

CAPITAL UNIVERSITY OF SCIENCE AND  
TECHNOLOGY, ISLAMABAD



**Impact of Project Complexity on  
Project Success Mediating Role  
of Agile Methodology Use and  
Moderating Role of Team  
Cooperation**

by

**Muhammad Munawar Zaman**

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

in the

**Faculty of Management & Social Sciences  
Department of Management Sciences**

2021

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*I dedicate my work to My Family, My Teachers and Friends. A very special thanks to my Father, Mother and Brothers who always supported me. Also a very special thanks to my supervisor who motivated me and gave me confidence which enabled me to reach this goal*



## CERTIFICATE OF APPROVAL

**Impact of Project Complexity on Project Success  
Mediating role of Agile Methodology Use and Moderating  
Role of Team Cooperation**

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## *Acknowledgement*

”Recite in the name of your Lord who created. Created man from a clinging substance. Recite, and your Lord is the most Generous. Who taught by the pen. Taught man that which he knew not.” Al-Quran[96:1-5]. I would like thank ALLAH Almighty for the will and determination to complete this work.

I am thankful to My Parents for their prayers, support and courage which kept me motivated through hot and cold, in ups and downs of my education and kept me going. so, I reached this milestone. Thanks to my brothers they saw what no one saw and pushed me forward so that i could make the last miles towards my goal. I would also like to thank my friend who believed in me and supported me through out my life.

A special thanks to my supervisor Dr. Mueen Aizaz Zafar for his support, his assistance, his guidance. Thankyou Sir.

**(Muhammad Munawar Zaman)**

## *Abstract*

The purpose of this study was to examine the impact of project complexity on project success with mediating role of agile methodology use and moderating role of team cooperation. The context was project-based organizations of Pakistan especially in the IT sector. Questionnaire were used to collect data from 250 employees of various organization working on different projects. Results indicate that project complexity is negative associated with project success, while agile methodology mediates between project complexity and project success. And results also confirmed the moderating role of team cooperation between agile methodology and project success.

**Project complexity, Agile Methodology, Team Cooperation, Project success.**



# Contents

<b>Author's Declaration</b>	<b>iv</b>
<b>Plagiarism Undertaking</b>	<b>v</b>
<b>Acknowledgement</b>	<b>vi</b>
<b>Abstract</b>	<b>vii</b>
<b>List of Figures</b>	<b>xi</b>
<b>List of Tables</b>	<b>xii</b>
<b>Abbreviations</b>	<b>xiii</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Theoretical Background . . . . .	1
1.2 Research Gap . . . . .	5
1.3 Problem Statement . . . . .	7
1.4 Research Questions . . . . .	8
1.5 Research Objectives for This Study . . . . .	9
1.6 Significance of Study . . . . .	9
1.7 Supporting Theories . . . . .	10
1.8 Structure of thesis . . . . .	12
<b>2 Literature Review</b>	<b>13</b>
2.1 Definitions of Variables . . . . .	13
2.1.1 Project Complexity . . . . .	13
2.1.2 Team Cooperation . . . . .	13
2.1.3 Agile Methodology Use . . . . .	14
2.1.4 Project Success . . . . .	14
2.2 Project Complexity and Project Success . . . . .	15
2.3 Project Complexity and Agile Methodology Use . . . . .	19
2.4 Agile Methodology Use and Project Success . . . . .	21
2.5 Mediating Effect of Agile Methodology Use between Project Complexity and Project Success . . . . .	24

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2.6	Moderating Effect of Team Cooperation Between Agile Methodology Use and Project Success . . . . .	26
2.7	Research Model . . . . .	28
2.8	Hypothesis of the Study . . . . .	29
<b>3</b>	<b>Research Methodology</b>	<b>30</b>
3.1	Research Design . . . . .	30
3.1.1	Research Philosophy and Quantitative Research . . . . .	30
3.1.2	Type of the Study . . . . .	31
3.1.3	Unit of Analysis . . . . .	31
3.1.4	Time Horizon . . . . .	31
3.2	Population and Sampling . . . . .	32
3.2.1	Sample and Sampling Technique . . . . .	32
3.2.2	Population . . . . .	33
3.2.3	Sample Size . . . . .	34
3.3	Procedure for data collection . . . . .	35
3.4	Sample Characteristics . . . . .	35
3.4.1	Gender . . . . .	36
3.4.2	Age . . . . .	36
3.4.3	Qualification . . . . .	37
3.4.4	Experience . . . . .	37
3.5	Instrumentation . . . . .	38
3.5.1	Project Complexity . . . . .	38
3.5.2	Agile Methodology Use . . . . .	39
3.5.3	Team Cooperation . . . . .	39
3.5.4	Project Success . . . . .	39
3.6	Covariates . . . . .	40
3.7	Scale Reliability . . . . .	40
3.8	Data Analysis Technique . . . . .	41
<b>4</b>	<b>Results</b>	<b>43</b>
4.1	Confirmatory Factor Analysis . . . . .	43
4.1.1	Measurement Model . . . . .	44
4.2	Descriptive statistics . . . . .	45
4.3	Correlation Analysis . . . . .	46
4.4	Regression Analysis . . . . .	47
4.4.1	Linear Regression Analysis . . . . .	47
4.5	Mediation Analysis . . . . .	48
4.5.1	Hypothesis 2 . . . . .	50
4.5.2	Hypothesis 3 . . . . .	51
4.5.3	Hypothesis 4 . . . . .	52
4.5.4	Total Effect . . . . .	52
4.5.5	Direct Effect . . . . .	52
4.6	Moderation Analysis . . . . .	53
4.7	Summary of Accepted / Rejected Hypothesis . . . . .	54

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<b>5</b>	<b>Discussion and Conclusion</b>	<b>56</b>
5.1	Discussion . . . . .	56
5.1.1	Hypothesis H1: Project Complexity negatively impacts Project Success. . . . .	57
5.1.2	Hypothesis H2: Project Complexity negatively impacts Agile Methodology . . . . .	58
5.1.3	Hypothesis H3: Agile Methodology use positively impacts Project Success . . . . .	59
5.1.4	Hypothesis H4: Agile Methodology use mediates the relationship between Project Complexity and Project Success. . . . .	60
5.1.5	Hypothesis H5: Team cooperation moderates the relationship between agile methodology and project success in such a way that high team cooperation will strengthen the relationship between agile methodology and project success . . . . .	61
5.2	Research Implications . . . . .	62
5.3	Limitations of Research . . . . .	63
5.4	Future Research Directions . . . . .	63
5.5	Conclusion . . . . .	64
	<b>Bibliography</b>	<b>65</b>
	<b>Appendix A</b>	<b>75</b>
.1	Questionnaire . . . . .	75

# List of Figures

2.1	Research Model of Project Complexity on Project Success, with mediating role of Agile Methodology and moderating role of Team Cooperation. . . . .	28
4.1	Linear Regression . . . . .	48
4.2	Mediation Analysis . . . . .	49
4.3	Mediation Analysis with Coefficients . . . . .	50
4.4	Hypothesis 2 pictorial representation . . . . .	51
4.5	Hypothesis 3 pictorial representation . . . . .	51
4.6	Linear Regression . . . . .	54

# List of Tables

3.1	Software companies.	34
3.2	Gender	36
3.3	Age	36
3.4	Qualification	37
3.5	Experience	38
3.6	Instruments	40
3.7	Covariates	40
3.8	Scale Reliability	41
4.1	Measurement Model	44
4.2	Descriptive Stats	46
4.3	Correlation	47
4.4	Simple Regression	48
4.5	Mediation Table	49
4.6	The Moderating effect of Team Cooperation	54
4.7	Summary about Accepted / Rejected hypothesis	55

# Abbreviations

<b>AM</b>	Agile Methodology
<b>CFI</b>	Comparative Fit Index
<b>CI</b>	Confidence Interval
<b>DV</b>	Dependent Variable
<b>GFI</b>	Goodness of Fit Index
<b>IFI</b>	Incremental Fit Index
<b>IV</b>	Independent Variable
<b>LL</b>	Lower Level
<b>PC</b>	Project Complexity
<b>PS</b>	Project Success
<b>RMSEA</b>	Root Mean Square Error of Approximation
<b>TC</b>	Team Cooperation
<b>TLI</b>	Tucker-Lewis Index
<b>UL</b>	Upper Level

# Chapter 1

## Introduction

### 1.1 Theoretical Background

From past few decades, Complexity is considered a critical component in project management literature ([Shenhar and Dvir, 2007](#)). The continuous demands and latest technological advancements has resulted in rapid increase in the complexity of the projects. It is now that managers consider its impacts on the success of project. Due to the unique nature of projects, each project tends to be of complex nature. This complex nature of project possesses level of uncertainties and complexities that contribute towards the unpredictability of the project.

Complexity is a terminology used throughout project management and it usually brings additional difficulties in achieving the desired outcome. There must be some technique to manage the project complexity so that team may not face difficulty in working on the project ([Kermanshachi et al., 2020](#)). Assessment of complexity of the project is an essential aspect of project which helps in effectively manage the project ([Baccarini, 1996](#)). Complexities in the project bring uncertainties which can change the project scope ([Liu and Wang, 2014](#)). Project complexity refers as the property of a project which makes it difficult to understand, foresee and keep under control its overall behavior, even when given reasonably complete information about the project system. Its drivers are factors related to project size, project variety, project interdependence and project context.” ([Vidal and Marle, 2008](#)).Complexity is one of the obvious project characteristics because of

the uniqueness of project (Laine et al., 2016). Complexity of the project causes obstruction in the project performance causing project to delay (Hanisch and Wald, 2014). Complexity is the prominent feature of the projectized organizations which is defined as an interdependency between number of different assignments (Burke and Morley, 2016). (Baccarini, 1996), defined the Project complexity as inter-related task and co-dependency between the tasks.

(Gidado, 1996) stated complexity is an execution of complex process which has various complicated parts combined in an operating network for the work flow within time, cost and quality to achieve desired result without any conflict between part of process. Complexity can be stated as difficulty of implementation of planned objective goals.(Hass and PMP, 2008) suggested that if one understands the complexity properly, it can help in finding the root cause of problem caused in project, which can increase the chances of project success. Complexity has got an importance of a vital element of project and is discussed while the projects are discussed (Wood and Ashton, 2010).

It is important for both practitioners and academics to understand project complexity, to know how to handle project complexity, and how does it affect individuals and organizations (Thomas et al., 2008).(Daniel and Daniel, 2018) said the complexity of projects is increasing which further increases difficulties in the projects and management of the project. In light of the project management research the most common definition of complexity is that project complexity consists of many different and interdependent aspects of the project that are being performed in uncertainty. Sometimes the interactions between the project tasks, their reciprocal interdependence, project teams adjustment and devotion towards the tasks makes it difficult to find the cause of failed task.

Software development is a field that keeps introducing new methodologies. In 2001 Agile methodology was introduced for the first time. Agile methodology is mostly adopted methodology in the software developing organization to develop projects (Beck et al., 2001). The Agile methodology is unique approach in project management which mostly used in software development. The methodology help project teams to respond to unpredictability while developing the software. Agile and traditional methodologies are very different to each other as agile averts from



the traditional methodologies less customer interaction, predefined scope of the project and more focus on documentation (Serrador and Pinto, 2015).

Agile Scrum methodology is the most widely used agile methodology. In which a small team is formed that is usually three to nine people. Each in the team is assigned full time to the project and the team is cross functional covering all the skill required to develop the project. The product owner prioritizes the task to be completed first and then the team creates a plan and a road map. Each task is further divided into modules by members and an estimation of time is given to complete a module. They start building the working version in short cycles called sprint. The team holds a daily meeting to check the progress and discuss about any difficulties. The team resolves disagreement by experimenting and feedback from the customers.

Agile methodology is a flexible technique that promotes the customer to be completely involved during the process of development, a regular delivery, iterative development and embracing change in a simple and easy way (Sun and Schmidt, 2018). Agile helps the employee to be innovative and do the iterative steps in a team environment where the productivity increases and the quality of product (Dhir et al., 2019). The agile methodologies are widely used in the field of Information Technology (IT) and software development to achieve quick outcomes and in stable way (Henriksen and Pedersen, 2017). Main focus of agile is the interactions of individuals, working software, flexible to changes and collaboration with the customer (Campanelli and Parreiras, 2015)

Most of the software developing organizations have moved towards the agile methodologies because of its flexibility, collaboration with the customer, and the effectiveness and efficiency it brings. The use of agile methodology has improved the quality of product very significantly on the software side because it allows to fix the bugs by reviewing over and over again as iterative model is followed and agile focuses on quality end product. Each successful project is dependent on the customer and what are his requirement and whether the developed project is conforming to those requirement. In traditional development major challenges are coordination between the team, what the project is intended to do, inability to adapt to changes and this inability to change quickly causes most project to fail

(Maruping et al., 2009).

It is very important to track the requirements of the customer to achieve quality in the project and project success. According to (Abrahamsson et al., 2017), agile is a fast growing technique which is targeting the software application and new techniques to adopt. Agile requires multidisciplinary team to work in a collaborative environment with smaller teams and high customer involvement as for traditional require a team of specialized skills, and individual work environment where larger team and less customer involvement. Both prove to be successful but the agile provides more quality (Lindsjörn et al., 2016). In software development field the complexity is mainly reduced using agile because agile involves continuous interaction with customer (Mishra and Mishra, 2011).

