CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, ISLAMABAD

Exploring Effects of Project Complexity on Project Performance through Role of Knowledge Sharing and Supportive Leadership: Empirical study of Construction sector of Pakistan

by

Rabia Munir

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

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I would like to dedicate this work to my parents and siblings for their support and motivation.

CAPITAL UNIVERSITY OF SCIENCE & TECHNOLOGY

ISLAMABAD

CERTIFICATE OF APPROVAL

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Abstract

This study is based on relationship between Project Complexity and Project Performance with mediating role of Knowledge Sharing and moderating role of Supportive Leadership. Context of this study is construction sector in Pakistan. Data is collected from 277 project team members working on different construction projects. Results of study indicate that there is negative relationship between project complexity and project performance and mediating role of knowledge sharing also established. Supportive Leadership is tested as moderator which shows insignificant results. Focus of this study is to encourage researchers to find out practices which can be useful to handle project complexity to suppress the negative effects on project. This study will raise awareness in the developmental sector of the Pakistan by focusing on project complexity to enhance project performance.

Key words: Project Complexity, Project Performance, Knowledge Sharing and Supportive Leadership.

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Abbreviations

PC   Project complexity

PP   Project performance

KS   Knowledge sharing

SL   Supportive leadership

Chapter 1

Introduction

1.1 Background of the Study

From past few decades, in project management literature complexity is considered critical component (Shenhar & Dvir, 2007). Quick growth of complex projects in different industries has triggered a growing number of studies, suggesting that understanding about the project complexity is key element of efficient project management (Luo et al., 2017). According to Baccarini (1996), project complexity is defined as "consisting of many varied interrelated parts and can be operationalized in terms of differentiation and interdependency".

Given definition of complexity by Baccarini (1996) is appropriate to any dimension of project that is related to project management process, it includes organization, technology, decision making, working environment, information and systems. Maturity of complexity in project management science is still very low and, compared to other areas of project management knowledge, it has not been sufficiently advanced (Makui et al., 2018). There are multiple factors that contribute to complexity of project schedules; it also includes multiple activities, level of detail, and project network's shape (Nassar & Hegab, 2006).

In literature of complexity, systems theory sums complexity in different views. According to systems approach if we speak in project management perspective,

project management is said to be project management system that contains multiple sub-system to make a larger system (Cleland, 1995). Effectiveness of the larger system is dependent on the effectiveness of the sub-systems. There are different subsystems controlling, planning, culture, stakeholders, HR, risk, knowledge management, etc that helps to make a whole system.

Literature also found that term complexity is related to difficulty and interdependence of different parts within a system (Geraldi, 2008). There can be different characteristics of complex project it may involve uncertainty or difficulty, unique nature of project, communication, lack of clarity of information. In addition to above characteristics instability and high degree of disorder also increase the complexity of project. According to CIOB (2008), organizations are under high pressure to deliver desired performance because of complex nature of projects.

Attaining or achieving project success is showed by the performance of project which includes multiple factors e.g. cost, budget, quality and satisfaction level of stakeholders involved (Takim et al., 2003). Project performance is dependent on many elements that include complexity, contracts, relationship with stakeholders involved, project manager competencies, skills and abilities of project team members.

According to Stevens (1996), project performance is measured and analyzed by performance measurement. Measuring performance is a method that includes reporting and collection of information which are relevant to input, efficiency and effectiveness of project (Love & Holt, 2000). Measurements are critical for tracing, predicting and monitoring the variables that are important to confirm the success in the end.

According to Wit (1988) project performance is dependent on different aspects such as scope/quality, time and cost. Shenhar and Dvir (2007) explained that project performance can be assessed in other strategic domains in organization e.g. project efficiency, team work, team learning, direct success, sharing concepts, and preparation for the future. Different resources are utilized appropriately to achieve desired performance e.g. human resource, financial resources and physical

resources etc. Adequate knowledge is also considered one of the resources to improve performance (Lawler, 2001). Knowledge sharing is considered vital element of knowledge management system and it also affects organizational performance (Alavi & Leidner, 2001).

