaboration. This study contributes to the existing literature of virtual collaboration and project success while task complexity plays a role of mediation as project gets more complicated if an employee faced more difficulties so trust with the effect of moderation plays a role among independent variable and with mediation to reduce the implications of uncertainty since literature on studied project management variables is very limited. This research verified an association between collaboration and success through complexity with the impact of trust in Project-Based Organizations.

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Appendix A



**CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY,
ISLAMABAD**

Department of Management Sciences

Questionnaire

Dear Participant,

As a MS research student at capital University of Science and Technology, Islamabad, I am collecting data for my research paper. It will take your 10-15 minutes to answer the questions and to provide the valuable information. I assure you that data will be strictly kept confidential and will only be used for academic purposes. Thanks a lot for your help and support!

Sincerely,

Bushra Yasin

MS (PM) Research Student

Faculty of Management and Social Sciences

**Capital University of Science and Technology,
Islamabad**

Please Provide Following Information

Gender

Female	
Male	

Age

18 -25		26 - 35	
36 - 50		51 and above	

Qualification

Matric		Intermediate	
Graduate		Post-Graduate	

Please read each statement, decide how much you agree, and write your response in the space next to the statement using the scale below. Answer every statement, even if you are not completely sure of your response.

1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Project Success Questionnaire

Sr.#	Items	1	2	3	4	5
1	The basic goals of this project were clear for all of us?					
2	The goals of the project were in line with the general goals of the organization?					
3	I was enthusiastic about the chances for success of this project?					
4	The results of the project benefited the organization?					
5	I could identify the benefits to the organization of the success of this project?					

Please read each statement, decide how much you agree, and write your response in the space next to the statement using the scale below. Answer every statement, even if you are not completely sure of your response.

1 = S.Dissatisfied, 2 = Dissatisfied, 3 = Neutral, 4 = Satisfied, 5 = S.Satisfied

Virtual Collaboration Questionnaire

Sr.#	Items	1	2	3	4	5
1	Overall, how satisfied were you with participating in this global virtual team collaboration?					
2	How satisfied were you with the other members in your team?					
3	How satisfied were you with the outcome of your team's project?					

Please read each statement, decide how much you agree, and write your response in the space next to the statement using the scale below. Answer every statement, even if you are not completely sure of your response.

1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Task Complexity Questionnaire

Sr.#	Items	1	2	3	4	5
1	I frequently deal with unstructured business problems.					
2	The business problems I deal with frequently involve more than one organizational group.					
3	The business problems I work on involve answering questions that have never been asked in that way before.					
4	In my job, there is a great deal of variety in the problems, questions or issues for which I need data.					
5	The business problems ideal with frequently involve more than one business function.					
6	In my work, I frequently have to think about business problems and the associated data in new ways.					
7	It is necessary to spend time thinking about how best to address a business problem before I being analysis.					

Please read each statement, decide how much you agree, and write your response in the space next to the statement using the scale below. Answer every statement, even if you are not completely sure of your response.

1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Trust Questionnaire

Sr.#	Items	1	2	3	4	5
1	I am not sure I fully trust my employer.					
2	My employer is open and upfront with me.					
3	I believe my employer has high integrity.					
4	In general, I believe employers motives and intentions are good.					
5	My employer is not always honest and truthful (reverse score).					
6	I don't think my employer treats me fairly (reverse score).					
7	I can expect my employer to treat me in a consistent and predictable fashion.					