Project success can be viewed as success of process, project or success of the organization (McLeod et al., 2012). Project success can be measured as the stakeholder satisfaction, organizational benefit and success of product and the development of the team (Atkinson, 1999). It is widely said that the methodology used to complete a project contributes toward the project success. Literature states that time, cost and quality are not the only aspects to measure the success but a successful methodology also needs to be reconsidered (Schwalbe, 2015). Literature shows that time, budget and quality is not the only criteria of success of project but the handling of complexity is also need to be considered (Baccarini, 1996),(Schwalbe, 2015). Anantatmula (2010) stated that complexity can lead people to work hard and stimulates new ways of thinking in order to accomplish goals and objectives. So, when complexity exist among the project aspects, there would be more than one person to help in a complex situation and the cooperation level will be increased among the team members. Hence project will become successful.

Moreover, project team have high workloads and stress to finding new ways or solutions to complexity, anticipation and prepare a response for the risks and to find a solution to satisfy the stakeholder groups which may have different demands often contradictory. Above mentioned argument supports that complexity can motivate team members to cooperate with each other and this can increase chances of success (Carson et al., 2007). Whenever a project faces a complexity in a project, team cooperation would automatically generate among the team members and

would ultimately lead towards project success.

Project requires high level of cooperation among the team members to save other member from any stress condition. This stressful condition would not let the members to complete tasks and can cause project failure (Pollack and Matous, 2019). To reduce the level of stress proper communication must be developed between the team members (Baiden, 2011). Literature suggests that team cooperation is positively associated with project success (Scott-Young & Samson, 2008).

The success of the project does not depend only on the agile methodology but there are many factors involved in the success of the project such as the team cooperation. (Iqbal et al., 2019) has studied that effective team in agile environment lead to project success or increase the agile productivity. If projects have complexity we need team cooperation to effectively manage the project complexity and that is the reason we have selected team cooperation as moderator in our model.

## 1.2 Research Gap

Project management is currently the field that has a lot of room for further research, as this domain is not explored as compared to other domains of management sciences (Shenhar and Dvir, 2007). Project managers are also considered to be unlucky that they could not capture the attention of researchers and practitioners (Turner and Müller, 2005).

(Dao et al., 2017) stated that project complexity is not properly understood by the practitioners and scholars and project complexity is an important aspect of project. And further stated that project team must use a certain methodology or technique to handle or identify the complexity factors. Despite many researchers have identified agile methodology as an important methodology and a topic to handle the uncertainties and allow the team to be flexible in the approach towards the project execution still its impact on Project Success is understudied topic.

(Rasnacis and Berzisa, 2017) stated that while adapting agile methodology project team aspects such as team cooperation, turnover, internal relationships and motivation have not been studied. As in agile the team comprises of those skilled

members which are to perform a specific task related to their skills. Despite the literature on project complexity and its functioning and effectiveness in projects, still literature lack empirical studies of project complexity and its consequences on team (Luna et al., 2015).

The team members want to coordinate their day-to-day tasks in order to achieve goals. Project team are bound to multiple things i.e., nature of tasks, degree of interconnectedness of each task with other tasks, size, composition, complexity of the tasks and behavior of team member within the group, timelines, deadlines. Therefore, in that case team cooperation is an important which should be present in the team member of a project team (Dyer Jr, 2015). Team cooperation is very important in project team and should be studied with the project complexity (Pollack and Matous, 2019).

Team cooperation is very important to increase the motivation and productivity of the project based organizations and team cooperation has a great role in employee communication and interaction with each other (Khan and Wajidi, 2019). Team cooperation is very important to increase the motivation and productivity of the project based organizations and team cooperation has a great role in employee communication and interaction with each other. And team cooperation is not extensively studied (Khan and Wajidi, 2019). Team cooperation is very important in project team and should be studied with the project complexity (Pollack and Matous, 2019). (Gundersen et al., 2012) stated that there should be more research done on the relationship between project complexity and team performance outcome by using the mediators representing the team processes. Many organizations still use traditional project management techniques and some are using hybrid techniques and some organizations moved towards agile methodology use approach. Those using agile methodology approaches are representing high success rate and this success, attracts other industries to shift towards agile methodology use. (Mishra and Mishra, 2011) stated that for better understanding of agile methodology use it should be used in a complex environment where the environment is changing rapidly.

There is gap for these variables in context of Pakistan because the relationship between project complexity and project success with mediating role of agile methodology is not studied before. Agile and traditional methodologies are very different to each other as agile averts from the traditional methodologies less customer interaction, predefined scope of the project and more focus on documentation (Serrador and Pinto, 2015). This relationship will be useful to understand how project complexity in project-based organizations. Recently no study has been done on the Project complexity and its impact on project success in moderation of team cooperation.

Team Cooperation was not studied with agile methodology (Iqbal et al., 2019). The effect of Team Cooperation on the Project success is not significantly studied (Mishra and Mishra, 2011).

### 1.3 Problem Statement

Project complexity is one of the critical factors of the project due to its novelty. Project complexity is of many types, but in this study complexity is captured as a broader aspect of project. Most of the projects are delayed due the innovation and the complexity of the project. Many projects of IT in Pakistan are facing delays and cost overrun due to the complexity.

Project complexity has been negatively associated with project success. It has been found as a negative aspect of the project which greatly effects the performance of the team. In the 21st century, environment is uncertain and has huge risks to meet the criteria of project success. Moreover, the projects are operated in short span of time and they are temporary in nature. So it is better to use a certain methodology i.e. (agile methodology) to handle projects which can adapt according to the needs of project. And lead the project to positive outcomes.

Different studies have explored the positive outcomes such as job satisfaction and performance but lack literature in project management, for short time spanned project with high uncertainty, complexity and market competition how agile methodology will help is still unexplored. Agile and traditional methodologies are very different to each other as agile averts from the traditional methodologies less customer

interaction, predefined scope of the project and more focus on documentation. We argue that Project complexity will reduce the chances of success. When there is a certain methodology i.e. agile methodology is used and the team is willing to cooperate with each other and willing to help in an uncertain and complex environment, will lead project to success.

Therefore in this research, Project complexity is studied to understand how it can affect project success while agile methodology is being used. Secondly, to check the mediation of agile methodology and also how agile methodology influences the project complexity, finally the study will also aim to check the moderating role of team cooperation between the agile methodology and project success.

## 1.4 Research Questions

On the basis of the problem stated above this study is will answer the following questions:

### **Research Question 1**

Does project complexity impact project success?

### **Research Question 2**

Does project complexity impact agile methodology use?

### **Research Question 3**

Does Agile methodology use impact project success?

### **Research Question 4**

Does agile methodology use mediate project complexity and project success?

### **Research Question 5**

Does team cooperation moderate the relationship of agile methodology use and project success?

## 1.5 Research Objectives for This Study

Main objective of the study is to test the developed model to find the relationship between agile methodology, project complexity and success of the projects. Furthermore, team cooperation is considered to be the moderator for the research model.

Objectives of the study are as follow:

1. To find the relationship between project complexity and project success.
2. To investigate the relation between project complexity and agile methodology use.
3. To investigate the relationship between the agile methodology use and project success.
4. To find the mediation of agile methodology use between project complexity and project success.
5. To find the moderating effect of team cooperation on agile methodology use and project success.

## 1.6 Significance of Study

This study adds not only the theoretical content related to project management but also practical implementations of agile methodology in a complex project. Study provides evidence and insights towards agile project management by investigating the hidden aspects and ways to do and successfully complete a project. It would be beneficial research especially for Pakistan context where projects face cost overrun and mostly face failure and where team is unable to effectively manage the complexity of the project.

This study contributes to the literature in many ways. First, it offers a new theoretical framework to understand the effects of project complexity on project success. Research on project success is very vital because it help many organizations improve their businesses. Today, many organizations, understand the

importance of success and they try to diversify their business in such a way they create a portfolio. So that they sustain even if one of the project fails.

The main focus of this study is to find the impact of project complexity on project success. Because of this in-built feature of project most of the project fail to meet the deadline. Agile and traditional methodologies are very different to each other as agile averts from the traditional methodologies less customer interaction, predefined scope of the project and more focus on documentation. This study provided the answer to why complex projects fail more frequently, and how agile can help making complex project successful, and why agile should be adopted for the project successful and how it will affect the customers. Secondly, it tested the relationship between team cooperation and project success in an agile environment.

This research is focused on providing the answer to can agile methodology cause projects to be successful, if reducing complexity, leads to the project success and as field of IT is introducing new technologies and tools the projects are becoming more complex, so this study will help in understanding if we reduce the complexity can the team cooperation lead to project success.

This study also highlights how the project complexity effects the outcome of the project. Moreover it encourages many organizations where traditional approaches are being used to adopt agile methodology for better execution pf projects and increasing the chances of success in projects. Furthermore agile methodology is not used only in IT projects but it is also being used in many other fields.

## 1.7 Supporting Theories

Complexity theory is the theory which best fits our research model and this theory is used as theory foundation.

Complex system are composed of many small components without any centralized control. Which make the organizations to show a nonlinear and surprising behaviors. Complex systems are those which composed of number of components and their interconnections (Simon, 1996). [Kauffman \(1996\)](#) stated that complexity theory provides the basis for the phenomenon that how team members represent



the patterned behavior and cooperate with each other to deal with the ambiguous situations. Complexity theory explains how various discipline concepts can be integrated and used in related domains.

It states that complex behavior is due to some rules, and all complex systems are a network of interdependent components which interact according to those rules. [Rose and Kodukula \(2011\)](#) stated that complexity theory is a concept used to manage the project teams in order to breed creativity needed to complete the project goals. Complex environment and chaos acts as a catalyst to elevate the complexity of the project.

Complexity makes it difficult and ambiguous to find out the operation of an organization. Modern complexity theory suggests complex systems can be sometimes predictable and sometimes unpredictable ([Cohen and Stewart, 2000](#)). Complex systems sometimes evolve to the edge of chaos [Kauffman \(1996\)](#). Complexity is one of the dimension of every project. One cannot predict or control the future of any complex system. An iterative approach based on making a decision, taking action, reviewing the outcomes and deciding on the next set of actions based on what has actually happened will move the project towards its intended goal. For best outcome this process should be carried out on multiple aspects of the project [Kauffman \(1996\)](#).

For supporting the research model we proposed Complexity theory as this theory has five basic concepts which are self-organization, non-linearity, complex systems, adaptation and networks. Team is the basic part of the project and while using the agile methodology team becomes more adaptive to change and can deal with any kind of change or complexity that may affect the project, so the team organizes itself and adopts a suitable counter to respond to change. Non-linearity is the unpredictability of the system in its outcome which we can say is the built-in feature of the complex project. An iterative approach based on making a decision, taking action, reviewing the outcomes and deciding on the next set of actions based on what has actually happened will move the project towards its intended goal. Adaptation is the aspect of complexity theory that we cover by using the agile methodology because of its ability to adapt to any situation and be flexible. This theory covers all the aspects in which project complexity can be connected

to project success and how agile can help in achieving project success.

## 1.8 Structure of thesis

Structure of the thesis is as, the first chapter is the introduction of the topic where we talk comprehensively about the background of the study, what is the problem, the research gap is then stated, significance of study, the research objectives, research questions and the supporting theory which is important for our model.

The second chapter is about the detailed literature review, providing the conceptual framework and the hypothesis regarding the model on the basis of the previous literature that has been done in the related field.

The third chapter is about the methodology in which we will discuss the methodology that is being used, the research design which comprises of time horizon, type of study, unit of analysis, setting of study, the instruments used for the collection of data.

The chapter four of the study is about the results, that are about the data collected and the analysis that was performed on the data collected using the instrument in form of tables and figures. Because of this in-built feature of project most of the project fail to meet the deadline. And there is detailed analysis about the hypothesis and there results and in the end we will provide a table that will show the acceptance or rejection of hypothesis.

The fifth chapter is about the discussion of Hypothesis and justification about the results. Furthermore, the implications of the study, strengths of the study, limitations , future research directions and in the last there is conclusion.

# Chapter 2

## Literature Review

### 2.1 Definitions of Variables

#### 2.1.1 Project Complexity

([Baccarini, 1996](#)) stated that complexity is subjective to the understanding of the team member and dealing with the task and situation where he faces the scoped definition, project objectives and deadlines which can further add to the complexity. Project complexity is considered as the most critical dimension of the project and ([Baccarini, 1996](#)) defined the complexity as “The number of varied elements, e.g. tasks, specialists, components; and interdependence or connectivity the degree of interrelatedness between these elements”.

#### 2.1.2 Team Cooperation

“Cooperation Includes offering help to only those team members who need it, pacing activities to fit the need of the team, and behaving in an unambiguous manner so that actions are not misinterpreted” ([Spielberger, 2004](#)). Also ([Edmonds, 1999](#)) stated project complexity as “Complexity is that property of a model which makes it difficult to formulate its overall behavior in a given language, even when given reasonably complete information about its atomic components and their interrelations”. This definition is appropriate for encompassing the project complexity

aspects and it emphasizes that generally complexity is related to how the project is modeled and perceived (Vidal and Marle, 2008). Team cooperation is very important to increase the motivation and productivity of the project based organizations and team cooperation has a great role in employee communication and interaction with each other. And team cooperation is not extensively studied (Khan and Wajidi, 2019). Team cooperation is very important in project team and should be studied with the project complexity (Pollack and Matous, 2019).