Researchers have argued that most of the time project managers and his/her team is responsible for achieving desired performance and it' s very important for managers to consider themselves as important component of project and manage everything accordingly (Cleland, 1995; Bourne & Walker, 2004). Hendrickson et al. (1989), explained that project management need up to date knowledge for understanding of new challenges, as project are unique in nature. Specifically, construction projects are considered complex in nature because of dynamism, interdependence of multiple activities and high level of uncertainty.

Gidado (1996), explains that complexity is basically execution of complex production in process, production process is referred to have various complicated parts fetched composed in an operating network for the flow of work within the given time, cost and quality to achieve desired result without any conflict between several parts in the process. Complexity can be considered as difficulty measure of implementation of planned objective goals.

Knowledge Management has been marked as an important aspect for both organizational and project performance (Alavi & Leidner, 1999). Knowledge should be accessible to everyone linked within organization. Knowledge sharing is considered critical element within organization as it is linked to individual's mind, beliefs and values which helps organizations to gain competitive advantage (Hoegl & Schulze, 2005). Knowledge factors effecting project will give edge to project in meeting its performance, and will result in desired success.

Exchange of knowledge and positive attitude towards learning increase positive outcomes of project and it also improve team performance and satisfaction (Navimipour & Charband, 2016). Wang and Hou (2015) explained that knowledge sharing behavior at workplace encourages employees and increases the motivation level among them. Knowledge sharing is considered very important in project based

environment as various people work together to perform different tasks to achieve single goal.

For effective project performance, projects need great leaders who know the importance of knowledge sharing and understand how to bind it in an easy way. Supportive leadership has gained attention in different research area such as mentoring fields (Allen et. al, 2004), leadership (House, 1996) and occupational stress (Kahn & Byosiere, 1992). House (1998), defined supportive leader, is the one who gives social and organizational support to its team. According to definition social support is referred to the emotional support which involves understanding, concern, listening and acceptability.

Leader plays an important role in team performance it shows the quality of relation with employees (Shoham & Ruvio, 2008). Supportive leadership increases the employee's ownership and commitment towards organization and it helps in attaining set goals effectively. Motivated team will maximize performance in order to pursue project goal. Positive leader's behavior increases trust, commitment, ownership, self-actualization and confidence among its team. There are different theories that prove its positive impact e.g. Leader-member exchange theory, Social exchange theory and Behavioral theory etc.

1.2 Gap Analysis

Project Performance is considered key indicator of project success or failure. According to literature different researchers have contributed to analyze the project complexity (Geraldi, 2011; Shenhar & Dvir, 2007; Pich et al., 2002) but limited studies had conducted to see these consequences on project performance. A recent study suggests that further research should be conducted on relationship between project complexity and performance.

Shenhar and Holzmann (2017) suggested that future research should be conducted to see how complexity of project plays in understanding and managing project and performance. This study will help to explore the relationship of project complexity and project performance considering the role of knowledge sharing and importance

of leadership. As per my knowledge not a single study is found that shows the role of knowledge sharing in complex projects and its effect on project performance. This study will focus on analyzing the importance of knowledge sharing along with supportive role of leader in complex projects that has been neglected in literature.

Theories have provided different association that how complexity affects project (e.g. Complexity Theory and Systems theory etc.). For this study, I think that systems theory is more suitable since it covers each variable. According to systems theory, there are different sub-parts that are involved in making whole system which are inter-linked and effect whole system if any of the part is not handled properly.

As project in itself is said to be a system and complex project can be considered as complex system. These systems are collection of interlinked elements which act as single unit such as employees, stakeholders and other resources involved. If any of the elements is not managed appropriately e.g. leader is not managing his/her role properly, it may result in conflict within teams, it will effect whole system and end results.

1.3   Problem Statement

Studies on project management mostly indicate a concern about analyzing factors that are effecting successful completion of project. One of the measure of analyzing success or failure is project performance. As different factors are linked with one another therefore uncertainty, dynamism and change can occur at any stage of the project. Dealing with such factors is highly critical in complex projects.

Different researches has been conducted on project complexity, still there are areas that need to be explored. Considering role of knowledge sharing and leadership and its effect on performance of complex project is completely untouched. Investigating impact of these variables will help project to be managed in better way.