### 2.1.3 Agile Methodology Use

According to (Agile Alliance, 2020) “Agile is the ability to create and respond to change. It is a way of dealing with, and ultimately succeeding in, an uncertain and turbulent environment.” The authors of agile manifesto stated that they used agile as their label because the word shows the adaptiveness to change and the quick response to the change and these are key attributes of their approach.

Agile methods were evolved to cover the risks involved in the projects and respond to changes in the market so this leads to the success of the project. Similarly measurable tests are required to analyze the successful production of the agile software development projects . Likewise it was identified that managers become informative related to the project so that more informed decisions could be made as it is found that processes, systems and people are correlated to each other for project success.

### 2.1.4 Project Success

According to (Rose, 2013)) project is a temporary activity which is used to create a unique product, process or service. (Turner and Müller, 2005) stated the definition of project as “Project is temporary organization to which resources are assigned to undertake a unique, novel and transient endeavor while managing the inherent uncertainty and need for integration in order to deliver beneficial objectives of change”.

Over the decades, project success has been targeted by the researchers however they have not been able to bring forward one definition of project success (He

et al., 2019). According to (Baker et al., 1997) a successful project is “if it meets the technical performance specifications and / or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among the key people in the parent organization, key people in the client organization, key people on the project team, and key users or clientele of the project effort, the project is considered an overall success”.

(Baccarini, 1996) said to achieve project success one should focus on the project management success and product success. Similarly, (De Wit, 1988) stated the project success as that project is considered successful which fulfills the requirement and everyone involved in the project shows satisfaction with the outcome of the project.

## 2.2 Project Complexity and Project Success

According to (Rose, 2013), project is temporary endeavor that has a defined start time, end time, resources and scope, unique in nature carried out to achieve specific objectives. It also includes different interlinked tasks which make it complex. It is difficult to define complexity because of its different associations between activities or tasks.

(Hass and PMP, 2008) Project complexity is emphasized on interdependent task which are difficult to manage or perform. Project complexity influences project in both positive way and negative way (Iles, 1997). (Edmonds, 1999) proposed a generic definition for complexity:

*“Complexity is that property of a model which makes it difficult to formulate its overall behavior in a given language, even when given reasonably complete information about its atomic components and their inter-relations”*

Project complexity includes numerous interlinked tasks, also the nature of project contributes towards the increase in the project and if project is multifaceted it also adds to the complexity of the project (Gransberg and Shane, 2015). Literature explains that the project success is influenced by project complexity and the characteristics of project e.g. size, schedule, task interdependence and etc. (Abdou et al., 2016).

Understanding the complexity, it refers to the present and future states of the project. It remains while the project manager makes decision, as complexity is involved due to the uniqueness of the project (Probst and Gomez, 1990). Project which are complex and uncertain are difficult to work with and understand. In the field of information technology the projects fail due to the complexity and their specifications, because of the innovations in the field, which make it difficult to understand and complex to handle the expectations of the customer.

Complexity has a negative impact on the project because of the disruptions that are caused by the complexity causing the project to become difficult to implement (Zhu and Mostafavi, 2017). (Qazi et al., 2016) project complexity has been extensively studied in literature because of its contribution in project failure. And said that project complexity was evaluated at the start by the team which caused the project to fail.

To effectively complete the complex project and to achieve the project success the organization must take advantage of the resources, their capabilities and the cooperation of the participant is very important (Gao et al., 2018). Team cooperation is very important to increase the motivation and productivity of the project based organizations and team cooperation has a great role in employee communication and interaction with each other. And team cooperation is not extensively studied (Khan and Wajidi, 2019). Team cooperation is very important in project team and should be studied with the project complexity (Pollack and Matous, 2019). The project management has widely acknowledged complexity as it can affect the planning, coordination, identification of the goals, and it can affect the projects outcome (San Cristóbal et al., 2018).

(Vidal and Marle, 2008) stated that the complexity is everywhere and is increasing continuously at a steady pace. Also stated that project manager deals with perceived complexity as he cannot understand and deal with the project complexity. (Baccarini, 1996) considered technological and organizational complexity regarded these as a core components of project complexity. (Edmonds, 1999) proposed a generic definition for complexity:

Project complexity is a fundamental aspect of project management (Tatikonda and Rosenthal, 2000). Literature suggests that the project complexity can cause

new projections in project and it affects the project results (Bosch-Rekvelde et al., 2011) (Gransberg and Shane, 2015); He et al. (2019). (Bjorvatn and Wald, 2018), stated that project complexity overrides the team capabilities because of its nature and its occurrence from either internal or external causes. (Geraldi et al., 2011) discusses the complexity as a whole in project, in tasks, structure of organization and uncertainty. An iterative approach based on making a decision, taking action, reviewing the outcomes and deciding on the next set of actions based on what has actually happened will move the project towards its intended goal. Project complexity is generated from known factors which have additional impacts on project. Difficult project objective, compressing the schedule, critical resource shortages and project team methodology may cause the project to become more complex and reduce the chance of meeting the project success (Dao et al., 2017). (Gidado, 1996) stated project complexity is one of those major factors of the projects that can affect the baselines of the project which can influence the project success.

With the latest innovations in the field caused the projects to be more novel and creative, it has been conceptualized that the creativity in projects caused the complexity to increase which reduces the performance of the team. Which affects the overall projects in a negative way (Lee et al., 2020).

Nowadays, most projects are novel and complex in nature which needs to be tackled in order to be successful. Research shows that project complexity is integrated in the activities of the projects, which can cause the consequences during communication, control and direction which are mostly used during the project and in the project management.

(Gao et al., 2018) stated that project complexity leads towards the transactional risks in inter-organizational exchanges, and if proper governance tools or mechanism is not present it can cause negative affect on the performance. Research has been undertaken for the identification of the causes for the project complexity and it is proposed that for effective management of project, project complexity must be properly understood by the team (Dao et al., 2017).

Luo et al. (2016) stated that many studies show that project complexity affects the project success. However detailed analyses lack evidence and the indicators of project success and project complexity are abstract and macroscopic. Due to the

complexity, projects often lead to the failure of project (Abdou et al., 2016).

According to (Lu and Ramamurthy, 2011), increasing complexity and the risks associated with them especially in large projects cause obstacles and hence become the root cause of failure. (Gao et al., 2018) stated that complexity has three dimensions i.e. Technical, organizational and environmental complexity, also complexity can impact the project performance.

Luo et al. (2017), stated that project complexity has a negative relation with the project success. (Bakhshi et al., 2016), management of complex system is difficult and most projects can be made successful if they are done by understanding the past success pattern and they can become failure if the managers focus on the project complexity factors. (Baccarini, 1999) said to achieve project success one should focus on the project management success and product success.

Similarly, (De Wit, 1988) stated the project success as that project is considered successful which fulfills the requirement and everyone involved in the project shows satisfaction with the outcome of the project. According to (Mir & Pinnington, 2014) Project success has been conceptualized as multidimensional or uni-dimensional construct. The project success can be measured but it varies form project to project as they can have different size, level of complexity and uniqueness.

Project success was conventionally measured against the triple constraint of cost, time and scope but many other factors have been included as contributing factor related to project success. (Gao et al., 2018) stated that to reduce the impact of project complexity element on the project success research is urgently required to state the risk associated with the project complexity and propose approaches to address these risks that could affect the project success.

Furthermore, (Gao et al., 2018) said there should be a construct that could capture the satisfaction between the teams problem solving behavior and the future willingness for cooperation and collaboration. And these could be used as reference for perceived project success and failure.

Gidado (1996) stated project complexity has reached a level where every project manager has to consider the influence of project complexity on project success,



also said that each project is complex in its own nature and if bringing the individual parts together influence the set goals then we can say that project is moving toward failure.

Hence, we hypothesize that

**H1:**Project complexity has a negative impact on project success.

## 2.3 Project Complexity and Agile Methodology Use

An evaluation of projects activities, complexity drivers and their demand on the resources of the organization needs to be conducted. An approach based on resource oriented process cost calculation was developed, which includes uncertainties related to complexity and the capacity to tolerate the complexity (Schuh et al., 2017). Project complexity can lead any project to success or failure and it can be increased if not handled properly.

(Baccarini, 1996) stated that project complexity can vary in different aspects of the project, i.e. technical complexity, organizational complexity and it includes the number of technologies and the teams familiarity with those technologies. Nowadays projects are more complex and innovative which are not appropriate for the traditional methodologies to be conducted under them.

To deal with the complex projects exceptional level of project management and some sort of methodology i.e. (agile methodology) that can cope with the complexity of the project. In project complexity mostly 4 dimensions are causing the complexity increase: size of the project, uncertainty in the project, team relationship, technicality in producing the desired outcome (Bergmann and Karwowski, 2018).

While developing new systems or software involves many stakeholders each having its own interests which increase technicality and hence overall complexity. Although complexity is in-built and a defining feature of project it is not empirically studied the impact complexity makes on project management performance (Burke and Morley, 2016). (Bakhshi et al., 2016) claimed the controversial topic of project

management is the complexity.

(Florichel et al., 2016) identified negative association between complexity and the budget and schedule of the project and as the number interrelated activities increased, the project becomes more exposed to delays and paying more cost. (Gidado, 1996) mentioned the factors that influence project success and how the factors impact the complexity to effect the success: the in-built complexity, technologies available, rigidity of the sequence of activities, overlapping phases and complexity of organization structure.

(Maylor and Turner, 2017) stated emergent complexities and change are more challenging to deal with, which were dealt with the traditional risk management which is characterized as planning and control response but this response acts as facilitator to emergent complexities. To deal with this the project manager must be able to respond in the best way possible to turn the situation in such a way that it becomes fruitful for the project.

(Liu and Leitner, 2012) also stated that while dealing with complexities manager tend to be flexible and deceptive in their practices, adopting according to situation e.g. to deal with socio-political and structural complexities they exploit by applying planned responses or explore to deal with the emergent complexities.

Agile methodology is an approach which is expressed in change adaptive behavior of individuals and groups in their social synergy while dealing with uncertainty and complexity of projects. (Sohi et al., 2016) it is impossible to predict anything with changing and complex context of a projects, so instead of making predictions and avoiding the changes, these should be included in the project. (Koppenjan et al., 2011) said as the client learns about new things the changes in scope are inevitable thus makes project more complex and uncertain.

(Magazinius and Feldt, 2011) said if we see a pattern of projects that have been successful we can see agile project management methods were one the many causes of project success by continuously changing the environment its tasks. Agile methodology can satisfy all the stakeholders of the project. Agile methodology improves the delivery time because of the quick and flexible reactions to changes and complexity issues lead to better management of the project.

(Sohi et al., 2016) studied the relation of agile methodology and project complexity and they found that if the project is divided in to smaller projects with intermediate deliveries will make the team to better understand the project goals. Because of these smaller projects the goals will be clearer as compared to the whole project.

According to Sun and Schmidt (2018) agile methodology is flexible to changes, complexity because it enables its user to communicate with the team members and the customers, without having to extensively document and wait for approvals. With customers continuous involvement, whenever the team faces any complex situation regarding the tasks of the project, they communicate and avoid the complex situation.

(Mishra and Mishra, 2011) stated the complexities in the agile software development projects are dealt by using the agile methodology because of the flexibility towards changes that are continuously happening and increasing complexity. So, literature shows how complexity can be reduced

**H2:** Project complexity negatively impacts agile methodology use.

## 2.4 Agile Methodology Use and Project Success

In 2001, agile manifesto was published by leading software process methodologists which addressed the inability to adapt quickly to changes and the impact of this inflexibility on the project results (Lechler and Yang, 2017). (Campanelli and Parreiras, 2015) stated that the manifesto has principles that allow to use agile methods in software development. And main focus is upon “individual interaction, Working software, Customer collaborations and responding to change”.

The Agile Alliance (2001) also published 12 Agile principles, namely, “Valuable software delivery on an early and continuous basis, Requirements changes are welcome, Deliver software frequently, Constant interaction between business people and developers, Motivated working people, Prioritize face-to-face communication, Working software is progress, Keep a constant working pace, Good design allied to technical excellence, Work simplicity, Self-organizing teams, and Improve continuously”.

Agile and traditional methodologies are very different to each other as agile averts from the traditional methodologies less customer interaction, predefined scope of the project and more focus on documentation (Serrador and Pinto, 2015). According to (Henderson-Sellers et al., 2014), agile method provide improved productivity, more flexibility and is more business oriented.

In comparison to traditional development agile allows free communication, it has concept of shared ownership i.e. each member is responsible for their work and contribution and follows an organic structure which is flexible, participative and encourages cooperation. And relies on incremental product delivery (Tam et al., 2020).

Agile methodology where it has its benefits still it is very complex to adopt to because of organizational features like change resistance, culture, low management support or involvement (Dybå and Dingsøy, 2008). Research has shown that organizations methodology of project management greatly impacts the project quality and decide the success and failure of the project (Rolstadas et al., 2014).

Adopting agile methodology enables the developer the flexibility and be responsive to the continuous changing requirements and environment. Agile methodologies have proved to have far higher flexibility and agility as compared to traditional software development methodologies and are used to produce higher quality in shorter time (Cheng et al., 2009).

In agile methodology both the developers and customer frequently adjust their priorities, strategies and actions by directly monitoring and giving feedback that results from their decisions (Cao and Ramesh, 2008). Agile and traditional methodologies are very different to each other as agile averts from the traditional methodologies less customer interaction, predefined scope of the project and more focus on documentation (Serrador and Pinto, 2015). According to (Henderson-Sellers et al., 2014), agile method provide improved productivity, more flexibility and is more business oriented. According to (Dhir et al., 2019), if certain attributes exist in project or its team like delivery of quality product, customer satisfaction and on-time delivery of product with conformance to planned estimations it can lead project to success.

Furthermore (Dhir et al., 2019) stated, some success factors in agile development

both in view of organization and team. In organizational view cooperative culture, work environment, and in team motivation, knowledge sharing, strong relationship between team members. These factors proved to be decisive due to agile methodology the overall efficiency, accuracy, time management, risk analysis and product quality of the project were high and project was successful.

(Mahanti, 2006) stated that for any project to be successful in agile environment the first thing to do is to educate and train the team so that they become familiar to agile framework, its principles, and most of all its practices before implementing the agile. Once it is adopted it should be completely used to achieve desired results.

For a project to be successful it is said that the project must be completed in allocated budget, time and according to the scope. Yet still the focus is on the customer satisfaction, which the most critical in declaring the project successful. Agile methodology allows its customers, stakeholders to be complete in charge of the project because they can allocate the priorities to the tasks.

They are a part of the development team and while the product is being developed the methodology suggests that the stakeholders must be present so that the project can be moved forward. In recent years the agile methodology became key methodology of the software development to make the projects successful (Stankovic et al., 2013).

(Conforto et al., 2014) stated agile methodology can be adopted in other fields as well, because of the trends toward the novelty and complex nature they might fail if carried using the traditional methodology instead for achieving success agile methodology should be implemented .

(Bergmann and Karwowski, 2018) stated that an agile project to be successful the integral part is the human factor that includes a highly skilled and thorough knowledgeable team, cooperative management, and involved customer. Secondly prescribed the practices for agile projects to become successful: smaller manageable teams, properly guided by the managers, information should be made easy to access and adaptive leadership.

(Sherehiy and Karwowski, 2014) said projects nowadays, to make them successful it is very important to have an organizational structure which is less hierarchical

and more flexible because it will support the fast-changing and complex environments. (Tripp, 2016), conducted a study that proved that by adopting agile methodology project success percentage can be increased.

According to (Vithana et al., 2018), for agile to be successful following characteristics should be present in the team: technical competence, collaborative development, coordination, effective knowledge management, customer engagement. By combining these factors the team could be successful in completing the project. So from above literature we can propose that

**H3:** Agile methodology use has positive impact on project success.

## 2.5 Mediating Effect of Agile Methodology Use between Project Complexity and Project Success

Project complexity being a dimension which is often ignored at project planning and execution stages. And project complexity has a negative impact on success of the project. When a project is highly complex research shows that those projects are very hard to manage and their objectives are hard to attain.

(Kermanshachi et al., 2020) stated that in project development process, project complexity is a crucial factor that should be considered. Also the type of project which are more at risk due to complexity are the industrial projects. (Mirza and Ehsan, 2017), said the major reason of project failure is the ever growing complexity.

According to (Mirza and Ehsan, 2017), complexity is of three categories which are Schedule Complexity, Cost Complexity and Scope Complexity and their research stated that projects which have high complexity have a tendency for bigger cost or overrunning the schedule.

Complexity often referred to unpredictability is a major problem in the traditional development environment. To solve this process agile process claimed to guide in those cases where the change could not be predicted (Breitschuh et al., 2018). Furthermore, they proposed a framework which was used to apply agile processes

where necessary in the project.

To avoid complications in the project they supported the complex phases by efficiently integrating expert knowledge. (Qureshi and Kang, 2015) stated that complexity occurs mostly due to the organizational factors and to measure the complexity, project complexity measure exist but are limited to their criteria. For this they proposed a model that would help in providing assistance in dealing with the complexity.

By using agile methodology in a project (Petersen and Wohlin, 2009) found that agile methodology helps by providing precise requirements because of reduced scope and thus can be achieved easily, direct communication of team and their willingness to help reduces the need for extensive documentation. The frequent deliveries help in receiving the feedback early.

Agile Methodology could be implemented in all industries as innovative and complex nature of projects could not be executed using traditional processes as they are out dated for project success. So opportunities should be analyzed in the industry to implement the agile methodology technique for successful delivery of the project. The need of rework is reduced and they found many more advantages that agile methodology provides if used in project.

(Moore and Spens, 2008) found that in a large - scale project, the team should cooperate and participate in the cross-team activities and invest time in the project wide activities. Specially the team leaders must participate for cross team communication and cooperation activities outside the team room.

This emphasis on the cross-team communication is because the dependencies and complexities that teams have while developing the project and while facing problem they could help each other and during decision making they can give suggestions. So, the project can be led to success.

For any project the activity that is considered critical is the requirements engineering, and research suggests that problems associated with requirement engineering could become a major problem that could lead the project to failure. Agile methodology ensures that requirement prioritization should be done by the input of customer and the developer (Mishra and Mishra, 2011).

By stating which requirements would benefit the customer the most those would

be given highest priority and would be developed early. The developers point out the complexity, technical risks, cost, or difficulty in doing that particular aspect or feature of the project. The requirements of the features of the project are easily accessible and available for revision and can be enhanced. This aspect of the agile methodology enables its user to manage complexity more effectively and can adjust according to the situation.

Agile is successful due to its ability to completely meet the user expectations. By incremental delivery of the product and adaptive to changes. (Gao et al., 2018) stated that project complexity can affect the performance negatively if not properly governed. Agile methodology was proposed for the delivering innovative and a reliable product in accordance to cost and schedule limits, while mitigating the risks by efficiently managing the complexities (Imani et al., 2017).

(Conforto and Amaral, 2016) said the agile team should be rapid and active enough to cope with the change can lead to better results. And if the customer is involved actively it can help in achieving the project success despite complexities. From above literature we can predict that.

**H4:** Agile methodology use mediates the relationship between project complexity and project success.

## 2.6 Moderating Effect of Team Cooperation Between Agile Methodology Use and Project Success

As for every project to be successful the human factor is one of the key factors that has proven to be decisive. (Zaitsev et al., 2020) stated in agile project development as opposite to traditional project development the emphasis has shifted to people from tools, controlled environment to a collaborative environment and instead of detailed documentation is discouraged because it will hinder the fast pacey development of agile methodology each is defined a task and that is done concurrently. Complexity makes it difficult and ambiguous to find out the operation of an organization. Modern complexity theory suggests complex systems can be sometimes



predictable and sometimes unpredictable . Most of all agile is focused on a skilled team and collaboration with customers to produce better quality outcomes.

(Tee et al., 2019) cooperation and coordination is required for effective collaboration. Previous work stated that to decrease the complexity it is better to do the project in modular approach. This modularity approach can only focus on the small number of interdependencies at different levels of the project. If the organization is doing projects according to its strength the cooperation will be higher in co-located team which will produce better results.

To avoid any misunderstanding between the teams of project using agile methodology each is defined a task and that is done concurrently. While performing their tasks if one team faces a problem by communicating with the project manager teams can cooperate with other teams to develop quality features or project. And this cooperation could lead to project success (Mishra and Mishra, 2011).

Team cooperation improves efficiency, effective resource usage, and problem solving. Which increases the productivity, reduces costs and improves the performance. When the team cooperation is high, the team can become more successful. To increase the team cooperation the organization must reduce the conflicts, improve the communications and improve the quality of relationship between the organization and the team and value consistency between the team (Hsu, 2017).

Agile methodology like XP ( Extreme Programming ) consist on a set of practices that allow increase in communication, simplicity, feedback, courage and cooperation. The main theme of XP agile methodology is to be together, with team and customer, communicate with each other and cooperate in complex situations and would allow them to successfully complete the project (Mishra and Mishra, 2011).

(Turginbayeva et al., 2020) stated complexity is the key for innovation in projects which can be handled by the project team. For better project performance from the team it is very important to create a sense of urgency of the project from the start of the project. Team cooperation can increase the efficiency and effectiveness of the project and team cooperation is very essential for project management which can help in solving the complexity caused by interdependencies of the activities of the project (Gemünden et al., 2018).

Strong team cooperation shows the higher level of interaction and communication

that is an opportunity for better understanding each other and can lead to better performance and will help in dealing with complexities of the project. Team cooperation has a positive effect on team performance and this team cooperation can reduce the risks which can affect the project outcome (Tian et al., 2015). From above literature we can hypothesize.

**H5:** Team cooperation moderates the relationship between agile methodology use and project success in such a way that high team cooperation will strengthen the relationship between agile methodology use and project success.

## 2.7 Research Model

Our research model consists of 4 variables, naming Project Complexity, Agile methodology use, Team cooperation and project success. Project complexity is independent variable and effecting rest of the variables. Agile Methodology use is a mediating variable which represents a relationship between dependent and independent variables if a relationship exists. Team cooperation is a moderating variable which represents strenght or weakness of relationship established by mediating variable. Project success is a dependent variable which is effected by all other variables.

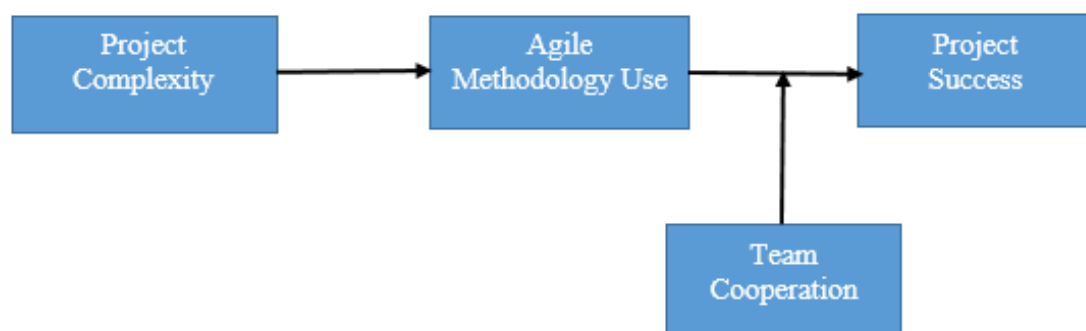


FIGURE 2.1: Research Model of Project Complexity on Project Success, with mediating role of Agile Methodology and moderating role of Team Cooperation.

## **2.8 Hypothesis of the Study**

**H1:** Project complexity has a negative impact on project success.

**H2:** Project complexity negatively impacts agile methodology use.

**H3:** Agile methodology use positively impacts project success.

**H4:** Agile methodology use mediates the relationship between complexity and project success.

**H5:** Team cooperation moderates the relationship between agile methodology use and project success in such a way that high team cooperation will strengthen the relationship between agile methodology use and project success.

# Chapter 3

## Research Methodology

This chapter is about the methodology adopted for research analysis. This chapter includes the population size, technique of sampling, sample size, characteristics of sampling, and reliability of variables, instrument and items involved in this research.

### 3.1 Research Design

#### 3.1.1 Research Philosophy and Quantitative Research

Research is conducted using the hypothetic-deductive method. In which a problem is initially observed in a contextual setting of population to access what is the problem and what is the gap that needs to be targeted. The problems found are explained clearly and what are the research voids in the population that need to be targeted by this study. The data and literature is collected through studying different researchers and by providing a theory in support of our model, hypothesis are formulated for model evaluation.

(Zikmund, 2003) defines design of research is the plan for researcher to specify the procedure and method for collecting and analyzing necessary information. Data was collected from the population and study sample which was used to deduce the statistics. After the data collection the results were formulated using data measurement tools, these results are compared with the hypothesis. If the results

support the hypothesis, then the results would be correct else the hypothesis would fail. Quantitative research methods are used to achieve population results. This work is focused in the hypothetic-deductive method for achieving the results of the study.

### **3.1.2 Type of the Study**

This study was causal in nature, designed to evaluate the impact of project complexity on project success with mediation of agile methodology. The moderation of team cooperation between agile methodology and project success is assessed. In this study data was collected from IT industry located in Rawalpindi and Islamabad. Initially, about 350 questionnaires were circulated to gather data and 290 actual responses were returned out of them.

### **3.1.3 Unit of Analysis**

Unit of analysis is one the most important and significant part of a research study. To make understandable the unit of analysis means that an individual who is the center of focus of analysis of the study. Unit of analysis can be a specific or could be a set of values that could be covered for analysis i.e. Individual, groups, cultures, organizations etc.

Our study is viewing the influence of project complexity over project success with agile methodology as mediator and team cooperation as moderator. As these are people relating factors so the unit of analysis for our study are the employees of project based organizations.

### **3.1.4 Time Horizon**

The data that was used in this study was acquired from the IT industry of different areas in Pakistan. As cross-sectional method of data collection was used and it took three months approximately. The research study is time bound so the cross-sectional method was used.