High level of project complexity requires more understanding and appropriate knowledge among teams. Therefore complex projects requires well managed knowledge sharing within project, and role of knowledge sharing is considered of high importance along with other factors e.g. leadership, team coordination etc.

Project management literature suggests that, complexity must be identified at earlier stage so that it could be managed appropriately. There are still areas that are necessary to be addressed because of change in working condition and demands. This study will find how role of knowledge sharing mediates between complexity and project performance, how leadership effects the association between project complexity and performance.

1.4 Research Questions

The present study tries to answers following questions:

Research Question 1

What is the impact of Project Complexity on Project Performance?

Research Question 2

What is the role of Supportive Leadership in managing complex project performance?

Research Question 3

What is the effect of role of knowledge Sharing in facilitating performance of complex projects?

1.5 Research Objectives

The objective of the study is to analyze and test anticipated model to find out the association between project complexity, knowledge sharing and project performance. Additionally, the supportive leadership is added the possible moderator for the relationship of mentioned variables in the research model (project complexity,

knowledge sharing and project performance). The specific objectives of the study are stated below;

Research objective 1

To explore the relationship between project complexity and project performance.

Research objective 2

To explore the role of knowledge sharing in project complexity and project performance.

Research objective 3

To examine the moderating effect of supportive leadership on the relationship of project complexity and project performance.

1.6   Significance of the study

The main emphasis of this study is to find out the effect of project complexity on project performance. The study attempts to analyze the critical factors that are influencing performance so that it could be managed effectively. Therefore, theoretically this study provides an opportunity to test association between project complexity and project performance. Present study also fills the current gap in the literature. Present study has significant contribution in project management literature.

This study will be useful to practitioners to analyze complex nature of project, and to identify the importance of effective knowledge sharing among employees, which will affect project performance. Leadership style also plays an important role in increasing or decreasing project's performance.

This study will also give new direction to the construction sector and refine process of complex project by analyzing importance of knowledge sharing and leadership, which will influence the performance of overall project. This study will encourage researcher to find out those practices which can be used to improve the performance of project.

1.7 Theoretical Support

Several perspectives have been presented by different researchers which are used to support the studies of project complexity. Systems Theory covers all variables in present study.

1.7.1 Systems Theory

Systems theory was proposed by biologist Bertalanffy (Kilburg, 1976), it gave a modeling plan that covers interrelations and overlay between various disciplines. Bertalanffy (1968), suggested that system is comprised of different interrelating parts and they are open and interactive with their environment.

As the systems theory emerges, research scholars from different fields began refining new concepts with systems theory considering it as foundation. Systems theory in management views an organization as an organism made up of numerous parts (subsystems) that must work together. It explains the dimension of dynamic and complex systems and emphasis on the arrangement and association between different parts that make a whole new system.

Systems philosophy is being perceived as a suggested solution to the problem of project management because of project's dynamic environment. Projects are said to be dynamic and complex in nature. There are different parts that are linked together with each other at various stages. Every part of system influences the whole system in its own way. When there is change in single element there is always an effect on other. It is important to understand how to fit each element in whole system and what will be its effect if it would change.

This study aims to find out relationship between project complexity and project performance with mediating mechanism of knowledge sharing and moderating effect of supportive leadership. For this purpose systems theory is used, as systems theory explain how different interlinked or interconnected parts are affecting the

whole system. Complex projects are said to be complex because of the interdependency and interconnection of different parts of project that influence project as a whole.

1.8 Structure of Thesis

Chapter 1 is the introductory portion that comprehensively talks about the background of the study, research gap, research questions, significance of the study, objectives of the research and supporting theory.

Chapter 2, includes the literature review in detail, it provides the conceptual framework with hypothesis on basis of past studies done in the relevant field.

Chapter 3, discusses the methodology which includes introduction to methodology, research design (includes time horizon, type of setting, unit of analysis and study setting), instrumentation and pilot testing.

Chapter 4, it comprises of results of the findings, tables and figures.

Chapter 5, it includes discussion and justification of results, theoretical and practical implications, study strengths and limitations, future research directions and conclusion.

Chapter 2

Literature Review

2.1 Project Complexity and Project Performance

According to PMI (2013), project is a temporary endeavor that is unique in nature, and is time and cost bound to achieve specific objective. Project includes different interlinked activities, which makes it complex. Defining complexity is difficult as it has many different associations. Project complexity emphasizes on interdependent activities or tasks that are challenging to manage (Hass, 2009). As projects are complex in nature therefore it influences the project performance, both in positive and negative ways (Iles, 1997).

The term 'complexity' has gradually become an important element when projects are discussed (Wood & Ashton, 2010). Hass (2009) suggested that understanding complexities of project correctly can help in understanding the root cause of problems occurred in project, which will effect performance. Since early 1990's, project success is linked to project performance measure, where success is associated to three constraints time, cost and quality (Hatush & Skitmore, 1997). According to Atkinson (1999), time, cost and quality are said to be iron-triangle, and are present in every definition of success.

Project complexity is an uncertain term and is difficult to absolutely evaluate (Corning, 1998). Complexity involves extensive number of interlinked parts, project multifaceted nature also contributes in making it complex, multifaceted nature is

hard to measure, numerous researchers have led various investigations to recognize its estimation variables and order (Bosch et al., 2011; Gransberg et al., 2013; He et al., 2015).

It is important to understand project complexity for both practitioners and academics. It is necessary for practitioners to know how to deal with complexity, and what affect does it make on individuals or organizations (Thomas & Mengel, 2008). In literature, researchers have explained project complexity and its characteristics that are influencing performance e.g. size, schedule, system interdependence etc (Cicmil, 2003; Benbya & McKelvey, 2006; Cicmil & Marshall, 2005; Davies et al. 2007; Ivory & Alderman, 2005; Abdou et al., 2016). Different researches has also focused on identifying the characteristics of complex projects and how organizations and its members deal with it (Jaafari, 2003; Williams, 2005; Geraldi & Adlbrecht, 2007; Maylor et al., 2008; Shenhar & Dvir, 2007).

Geraldi et al. (2011), presented five dimensions of complexity- structural, socio-political, pace, uncertainty and dynamic, that in detail view complexity in wider perspective. Structural complexity deals with the large number of interconnected parts to make whole new system (Clarke, 1999).Understanding uncertainty, it refers to both present and future states involved in formation of whole system. It's an unavoidable gap for manger while making decision, as uncertainty is involved while creation of uniqueness (Probst & Gomez, 1991).

Dynamics complexity is relevant to the changes made in the system. Changes can be made in design (Geraldi & Adlbrecht, 2007), specifications, planning, team (Maylor et al., 2008), stakeholders (Hobday, 1998), and environment etc., and these changes may lead to increasing level of risks in project. Pace is related to time goals which have strong effect on project because of interdependency of different parts (Shenhar & Dvir, 2007). Pace basically refers to the speed of work is been carried in specified time. While project is carried out there is interest of different parties involved (Maylor, 2001). Such social pressure makes project complex and hinders in achieving specified goal (Goldratt, 1997).

Project complexity is viewed as a fundamental factor in the field of project management (Tatikonda & Rosenthal, 2000). In any case, the attributes and nature

of project unpredictability is an unsure stated issue. From investigation it is explored that a few elements are considered as drivers of task difficulty e.g. risk and uncertainties. On one hand, multifaceted nature of project is also considered as driving element for difficulty of projects researchers have recommended paying more consideration towards characterizing and dealing with the complex projects (Luo et al., 2016). It is viewed that the undertaking performance is also linked with project multi-dimensional nature.

According to Yu et al. (2006), project difficulty with a firm definition should be accurately estimated by focusing on the end goal and powerful management of tasks. Literature has suggested that project complexity can likewise impact project performance and additionally project results, and complexity can make new projections (Bosch et al., 2011; Gransberg & Shane, 2013; He et al. 2015). (Tam, 2010), explained that efficient characterizing of complex activities, their traits and interrelations will empower the project to describe complicated nature. In this manner, it is smarter to maintain and get complex nature in the responsible setting amid project management instead of decreasing or evading it (Wang & Xu, 2009). It is critical to connect all the activities proficiently with the project implementation, and to decrease the number and impact of negative results emerging from this complexity (Tam, 2010).