## **3.2 Population and Sampling**

### **3.2.1 Sample and Sampling Technique**

It is very difficult to gather data from all population because of time and resource limitation. So, we use the sampling approach, there are two types of sampling probability sampling and non-probability sampling. First we will discuss the how sampling is performed. For doing the sampling we have to go through four stages which are as follows: identification of the sampling frame from the population (expected audience), deciding the suitable sample size, selection of appropriate technique and sample from the population and last checking of the sample if it is representing the population or not.

For a probability sampling there are five major techniques that can be adopted which are as follows: Simple Random, Systematic, Stratified Random, Cluster, Multi-Stage. In each of the probability sampling the researcher choses a sample from a large population by selecting the sample randomly.

For non-probability sampling there are four major techniques which are as follows: Convenience, Snowball, Quota, Purposive, Self-Selection. In non-probability sampling techniques, the sample is selected through a non- random process. In these sampling techniques the researcher could select the audience specifically related to the targeted research.

In our study to save time and due to other limitations convenience sampling was used. Convenience sampling allows efficient collection of data. It is most suitable approach for gathering data in project based organizations of Pakistan showing the impact of project complexity on project success.

For collection of data, a particular group of individuals is identified for representation of entire population. Project based organization were targeted who have been continuously dealing with project and can contribute in significant manner. And can help us in collection of data about the impact of project complexity on project success.

The sample includes managers and employees of various organizations. Data were collected by means of self-reported questionnaires. Participants were made confident about the information they have submitted for this research. At least 350

questionnaires were circulated among the sample.

The questionnaire was divided into five sections where in the first section respondents were asked about the information related to their demographics namely gender, age, qualification, education, experience. And in the later parts questions related to our variables were asked.

The respondents were assured regarding the information they provided would be kept highly confidential in order to encourage participants to provide authentic data related to the topic and it was pledged that all the information being gathered would only be used for academic purpose in order to get insight about the role of Agile methodology use in the project success.

We used 5 point Likert scale to measure the responses where 1 represents “strongly disagree” and 5 represents “strongly agree”.

### **3.2.2 Population**

The population of this study are the employees (i.e. project managers & employees) that are part of project based organizations of IT and software development field based in Rawalpindi and Islamabad.

The sample was from several types of projects might that be local, international, small scale or large scale projects. Project from IT and Software background in order to get broader sight of the impact of project complexity on project success. In this research questionnaire were distributed online using Google Forms between the respondents.

Data was collected from the people who are working in project based organization. Data was collected from private organizations (software houses and software developing organizations) of Islamabad and Rawalpindi. The data was collected through questionnaire which will filled using Google form. Convenience Sampling was used for collection of data for the impact of Project complexity on project success with agile methodology use as a mediator and team cooperation as moderator. More than 300 questionnaires was distributed among respondents and they were asked to complete it as accurately as possible.

Respondents filled total of five sections. In the first section respondent provided

demographic information (gender, age, qualification and experience) the later sections will have the questions related to variables.

TABLE 3.1: Software companies.

<b>Name</b>	<b>Location</b>
United Sol Pvt ltd	Islamabad
MTBC	Rawalpindi
BroadPeak	Islamabad
Solutionsplayer	Islamabad
Zigron Technologies	Islamabad
KeyDevs	Islamabad
Apollo Telecom	Islamabad
WebTechPk	Islamabad
Helixatech	Islamabad
VQode Solutions	Islamabad

### 3.2.3 Sample Size

Initially the number of distributed questionnaires was 350, which were distributed using Google Forms. From those 350 questionnaires only 250 properly filled were received back. With the response rate of 71.4% selected for the analysis purpose. The sample size was which was used for the study consisted of these 350 questionnaires. Which were calculated by using the Cochrans Sample size formula.

$$n = \frac{z^2 p q}{e^2} \quad (3.1)$$

In the above mentioned formula n is the size of sample, z is the estimated standard deviation, p is the estimated proportion of the population which can be attributed in the questionnaire, q is 1 - p (estimated proportion of the population), and last e is the desired margin or error.

We assumed that more than 85% work as manager or employees in a project based organization. This our assumption gave us the value of p = 0.85, by having the value p we can get the value of q by the equation

$$q = 1 - 0.85$$



$$q = 0.15$$

For the value of  $z$  we use the Z-Table for which we must have a confidence level, and for the current study we are using the confidence level of 95% giving the margin or error the value of  $\pm 5\%$ . So by having the value of confidence level equal to 95%, the value of  $z$  as per the Z-Table is 1.96.

So, by applying these values to the equation

$$n = \frac{(1.96)^2(0.85)(0.15)}{(0.05)^2} \quad (3.2)$$

$$n = 196$$

We would require at least 196 valid responses for our questionnaire.

### 3.3 Procedure for data collection

For collection of data friends working in the IT/software organizations were asked to fill the questionnaires, and they were also asked to forward it to their colleagues. Without these friends it is very impossible to collect data from private IT/software organizations as they don't allow anyone to disturb their busy schedules and secondly going in each and every organization is almost impossible. So, by using references of friends data collection was made possible. For data collection each respondent was encouraged by ensuring them that the information they will be provide will be kept confidential and it was being collected for only educational purpose.

Approximately 350 questionnaires were circulated for the data collection but only 250 properly filled questionnaires were received and considered.

### 3.4 Sample Characteristics

The demographic information collected in this research are; gender, age, qualification, experience.

### 3.4.1 Gender

Gender is considered as a significant demographic element because of the difference between male and female in a certain population sample. In this research, it has been tried to honor the gender equality but still it has been viewed that the proportion of male staff is significantly larger than that of female staff.

TABLE 3.2: Gender

Gender	Frequency	Percent
Male	167	66.8
Female	83	33.2
<b>Total</b>	250	100

Table 3.2 shows the gender ratios of males and females in which 68.8% were male and 33.2% were female respondents. This table shows that percentage of male respondents is high.

### 3.4.2 Age

Age is also one of the important demographics, which some respondents feel uncomfortable in disclosing it. So, for the convenience of the respondents range of ages were utilized instead asking particular respondent their age.

TABLE 3.3: Age

Age	Frequency	Percent
20 - 25	49	19.6
26 - 30	164	65.6
31 - 35	34	13.6
36 and Above	3	1.2
<b>Total</b>	250	100

Table 3.3 shows that the most respondents were of age between 26 - 30 which makes 65.6% of the total respondents. 13.6% respondents were having age ranging from

31-35, 19.6% percent were having age ranging between 20-25, 1.2% respondents were having age between 36 and above.

### 3.4.3 Qualification

Education is the key factor that is considered important for the success and progress of any nation and makes it to compete worldwide. Education help the students to grow and be a good person as whole and become an important part of the society. So, it is also an important dimension of demographics.

TABLE 3.4: Qualification

Qualification	Frequency	Percent
Matric	0	0
Intermediate	0	0
Bachelors	190	76.0
Masters	60	24.0
Ph.D	0	0
<b>Total</b>	<b>250</b>	<b>100</b>

Table 3.4 shows the qualification of the respondents. Most of the respondents had qualification of Bachelors, which involves 76% percent of the total population. 24.0% respondents had Masters qualification.

### 3.4.4 Experience

Respondents were asked about experience they had, for that multiple ranges of experience were provided so that respondents could comfortably choose the specific time period of their experience.

Table 3.5 displays the experience of the respondents, in which we can see that maximum number of respondents have experience between 0-5 years which means 51.2% respondents were between this range of experience. 44.0% respondents

TABLE 3.5: Experience

Experience	Frequency	Percent
<b>0 - 5</b>	128	51.2
<b>6 - 10</b>	110	44.0
<b>11 - 15</b>	9	3.6
<b>16 - 20</b>	3	1.2
<b>21 and Above</b>	0	0
<b>Total</b>	250	100

belong to experience range of 6 10, 1.2% had 16 20 years of experience, 3.6% had 11 15 years of experience.

## 3.5 Instrumentation

For evaluation of our variables we used close ended questionnaires that were adopted from multiple sources. Questionnaires were distributed among the respondents working in project based organization.

The responses were recorded using five point Likert scale where 1 represents “strongly disagree” and 5 shows “strongly agree”. Demographics were also included in the questionnaire.

### 3.5.1 Project Complexity

The 3 item scale was adopted for project complexity is developed by (Bjorvatn and Wald, 2018). complexity is subjective to the understanding of the team member and dealing with the task and situation where he faces the scoped definition, project objectives and deadlines which can further add to the complexity. The items of scale are e.g. “The project had a high degree of complexity concerning content.”, “To me, the project had a high degree of complexity concerning interdisciplinary participants”, “The project was characterized by high risk and uncertainty”.

Responses will be recorded using a 5 point likert scale where 1 represents “Strongly disagree” and 5 represents “Strongly Agree”.

### 3.5.2 Agile Methodology Use

The 6 items scale was adopted for Agile Methodology use is developed by Lu and Ramamurthy (2011). Some included items of scale are e.g. “We are quick to make and implement appropriate decisions in the face of market/customer-changes”, “We constantly look for ways to reinvent/reengineer our organization to better serve our market place”, “We fulfill demands for rapid-response, special requests of our customers whenever such demands arise; our customers have confidence in our ability”.

The responses will be recorded using a 5 point Likert scale where 1 represents “strongly disagree” and 5 represents “strongly agree”.

### 3.5.3 Team Cooperation

Team cooperation is very important to increase the motivation and productivity of the project based organizations and team cooperation has a great role in employee communication and interaction with each other. And team cooperation is not extensively studied. The 4 item scale was adopted for team cooperation is developed by (Dierdorff et al., 2011). Some included items of scale are e.g. “Other group members usually let me know what they expected from me.”, “I often made suggestions to other group members about better work methods”, “When I was busy, other group members volunteered to help me out”.

The responses will be recorded using a 5 point Likert scale where 1 represents “strongly disagree” and 5 represents “strongly agree”.

### 3.5.4 Project Success

Project is considered successful which fulfills the requirement and everyone involved in the project shows satisfaction with the outcome of the project. The 5 item scale was adopted for Project Success is developed by (Aladwani, 2002). Some included items of scale are e.g. “The basic goals of this project were clear for all of us”, “The goals of the project were in line with the general goals of the organization.”, “The results of the project benefited the organization”.

Responses will be recorded using a 5 point Likert scale where 1 represents “strongly disagree” and 5 represents “strongly agree”.

TABLE 3.6: Instruments

No.	Variables	Source	items
1	Project Complexity (IV)	(Bjorvatn, T. and Wald, A., 2018)	3
2	Agile Methodology use (Med)	(Lu and Ramamurthy 2011)	6
3	Team Cooperation (Mod)	(Dierdorff et al. 2011)	4
4	Project Success (DV)	(Aladwani and Adel 2002)	5

### 3.6 Covariates

In this research, we used One Way ANOVA test to see that control variables for the current study that could affect any variable. Our results show demographics do not affect any of direct or indirect relationships. So the demographics are not controlled in the study. Through the ANOVA analysis, the value of significance p for all demographics were above 0.05 which makes them insignificant in this research.

TABLE 3.7: Covariates

Covariates	F Value	Sig.
Gender	0.377	0.540
Age	0.855	0.473
Experience	0.638	0.645
Qualification	0.832	0.125

### 3.7 Scale Reliability

Reliability process is carried to check the consistency of the results. It is measured by Cronbachs alpha as it measures the internal consistency and reliability of the scale. Cronbach alpha provides the reliability of the scales or instruments used. The value of Cronbachs alpha should be greater than 0.70 for the scale to be considered and accepted.

We created the variables in the software i.e. PC (Project Complexity), AM (Agile Methodology use), TC (Team Cooperation) and PS (Project Success). Cronbach alpha expresses the inter-dependencies of the variables and also gives the view of that whether those variables have connection between them or not. The greater the value of Cronbach alpha the reliability of the scale will be greater and the lesser the value of Cronbach alpha the less reliable the scale is. Table 3.8 shows the Cronbach alpha value of each scale used in the research.

TABLE 3.8: Scale Reliability

Variables	Cronbach alpha	items
<b>Project Complexity (IV)</b>	0.840	3
<b>Agile Methodology use (Med)</b>	0.705	6
<b>Team Cooperation (Mod)</b>	0.750	4
<b>Project Success (DV)</b>	0.765	5

In the table 3.8 reliability and validity of the each variable were analyzed and represented. Cronbach Alpha value of Project Complexity was 0.840, Agile Methodology use was 0.705, Team Cooperation was 0.750, Project Success was 0.765.

### 3.8 Data Analysis Technique

After data collection, data is collected from more than 300 respondents were separated and for the analysis of the data was completed by using IBM SPSS version 21. Multiple steps were performed during analysis of the data such procedures are mentioned below

1. Filtering of appropriately filled questionnaires and only filtered data was selected for the analysis.
2. We created the variables in the software i.e. PC (Project Complexity), AM (Agile Methodology use), TC (Team Cooperation) and PS (Project Success).
3. Frequency tables were used to describe the sample.
4. Descriptive statistics was completed by using numerical values.

5. Cronbach alpha provided the reliability of the scales or instruments used.
6. Using Pearson correlation, correlation analysis was performed to check the significant relationship between the variables.
7. We performed regression analysis after the model was confirmed fit for our study. Single linear regression analysis of independent and dependent variables was performed to check their specified relation.
8. Preacher and Hayes Process was used to carry out mediation and moderation to identify the effect of mediator and moderator between the independent and dependent variables.
9. After the results of regression analysis, hypothesis were determined either accepted or rejected.



# Chapter 4

## Results

This chapter covers the results of the analysis process in which descriptive statistics (Mean and Standard deviation), correlation analysis, regression analysis according to mediator and moderator. Analysis results describe whether hypothesis were accepted or rejected. IBM SPSS (Statistical Package for Social Sciences) is used for analysis process.

### 4.1 Confirmatory Factor Analysis

Confirmatory factor analysis was proposed for the authenticating and measurement of the model which comprises of multiple variables. And for our study the variables are Project complexity, Agile methodology, Team cooperation and Project success.

Comparative Fit Index (CFI) shows that all variables are not associated and evaluate the model with covariance matrix. The value of CFI should be near 1 so that it can be accepted. Value of CFI above 0.90 shows good model fit and below exhibits poor model fit. Gefen et al., (2000) states Goodness of Fit Index as absolute fit for the measurement of model. GFI is defined as the degree of variance and covariance proportion (Raykov and Marcoulides, 2000). GFI value should be close to 1 and for a good model fit it should be greater than 0.80 and below this threshold will be considered as poor model fit.

Byrne (1998) stated that Root Mean Square Error of Approximation (RMSEA)

is used to evaluate the model fitness with population of covariance matrix. The acceptable range for RMSEA should be between 0.06–0.08.

To evaluate the model fitness Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Chi-Square value, Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA) were used.

#### 4.1.1 Measurement Model

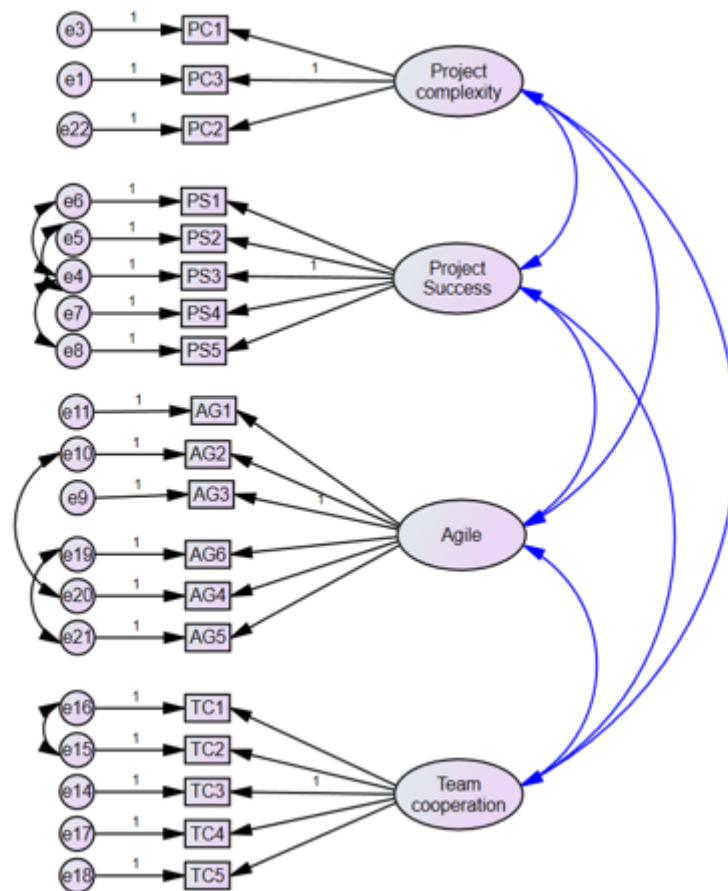
Anderson and Gerbing (1988) conducted confirmatory factor analysis for the validation of measurement model, in which four latent variables were used. Similarly for our model we have four variables Project complexity, agile methodology, team cooperation and project success. The model fit includes different indices such as model chi-square, comparative fit index (CFI), Tucker-Lewis index (TLI), incremental fit index (IFI), goodness of fit index (GFI) and root mean square error of approximation (RMSEA).

TABLE 4.1: Measurement Model

MODEL	CMIN/DF	CFI	TLI	IFI	GFI	RMSEA
<b>Baseline Model</b>	2.631	.892	.950	.962	.819	.057

Before explaining the table given above it is important to discuss the figure 4.1. The PC latent variable shows the project complexity. PS shows project success, AG shows agile methodology and TC shows the team cooperation. Table 4.1 shows the results for the model fit. To achieve the good model fit certain error terms were linked. Therefore the table shows all the values that are acceptable for a good model fit as stated by Hair et al (2009). IFI value is greater than 0.90 which is 0.962, which means an excellent fit. CFI value should be greater than 0.90 and it is 0.892 which means it is not a good model fit. RMSEA value should be less than 0.07 it is 0.057 which means a good model fit. Similarly, TLI should be greater than 0.90 and it is 0.950 meaning a good fit. Moreover, the GFI should be greater than 0.80 and it is 0.819 meaning an excellent model fit. Lastly, the value of Chi-square for good model fit it should be less than 3 and for our model it is 2.631 which

represents a good model fit. Overall the four factor model results show good and excellent model as the values show.



## 4.2 Descriptive statistics

Descriptive statistics show the important information about the variables used in the research i.e. Project complexity, Agile methodology use, Team cooperation and Project success. Descriptive statistics is the summary of the whole data collected using questionnaire. In descriptive statistics, the statistics included are, total number of respondents, maximum and minimum value of each variable, mean and standard deviation of each variable. Average of the responses is mean, and the change of responses from their mean is the standard deviation.

Table 4.2 shows the total sample size is 250 for the variables. Each variable

was recorded using 5 point Likert scale in which 1 depicts strongly disagree and 5 depicts strongly agree. Mean and standard deviation show the essence of responses. The mean value of Project Complexity is 3.32 and its standard deviation is 0.819. The mean value of Agile Methodology use is 3.28 and its standard deviation is 0.831. The mean value of Team Cooperation is 3.26 and its standard deviation is 0.765. The mean value of Project Success is 3.38 and its standard deviation is 0.703 respectively.

TABLE 4.2: Descriptive Stats

Variables	Sample Size	Min Size	Max Size	Mean	Std. Deviate
<b>Proj. Complex.</b>	250	1	5	3.32	.819
<b>Agile Method.</b>	250	1	5	3.28	.831
<b>Team Cooper.</b>	250	1	5	3.26	.765
<b>Proj. Success</b>	250	1	5	3.38	.703

### 4.3 Correlation Analysis

Correlation analysis is performed for the identification of the strength and the direction of the study variables. It helps in finding the connection between different variables. Direct and inverse relations could exist in the analysis, which means correlation could be positive or negative. Direct relation in the analysis is used to show the effect of one variable on the second variable, meaning that if one is increased the second variable will also increase and similarly the decrease in one variable will decrease the second variable. And for the inverse relation in the analysis shows the inverse effect of the variables on each other. Increase in one variable will decrease the second variable and vice versa.

Range of values for the correlation analysis is from -1 to +1, where +1 shows the correlation analysis of the variables as perfect correlation and -1 shows that variables are negatively perfect correlation exist between the variables. The 0 shows that there is no correlation exist between the variables. Basically, correlation analysis is performed to check the nature of variation between the variable.

TABLE 4.3: Correlation

Variables	1	2	3	4	5
Project Complexity	1				
Agile Methodology use	-.392**	1			
Team Cooperation	-.237**	.670**	1		
Project Success	-.471**	.640**	.791**	1	

\*\*Correlation is the significant at the 0.01 level (2 - tailed) N=315, \*P  $\leq$  0.05, \*\*P  $\leq$  0.01, \*\*\*P  $\leq$  0.001

Table 4.3 shows the correlation of variables of our suggested model. Project Complexity is negatively correlated with Agile Methodology use ( $r = -.392^{**}$ ,  $p < 0.01$ ). Project Complexity is negatively correlated with Team Cooperation ( $r = -.237^{**}$ ,  $p < 0.01$ ). Project Complexity is negatively correlated with Project Success ( $r = -.471^{**}$ ,  $p < 0.01$ ). Agile Methodology use is positively correlated with Team Cooperation ( $r = .670$ ,  $p < 0.01$ ) and with Project Success ( $r = .640$ ,  $p < 0.01$ ). Team Cooperation is also positively correlated with Project Success ( $r = .791$ ,  $p < 0.01$ ).

## 4.4 Regression Analysis

To validate the results of the correlation analysis i.e. there is a relationship between variables, regression analysis is done in this research. It describes the dependency between the variables and to what extent change in one brings change in the other variable. Simple regression or linear regression is performed for checking the relationship of independent and dependent variables. For multiple variables the multiple regression analysis is performed.

Preacher and Hayes PROCESS macro has been used for both mediation and moderation regression analysis in this research.

### 4.4.1 Linear Regression Analysis

**Hypothesis 1:** Project Complexity has a negative relation project success.

Un-standardized regression coefficient reported N= \* $p \leq 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p \leq 0.001$

TABLE 4.4: Simple Regression

Predictor	Project Success		
	$\beta$	R <sup>2</sup>	Sig
Project Complexity	-.482***	.233	.000

Table 4.4 shows the result of first hypothesis. According to H1, Project Complexity is negatively affecting the Project Success. Results of regression show that Project complexity is negatively affecting the Project success and there is a significant relation between them. The R<sup>2</sup> value is 0.233, Beta coefficient = -.482 and  $p$  value = 0.000. The  $p$  value of 0.000 shows that relationship between the variables is highly significant. The negative value of beta shows it is a negatively effecting and there is a negative relation between the IV and DV. This shows that Project Complexity is bringing a negative change of 0.233 in Project success. Hence, our first hypothesis is accepted by applying linear regression.

In this study, Project Complexity is denoted by X which is our independent variable, Project Success is denoted by Y which is our dependent variable. The unmediated model is shown below. Path C shows the direct and unmediated link of dependent and independent variables.

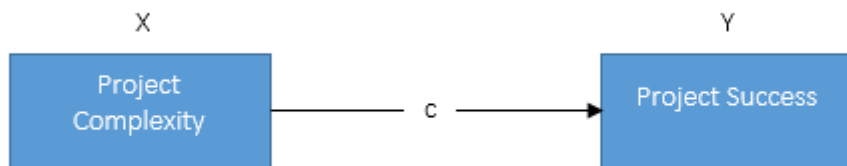


FIGURE 4.1: Linear Regression

## 4.5 Mediation Analysis

By doing the mediation analysis, we will check our hypothesis i.e.

H2 Project complexity has a negative impact on agile methodology use. The second hypothesis for this analysis we will check agile methodology has positive

impact on project success. The third is that agile methodology use mediated the relationship between project complexity and project success. So to check our hypothesis H2, H3 and H4, we utilized Process Macro by Hayes. The paths between independent variable to mediator and mediator to dependent variable must be significant to prove the mediation process.

The explanation of each path is following: Note. Un-standardized regression

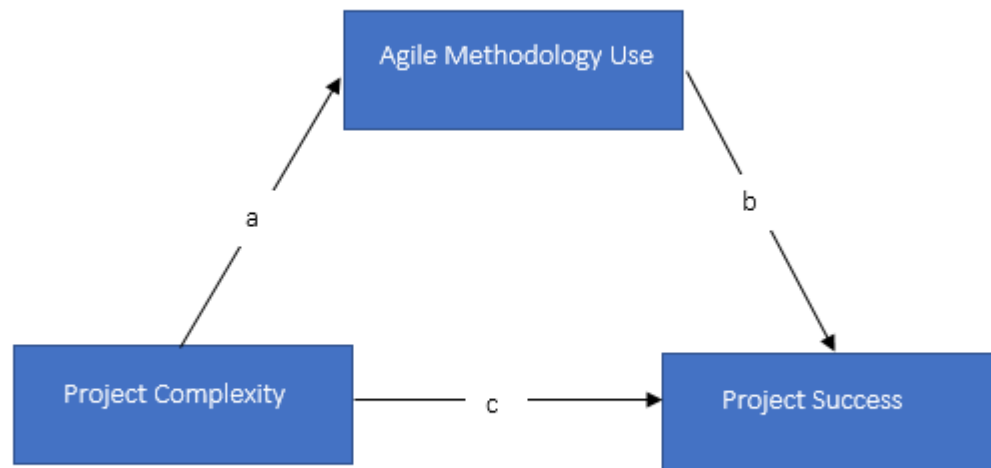


FIGURE 4.2: Mediation Analysis

TABLE 4.5: Mediation Table

IV	Effect of IV on M (a Path)	Effect of M on DV (b path)	Direct Effect of IV on DV (c path)	Total Effect of IV on DV (c path)	Bootstrap. Results for indirect	Results for Effect
	B	B	$\beta$	B	LL95% CI	LL95% CI
Project Complexity	-.3905**	0.6315**	-.2562**	-.482**	.3730	.1176

coefficient indicated. Bootstrap sample size 5000. LL = Lower Limit; CI = Confidence Interval; UL = Upper Limit, N = 315, \*P<sub>i</sub>.05; \*\*P<sub>i</sub>.01

So, According to Figure 4.4, we have to check three paths for checking our hy-

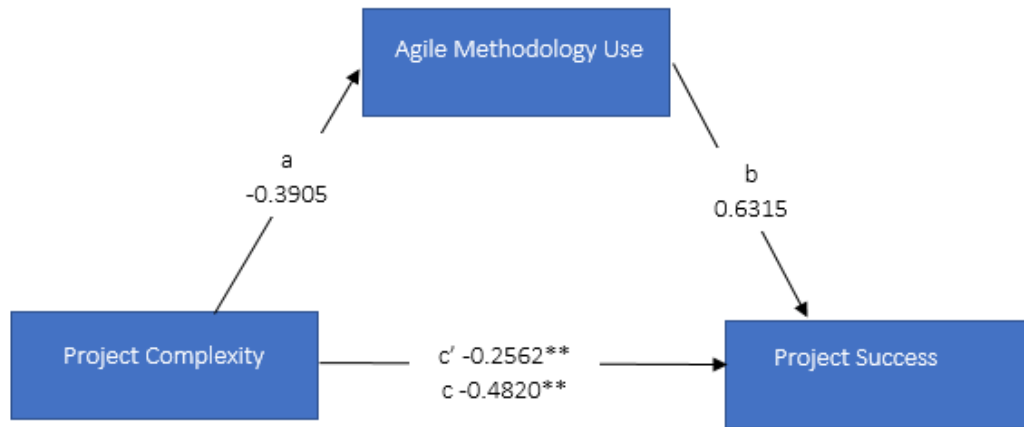


FIGURE 4.3: Mediation Analysis with Coefficients

pothesis, which are a, b and c path.