Baccarini (1996) suggested that considering unpredictability into connection with complexity and innovation will help to deal with multifaceted nature of projects. Tatikonda and Rosenthal (2000) stated that project complexity is firmly identified with the communications among hierarchical components and subtasks. Maylor et al. (2008) distinguished the components of complex nature as mission, organization, delivery, partners, and group. Girmscheid and Brockmann (2008), separated it into five classes: undertaking, society, culture, operation, and insight intricacy.

According to He et al. (2015), a six-classification system of complexities comprising of innovative, authoritative, objective, ecological, social, and data complexities were proposed with a complete writing survey to measure project development extends in China. In any case, the impact of the previously mentioned intricacy factors on project multifaceted nature isn't completely comprehended and is still

under study. Accordingly, the main target of the study was to build up a measure for project multifaceted nature by analyzing the connection between intricacy factors and its impact.

Numerous researchers presented that change is one of the major factor which makes project complex, as different part are interlinked, change in one part causes automatic shift in another activity (Atkinson 1999; Jugdev & Mller 2005; Molenaar et al. 2013). According to Baccarini (1996), it is reasonable to characterize innovation as a change procedure. Innovation, hence, can be seen into three aspects: attributes of information, qualities of materials and the gear and sequencing of exercises i.e. tasks (Williams, 2011). Additionally, innovation can be connected at any level of the task association, e.g. entire association or gathering or person that makes whole project framework. Innovation is being multi-dimensional can be arranged into two kinds: multifaceted quality and vulnerability (Vidal & Marle, 2008). Innovative uncertain nature can be operationalized as the challenge of project performance.

Muller et al. (2008), stated that development projects are getting to be greater and it is considered as the beginning of complexity, it is critical to comprehend the concept and management of complexity. The development industry has gone up against extraordinary trouble in adapting to the expanding complexity (Kennedy et al., 2011). Regardless of broad research on the idea of intricacy, there is no single agreement on project complexity. Complexity can be seen differently in various fields (Nguyen & Hadikusumo, 2017).

Keeping in mind the end performance, project complexity should be realized and estimated proficiently (Lenhard et al., 2017). Development projects, such as construction projects, include collection of interconnected elements which create multidimensional nature with described qualities. It is believed that problems related with decision making and performance achievement, which are originated from unique nature of projects, the comprehension of unpredictability is fundamental for project management (Remington et al., 2009).

The achievement of a desired performance in this manner at last relies on project execution (Scott & Chan 2004). Performance target measures exist for the

evaluation of undertaking complicated nature, for the most part because the complexity is primarily identified with the subjectivity of the eyewitness (Corning, 1998; Meyer et al., 2002).

Desired project performance is achieved by project's efficiency and effectiveness (Belout, 1998). In past studies researchers found that employees contribute to organization performance and learning behaviors in positive way (Law & Ngai, 2008). In literature project performance is measured various times. It is difficult to measure performance without taking into account knowledge, partnerships and competences (Iles & Hayers, 1997).

Researchers have observationally researched connections between parts of complexity and results in projects (Clarke, 1999). Literature relates success with the performance achieved at the end of the project, e.g. project completed within estimated budget, according to desired quality, within estimated time is considered successful (Shenhar et al., 2001). According to Bozarth et al. (2009), complexity significantly decreases the end performance.

H_1*: Project Complexity is negatively influenced with Project Performance.*

2.2 Role of Knowledge Sharing

A lot of research has been done previously to understand the importance of knowledge management in organizational context, which influences behavior, performance and attitudes in an organization in positive way (Omotayo, 2015). Knowledge sharing is seen as exchange of social and cultural relationships e.g. it involves exchange of experience, skills and ideas within departments and organization (Gharakhani & Mousakhani, 2012).

In specific knowledge sharing literature of project management, effective knowledge sharing motivates organizational and individual learning, which in results affects the outcome (Dietrich et al., 2013). A study shows that knowledge sharing has positive effect on performance in uncertain environment (Salehzadeh et

al, 2017). During the last two decades, the discipline of knowledge management is gaining popularity. Knowledge is considered key resource of an organization and effective knowledge sharing is important for organization's success (Nonaka & Takeuchi, 1995).

Previous researches suggested that organizations are powerful at 'learning' have created schedules that enable them to viably create, store. Furthermore, apply new learning on precise evidence (Nelson & Winter, 1982; Evitt & March, 1988; Cohen & Levinthal, 2000; Nonaka, 2000; Rasiah, 2017). Nelson and Winter (1982) were among the first to contend that interactive environment is the core element that influences performance and that organizational learning would be required to happen when firms create 'adaptation routines' that permit the firm to adjust existing schedules in light of new learning. Different researchers have additionally seen organizational learning as routine based and history subordinate that has positive impact on outcome (Levitt & March, 1988; Nonaka, 1994; Law & Ngai, 2008).

Grant (1996), presented a learning routine as a regular pattern of interactions among people that allows the exchange, recombination, or then again making of particular learning. Importance of knowledge sharing has been discussed in literature in several times e.g. (Hendriks, 1999; Goodman & Darr, 1996; Teece, 2000; Omotayo, 2015), but still there is requirement to analyze its importance in making project critical (Shenhar & Holzmann, 2017).

Knowledge sharing is very important in project-based organizations (Pektaş & Pultar, 2006). Without effective knowledge sharing project can suffer from different problems e.g. coordination issues, unsuccessful collaborations etc. (Herbsleb & Moitra, 2001). Knowledge sharing in projects can be challenging and difficult task (Sethi et al., 2001). Ipe (2003), found that sometimes team members are reluctant to share knowledge, because it gives them edge over others and sharing may weakens their potential value. Literature shows that project manager's behavior plays an important role to achieve project success (Scott-Young & Samson,

2008). It has been argued that developing a knowledge sharing culture and creating right platform for knowledge sharing is a fundamental concern for successful organizational performance (Almahamid et al., 2010).

Past research recommends various difficulties related with knowledge sharing in a system setting (Nonaka, 1994; Ipe, 2003; Patrick & Sonia, 2009). The primary difficulty is the means by which to arrange individuals to take part in the system and to straight forwardly impart profitable learning to other system individuals (Wood & Gray, 1991). The characteristic inclination of individual firms is to ensure expertise seen as exclusive to anticipate unfortunate learning overflows. Thus, numerous organizations (particularly those with restrictive expertise) are hesitant to take part in efficient learning sharing exercises.

According to Kogut and Zander (1992), organizations exist since they are superior to anything markets at exchanging, recombining, and making information. A key test for an information sharing system is to inspire individuals to take part and contribute learning to achieve great outcome. Sharing knowledge among the team increases motivation and helps in dealing with the complications occur within the project (Ngulube & Dube, 2012).

The systems approach has been broadly explained the interconnection of different parts (Bertalanffy, 1968), human resource is considered one of the major parts in system. Humans are involved therefore various behavioral and cultural dimensions impact the whole system (Hsu, 2006). Various social measurements that possibly impact learning sharing have been recognized (Kankanhalli et al., 2005). Knowledge sharing is the significant means through which representatives can add to performance, advancement, and eventually attaining the competitive edge (Wasko & Faraj, 2005). Literature shows that knowledge sharing plays important role in projects (Lin & Lee, 2005) and creating a right platform for knowledge sharing is a fundamental element consider for successful organizational performance (Almahamid et al., 2010).

Construction projects are usually said to be complex, therefore managing knowledge properly in complex scenarios will be helpful for successful results (Tupenaite et al., 2008). According to Kilpatrick (2006), organizations need to consider the

importance of human side also. Complex projects need a well-managed knowledge instructional methodology, so that project team knows the importance of knowledge division to deal with problematic situations.