### 4.5.1 Hypothesis 2

In hypothesis H2, we assumed that project complexity is negatively associated with agile methodology use. Project complexity is the element which is at most attention in the recent time, as agile methodology is of iterative and continuous nature and it encourages interaction with customers for getting the correct information for the implementation and execution of projects with the information sharing with the stakeholders makes the project complexity lower. Hence, in this way the project moves to the success for achieving of its requirements. In this mediation path a shows the result of hypothesis. The result can be seen in the mediation table second column.

Results show that there is a negative significant relation between the variables. The  $\beta$  coefficient value -0.3715,  $R^2$  value is 0.1694 with the  $p$  value of 0.000.



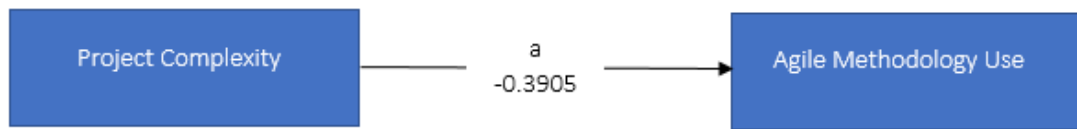


FIGURE 4.4: Hypothesis 2 pictorial representation

Negative value of B depicts that there is a negative relation between the project complexity and agile methodology use.  $P = 0.000$  shows that there is a significant relation between the variables.  $R^2$  value 0.1694 shows that Project complexity is causing 0.1694 change in agile methodology.

### 4.5.2 Hypothesis 3

Moving on to the third hypothesis, we analyzed H3 according to which agile methodology use has a significant and positive relation with project success. Column three of the mediation table shows the results of our hypothesis H3 i.e. Effect of M on DV (path b) in table 4.4. Results showed that the agile methodology use is positively associated with project success. Path b shows the link in figure. The  $\beta$  coefficient value is 0.6325, the value of  $R^2$  is 0.5702 with the  $p$  value of 0.000. Positive value of  $\beta$  and  $p$  shows that there is a significant relation between agile methodology use and project success. As  $R^2 = 0.5702$  which shows that 1 unit change in agile methodology use causes 0.5702 change in project success. So results justify and prove our hypothesis 3.

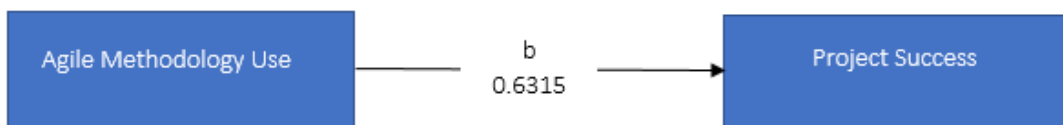


FIGURE 4.5: Hypothesis 3 pictorial representation

### 4.5.3 Hypothesis 4

For mediation in our model we analyzed our Hypothesis 4, which states that agile methodology use will mediate the relationship between project complexity and project success. The result of this hypothesis are shown in table 4.5. Results show that indirect relation between the project complexity and project success has lower level confidence interval of -.1176 and upper level confidence interval of -.3730. Both values LLCI and ULCI have same negative values and no zero exists between them. So we can say that the mediation is happening. Hence, hypothesis 4 is accepted that agile methodology use mediates relationship between project complexity and project success.

So using the model 4 of PROCESS macro by Hayes in SPSS, we analyzed our three hypothesis and used their results to prove our three hypothesis. Mediation table has some other values lets take a look on what those are one by one.

### 4.5.4 Total Effect

Total effect explains the IV and DV relation which is in our study is the project complexity and project success. This relation is our hypothesis 1 and it was also analyzed in linear regression analysis. So total effect of project complexity on project success is -0.482 with the significance of 0.0000 i.e.  $\beta = -0.482$  and  $p = 0.0000$  respectively.

As the value of  $\beta$  is negative than there is a negative relation between the variables and  $p = 0.000$  that means there is a significant relation between these variables. The values were same in the linear regression showing the negative relation between Project success and Project complexity, so our hypothesis 1 is accepted by both of the processes.

### 4.5.5 Direct Effect

Direct effect shows the effect of Independent variable on dependent variable in the presence of the mediator. In our model, it shows that project complexity has an effect on project success in the presence of agile methodology. Results show

that the impact of project complexity on project success in the presence of agile methodology is  $-.2562$  and the value of  $p$  is  $0.000$ .

This means that Project complexity has a negative and significant impact on project success in the presence of the agile methodology. The same values in the linear regression showed the negative relation between Project success and Project complexity. Thus, proving our model and hypothesis. The  $\beta$  value shows the negative impact and  $p$  shows the significance of the relation.

## 4.6 Moderation Analysis

Hypothesis 5 suggests that team cooperation moderates between agile methodology use and project success which means that team cooperation strengthens the relationship of these variables. Table 4.6 explains the results of this hypothesis. In the results the upper level and lower level confidence interval of  $0.0206$  and  $0.2029$  and both have same sign and no zero value exists between them. Similarly, interaction term shows positive and significant regression coefficient ( $\beta = 0.4129$ ,  $p = 0.0008$ ) which means that team cooperation moderates relationship of agile methodology use and project success positively and significantly. Hence we can say that hypothesis 5 was supported by moderation analysis.

The Figure 4.6 shows the graphical representation of acceptance hypothesis 5 team cooperation moderates the relationship between Project Complexity and Project success. To better explain the effect of team cooperation, slope for moderator is plotted. Figure explains that slope of relation between AM and PS is stronger with high TC. There are 3 slopes showing three different value of TC a low value, a mean value and a high value. With low team cooperation the project success is low and agile methodology is also low. And as the value of team cooperation increase the value of success also increases by increasing the use of agile methodology.

Note. Un-standardized regression coefficient indicated. Bootstrap sample size 5000. LL = lower limit; CI = confidence interval; UL = upper limit  $N = 300$ , \* $P < .05$ ; \*\* $P < .01$

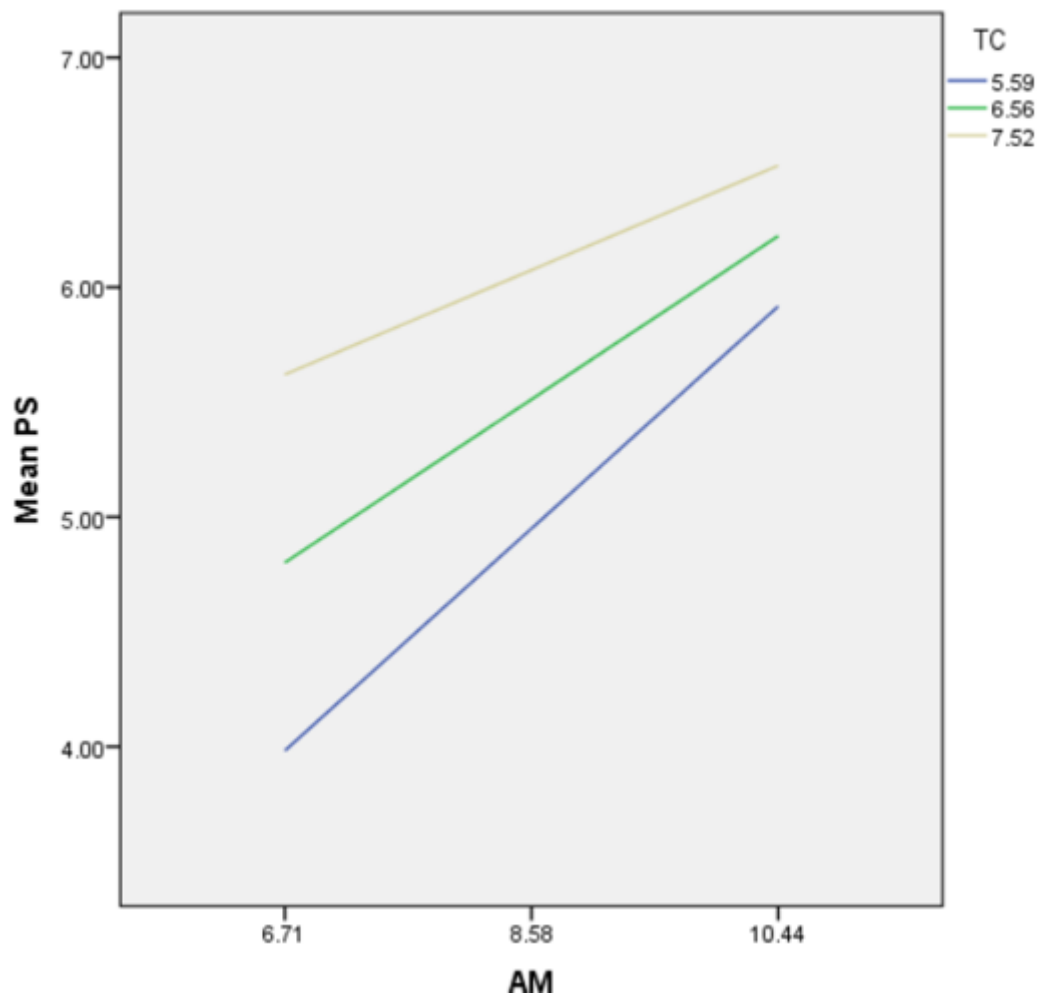


FIGURE 4.6: Linear Regression

TABLE 4.6: The Moderating effect of Team Cooperation

	$\beta$	$se$	$T$	$p$
<b>Int_term</b>	0.4129	0.0737	3.3170	0.008
		<b>LL 95% CI</b>		<b>UL 95% CI</b>
<b>Bootstrap results for direct effect</b>		.0206		0.2029

## 4.7 Summary of Accepted / Rejected Hypothesis

The summary of results depict that all hypothesis are accepted on the basis of results gathered using analysis technique. Results are deemed true on basis of accurate data analysis. All these hypothesis are accepted in the context of Pakistan.

TABLE 4.7: Summary about Accepted / Rejected hypothesis

<b>Hypothesis</b>	<b>Statements</b>	<b>Results</b>
<b>H1</b>	Project complexity has a negative impact on project success.	<b>Accepted</b>
<b>H2</b>	Project complexity negatively impacts agile methodology use.	<b>Accepted</b>
<b>H3</b>	Agile methodology use positively impacts project success.	<b>Accepted</b>
<b>H4</b>	Agile methodology use mediates the relationship between project complexity and project success.	<b>Accepted</b>
<b>H5</b>	Team cooperation moderates relationship b/w agile and project success.	<b>Accepted</b>

Conclusion can be drawn from the results that project complexity has a negative and significant relation with agile methodology and project success. Agile methodology mediates the relation between project complexity and project success. Last team cooperation strengthens the relation of agile methodology and project success as a moderator.

# Chapter 5

## Discussion and Conclusion

### 5.1 Discussion

This chapter includes hypothesis relationship and also their justification of acceptance or rejection including the implications of the hypothesis theoretical and practical, strengths and weaknesses of the study and future directions. The main purpose of the study is to check the impact of Project Complexity on Project Success. In this study, we took Agile Methodology as mediator and Team Cooperation will act as the moderator between Project Complexity and Project Success. This research was conducted using data from multiple project based organizations, so the context is Pakistan in the study.

We intended to check the proposed hypothesis which are Project Complexity has a negative relation with Project Success, Project complexity is negatively impacted by Agile Methodology use, Agile methodology use mediates Project Complexity and Project Success. And Team Cooperation moderates the relationship between Agile Methodology and Project Success in such a way that high team cooperation will strengthen the relationship between Agile Methodology and Project Success. These hypothesis were tested by the data collected from 315 respondents. Our hypothesis are summarized in the section of results. So hypothesis H1, H2, H3 and H4 are accepted creating a relationship between Project Complexity and Project Success using Agile Methodology as mediator. The results suggests that Project Complexity in any project can lead the project to failure. PC can be minimized

by adopting Agile Management throughout the organization.

This study includes Team Cooperation as a moderator. Results after the analysis show that in organizations of Pakistan Team Cooperation positively influences the relationship between Agile Methodology and Project Success. The results show that Team Cooperation is significantly and positively affecting the relationship between Agile Methodology and Project Success. Hence, as a moderator it is strengthening their relation.

It can be observed that all of our hypothesis are accepted and are supported by the results achieved after the data analysis. The data was collected from the organizations of Pakistan. So, this study is in context of Pakistan. Detailed discussion about the hypothesis is as following:

The main purpose of this study was to develop an integrated model of perception of politics with its dual outcomes. In order to attain the purpose, the research questions were articulated and tested with respective hypothesis. Generally, we found a good support for our hypotheses, while some results were contrary to expectation. In following chapter, the possible reasons for these results are discussed in detail.

### **5.1.1 Hypothesis H1: Project Complexity negatively impacts Project Success.**

It was proposed that Project Complexity has a negative impact on Project Success, this means that there is negative association between these variables. After the data analysis the results achieved against this hypothesis. This can be supported by literature.

(Baccarini, 1996; Iles, 1997; Shenhar and Dvir, 2007; Shenhar and Holtzmann, 2017; Geraldi, 2011), all stated that there is relationship between project complexity and project success. In nature of projects the construction projects are the most complex because of their more interrelated parts involved in the project which makes them complex and risky. If these interrelated parts are handled properly, it may lead to desired outcome. If not handled accordingly project may not get desired results. And the project will be deemed as failure.

Results also show that if complexity is not properly analyzed it will affect the project success negatively. As each project is thought to achieve success, and success is the end goal of each project. Project success can be measured differently e.g. some project can be considered successful if they are completed in a certain time, some can be considered successful if they achieve certain level of quality and some can be considered successful if they are completed in a certain budget.

### **5.1.2 Hypothesis H2: Project Complexity negatively impacts Agile Methodology**

We suggested in our hypothesis H2 that Project Complexity is negatively associated Agile Methodology use. Data was collected from organization in Pakistan and then different analysis were performed on the data. The results of analysis supported this hypothesis. The p value shows that the relation between these variables is significant. The value of R2 shows the factor of change in PC is affecting AM. However, results were well supported our hypothesis.

(Bakshi et al, 2016; Burke and Morley, 2016; Floricel et al, 2016; Bergmann and Karwowski, 2018) stated that project complexity is the one of the major aspects of the project which affect the performance and results of the project. Because of this in-built feature of project most of the project fail to meet the deadline. And project complexity must be completely understood by the manager to effectively managing the project. Project complexity is the element which is at most attention in the recent time, as agile methodology is of iterative and continuous nature and it encourages interaction with customers for getting the correct information for the implementation and execution of projects with the information sharing with the stakeholders makes the project complexity lower (Maylor and Turner, 2017) stated that to deal with complex projects one must have good project management skills and should be able to use a certain methodology to deal with complex nature of the project.

Results show that AM reduces the PC, and there is a negative relationship between the two variables. This means that if agile methodology is used it will bring



project complexity lower by its iterative behavior continuously involving the customer in the development process. So, by lowering the complexity factor of the project, project moves towards success.

### **5.1.3 Hypothesis H3: Agile Methodology use positively impacts Project Success**

Moving towards third hypothesis stating that Agile Methodology use has a positive impact on project success. The results of our hypothesis ( $\beta = 0.6325$ ,  $R^2 = 0.5702$ ,  $p = 0.000$ ) proved that there is a positive and significant relation between Agile Methodology use and Project Success. The positive value of  $\beta$  proves the positive relation of the two variables. P value elaborates the significance of the relation between them, and  $R^2$  explains the change in one unit of Agile Methodology use brings 0.000 change in Project Success.

The results support the previous work on these variables. The project success is measured by measuring it against the triple constraints. These can be achieved by properly managing the customers, their expectations and by adopting a set of steps (Thomas et al. 2008). The project success is believed to be related to the way the project is carried, how each individual aspect of the project is carried out. Which means that properly managing of the project can lead it to the success.

Boh (2007) stated that if project activities are done an order and by using a standardized way the amount of effort can be reduced which can save time, and cost on performing those activities. All these time cost saving activities will help in achieving project success. This study proposed that by use of a proper methodology in performing project activities the chances of success can be increased. So it can be the key to achieve success in this competitive era.

#### **5.1.4 Hypothesis H4: Agile Methodology use mediates the relationship between Project Complexity and Project Success.**

In hypothesis 4, it is proposed that agile methodology mediated the relationship between project complexity and project success. This study states that agile methodology is playing the role of mediator and this hypothesis has been accepted because our results show the significance of the hypothesis. The main indicator of this hypothesis is the upper and lower limit both has the same sign and no zero value exists between them while bootstrapped at 95%. Interval value around the indirect effect of relationship between Project complexity and Project Success. Lower limit =-.1176 and upper limit =-.3730

Literature also suggest the same about the findings. Many researchers have stated their support in their own ways. Batra (2018) stated that agile values have a significant effect on the complexity and project success. Confronto and Amaral (2016) stated that agile if implemented in stages of the project can be able to reduce complexity and move project towards success. Confronto et al. (2014) stated that the agile methodology can be a mediator in achieving success in project of any field and agile can be implemented in any field other than software development field. The literature proposes that agile methodology play a vital role in achieving success in complex projects. Because of the nature in which the AM deal with the tasks or project it play vital role in effective management of the project, which ultimately leads to project success. The results of this hypothesis clearly state that the relationship between project complexity and project success is mediated by agile methodology positively and significantly in organizations of Pakistan.

### **5.1.5 Hypothesis H5: Team cooperation moderates the relationship between agile methodology and project success in such a way that high team cooperation will strengthen the relationship between agile methodology and project success**

Hypothesis 5 shows the moderation effect of team cooperation between agile methodology use and project success. The results of this hypothesis have showed a positive and significant relationship.  $\beta=0.4129$  shows that the team cooperation is positively impacting the relationship of Agile Methodology use and Project Success.  $P=0.008$  shows that team cooperation has a significant relation on the link between AM and PS. As the lower and upper limit for the interaction have same sign and no zero values exist between the relationship of AM and PS.

In this study, we found the moderating effect of team cooperation on the relationship of AM and PS. Specifically, this study was purposed to prove that team cooperation enhances the chances of project success with help of using agile methodology use.

Team cooperation has not been studied in context of agile methodologies and Project Success. Team cooperation has a positive effect on team performance and can lead project to success (Tian et al., 2015). As project is team effort and team needs good communication and an environment where each member felt comfortable so that they can perform better. By receiving an environment where one feels good and gets help in case of any problem will be able to give his best for that team. Good cooperative team will have a positive and far better outcome than the one where cooperation is missing. And projects can be managed more efficiently and effectively.

So, it is concluded from the previous research and results of our data analysis that team cooperation should be encouraged in organizations. Data suggests that in context of Pakistan, higher team cooperation can increase the productivity of an organization. And our result show that the team cooperation strengthens the relationship of agile methodology use and project success by performing moderation between them.

## **5.2 Research Implications**

Our study includes theoretical and practical implications with focus on project based organizations as previous studies have not investigated the effect of team cooperation on project success in a complex environment while adopting agile methodology use specifically in Pakistan context. Our results significantly show that with the role of team cooperation enhances the success rate in projects where agile methodology is being adopted. Practically, each project is complex in its own nature and agile is the proved methodology to reduce complexity of project. A significant relationship has been confirmed between project complexity and project success with agile methodology use being a mediator. By adopting the agile methodologies in a complex project, it will have a great impact on the team because agile methodologies use have no formal leader and the task are delegated to team members which are responsible for the task completion. And if the team cooperation is high in the team than the productivity of the team will be increased as they will be willing to help each other. By adopting the agile methodology in complex project, it will enable the team to be more focused on the complexity increasing factors of the projects and by solving those or minimizing those factors the team would make the project successful. By adopting agile methodology in a complex environment or complex project agile methodologies use would enable the team more responsible and would increase the sense of cooperation among the team members that would eventually make the environment more work friendly. Project complexity and project success is extensively studied in past literature but using team cooperation as a moderator is not studied. Research introduces team cooperation as moderator exposed the impact on agile methodology and project success. Results certified that team cooperation is connected to agile methodology use and enhances the chances of project success.

This research is important for managers, employees, supervisors and leaders, since in Pakistan there is a few organizations that are using agile methodology use in conducting projects and even more few consider team cooperation to be a part of the organizational culture. And very few projects meet the success criteria. Moreover this study highlights the importance of agile methodology use and team

cooperation for the success of project.

### **5.3 Limitations of Research**

This study also has limitations like any other research, firstly the main limitation is of the time and resources. There are always limitations because it is not possible to cover all elements. The model is analyzed through single mediator and moderator. Data gathered from different organizations based in two cities of Pakistan. So for future, researchers can gather data from different project based organizations based in different cities of Pakistan. The researchers can use more time to gather data in future.

The data gathering method used for this study was convenience sampling also referred as a limitation in the study because it does not reflect the real population. If the data was collected from actual population, the results might be different. Persuading employees give data is very difficult task because they are least willing to help in this regard.

### **5.4 Future Research Directions**

All aspects of the study cannot be studied so there is always room for improvements. This research provides many possibilities for future researches. In this study, we aimed to test the impact of project complexity on project success by using agile methodology use.

Moreover, the relationship of project complexity and project success can be studied using other variables. Changing the moderator between the agile methodology use and project success can also be focused in future researches.

We suggest additional study to be made on data and techniques to data collection. This study has team based mediator and moderator by changing one or both can lead to different results.

## **5.5 Conclusion**

The present study makes an effort to investigate the relationship of project complexity and project success in a project based organization of Pakistan. A questionnaire was used to conduct the data collection for examining the impact of project complexity on project success with agile methodology use as a mediator and team cooperation as a moderator. Almost 350 questionnaires were distributed for analysis purpose of the said relationships but 315 questionnaires were utilized for the study having correct information. The present study and proposed hypothesis were accepted and supported in the light of complexity theory showing how to deal with complex projects. There are five hypothesis in this study, tested and evaluated in Pakistan context. The research has provided complete view of the impact of project complexity on project success with mediating role of agile methodology use and moderating role of team cooperation.

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# Appendix A

## .1 Questionnaire

I am students of MS Project Management at Capital University of Science and Technology, Islamabad. I am conducting a research on “Impact of Project Complexity on Project Success, Mediating role of Agile Methodology Use and Moderating role of Team Cooperation”. You can help me by completing the attached questionnaire. You will find it quite interesting. I appreciate your participation in my study and assure that your responses will be held confidential and will only be used for academic purposes.

Sincerely,

**Muhammad Munawar Zaman,**

**MS(Project Management)**

**Faculty of Management Sciences,**

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

### **Please Provide Following Information**

**Note: Please answer these questions as being a part of Agile team i.e.**

**Team lead/Scrum master** is responsible for facilitating the team, obtaining resources for it and protecting it from problems, **Team member** is responsible for creation and delivery of the system. This includes modeling, programming, testing, and release activities, **Product owner** is responsible for the prioritized work item list (called a product backlog in Scrum), for making decisions in a timely manner, and for providing information in a timely manner.

Please refer to these while answering the agile methodology use questions.

This questionnaire is being used to find the influence of agile methodology use on project success.

	1	2
Gender	Male	Female

	1	2	3	4	5
Age	18--25	26--33	34--41	42--47	50 and above

	1	2	3	4	5
Experience	0--5	6--10	11--15	16--20	21 and above

	1	2	3	4	5
Education	Matriculation	Intermediate	Bachelors	Masters	PhD/ Post PhD

Project complexity						
1	The Project had a high degree of complexity concerning content	1	2	3	4	5
2	To me, The Project had a high degree of complexity concerning interdisciplinary participants	1	2	3	4	5
3	The Project was characterized by high risk and uncertainty	1	2	3	4	5

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

Agile Methodology Use						
1	We are quick to make and implement appropriate decisions in the face of market/customer-changes	1	2	3	4	5
2	We constantly look for ways to reinvent/reengineer our organization to better serve our market place	1	2	3	4	5
3	We treat market-related changes and apparent chaos as opportunities to capitalize quickly	1	2	3	4	5
4	We fulfill demands for rapid-response, special requests of our customers whenever such demands arise, our customers have confidence in our ability	1	2	3	4	5
5	We can quickly scale up or scale down our production/service level to support fluctuations in demand from the market	1	2	3	4	5
6	Whenever there is a disruption in supply from our suppliers we can quickly make necessary alternative arrangements and internal adjustments	1	2	3	4	5

Team Cooperation						
1	Other group members usually let me know what they expected from me	1	2	3	4	5
2	I often made suggestions to other group members about better work methods	1	2	3	4	5
3	When I was busy, other group members volunteered to help me out	1	2	3	4	5
4	I was willing to help finish work that had been given to other group members	1	2	3	4	5