H_{2a}**: Project Complexity is positively influenced with Role of Knowledge Sharing.**

H_{2b}**: Role of Knowledge Sharing is positively influenced with Project Performance.**

H_{2c}**: Role of Knowledge Sharing positively mediates Project Complexity and Project Performance.**

2.3 Supportive Leadership

Supportive leadership has been of interest in the different fields (Cohen & Wills, 1985). Effective and supportive leadership represent differential relationships with several outcomes (Yukl, 1999). According to literature supportive leadership shows positive relationship with satisfaction and performance (Fisher, 2000). When leaders focus on employee's preferences and needs, employees feel valuable as support depicts the sense of worth (Bandura, 1997).

Project leader influences the whole team, and eventually development and knowledge exchange, through his or her behavior and supervision (Hatfield et al., 1986). It involves dealing with the project and its coordination, the group association, task improvement, issue identification and search for solutions (Hazy, 2013). Leaders are basically required to minimize difficulty and manage performance accordingly (Osborn & Hunt, 2007). Toor and Ofori (2008) found that 21st century needs project managers with an alternate approach and diverse characteristics and expertise manage complex projects.

Further, supportive supervision can make a domain of high concern for the employees and the work, enhances individual motivation and eagerness for the work and a readiness to build up open, powerful communication channels (Ojiako et al., 2011). Leaders are in unique position as they are giving and receiving both, from

one viewpoint, they are influenced by activities and support of the organization since they are workers (Shanock & Eisenberger, 2006). They are required to supervise and support subordinates, and manage events that effect the organization (Beck & Plowman, 2009).

Literature has found that supportive supervision leads to different positive outcomes. Mitchell (1974), declared that supportive leaders can encourage friendly and supportive environment, helps in decreasing the work pressure and dissatisfaction that might be experienced by representatives generally in complex or critical environment. Leadership is a complex practice that is essential to effectively project administration (Slevin & Pinto, 1991). Social researchers have been studying the supervision over the past 50 years trying to better know the procedure and to come up with suggestions concerning effective leadership practices (Nanjundeswaraswamy & Swamy, 2014).

Projects are managed by using different teams, which are complex for two reasons: i.e. each task is unique, and second is team selection (Smith, 2001). As in a traditional organizational structure, issue arises in team selection, and in numerous organizations a project manager might not have the option to choose the project team. Furthermore, project teams are occupied with more than one project. Kerzner (2006) found that activities lead to performance failure due to lack of meeting time, cost because of poor moral support, lack of motivation, poor employee interaction, poor efficiency, and commitment issues of team. It is stated from Kerzner's study that individuals related issues assume a significant part in project performance, underlining the significance of a project manager's skills and leadership style.

According to Thomas and Mullaly (2007), numerous variables, which drive project performance, are linked with the human side. Among these elements, managing conflicts and issues in project is a major determinant of performance achievement. Effective relationship and conflict management among team creates a sense of trust, motivation, effective communication, and clarity in command. It is also important to describe roles and duties among team with clarity.

Communication and cooperation among project teams are viewed as major empowering factors by different studies. With regard to problems related to project failure, Potts (2000), stated the seriousness of these issues with formation of teams, providing effective leadership, see how to influence, select a suitable negotiation style, accomplish great correspondence, and develop problem solving behavior. He further found that these soft skills make an extensive difference to project performance and productivity.

The aim of the project is to achieve set performance and leader plays an important role in achieving desired outcome. According to Anantatmula (2010), knowledge sharing, innovative ideas and team development are related project leadership in attaining desired performance. A leader can influence the team to achieve goals by common efforts (Northouse, 2018).

Liang et al. (2017) stated that different attributes and skills are required to manage project needs. Their study shows that relationship (project manager and subordinate) have positively significant impact on performance. Employees who feel trusted by their supervisors and managers shows enhanced work performance (Huang & Paterson, 2017). According to Tourish (2018), leadership influences complexity and performance of system.

H_3: *Supportive Leadership positively moderates the relationship between Project Complexity and Project Performance.*
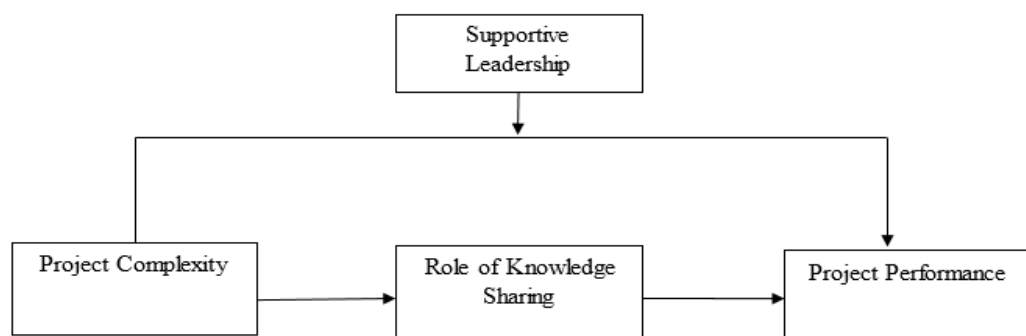
FIGURE 2.1: Research Model

Chapter 3

Research Methodology

3.1   Introduction

Chapter 3 explains the methodology that is used to find out association of project complexity and project performance, with the mediating role of knowledge sharing and moderating role of supportive leadership. Methodology is the process of collecting data and describing techniques used for analysis. It also deals with the measurement of variables and instruments used for data analysis.

3.2   Research Design

Research design is the outline that refers to combine different parts of study, so that research problem can be addressed effectively. According to Zikmund (2003), research design is a framework that highlights the procedure and method for analyzing and collecting necessary information for research. Research design includes time horizon, type of setting, unit of analysis and study setting which are discussed below.

3.2.1   Type of the Study

This is a causal study where impact of project complexity on project performance with mediating role of knowledge sharing and moderating role of supportive leadership is measured.

3.2.2   Study setting

Participants of the study were from different projects, it includes middle and top level management, managers and their subordinates working in project based organizations of public, private and semi-government sector.

3.2.3   Time Horizon

Time involved for data collection is 1 and half month for this study, data is cross sectional in nature since it was collected at one point in time.

3.2.4   Unit of Analysis

Unit of analysis deals with the 'what' or 'who' that is being studied. Unit of analysis involves individuals, groups, industry or organization etc. It specifies the character or feature of individual or an object which is to be analyzed. For this study unit of analysis are project managers and employees working in project based organizations in various cities across Pakistan.

3.2.5   Population

According to Sekaran (2001), population is the whole group of individual or an object to which researcher is concerned to investigate and generalize the findings. For current study project based organization's employees are taken as population from various cities across Pakistan.

3.2.6   Sample

Sample is basically a representative of whole population which is selected for research. Convenient and snowball sampling techniques are used. Data is collected from construction industry's project based organization. Total 350 questionnaires were distributed, out of 350 questionnaires in this study 332 were received back, 277 questionnaires collected are properly filled that are considered for analysis, 55 questionnaires were partially filled and 18 questionnaires were not returned. Author, visited work offices and explain the purpose of the study and data collection method.

It is believed that outcome of construction sector contributes significant share in Pakistan's gross capital. Now-a-days this sector is playing pivotal role in boosting country's economy, economic survey of Pakistan'17 shows 2.7% contribution in GDP by this specific sector (Husain, 2017). According to BMI (2016), it is estimated that construction sector will contribute 9.1% annually by 2025, and major share will be added by CPEC. Therefore, considering construction sector for this study will help to understand how complexities are influencing performance of majorly contributing sector of Pakistan.

3.2.7   Sample Characteristics:

Sample characteristics includes demographics used in the questionnaire for research, it includes characteristics e.g. age, gender, qualification, sector and experience. Sample characteristics are specified in the tables present in chapter 4 (Results).

3.2.7.1   Age

Age composition in this study is divided into 6 categories 1=25 or below, 2=26-30, 3=31-35, 4 =36-40, 5= 41-45, 6= 51 or above. Specified in Table 4.1 results section

3.2.7.2   Gender

Gender composition of the study includes 2 groups male and female, where group male is denoted by '1' and group female is denoted by '2'. Also specified in Table 4.2 mentioned in results portion and questionnaire attached in annexure.

3.2.7.3   Qualification

Education is considered important part of demographics; in this study qualification is divided into 5 main degree levels i.e. Bachelors, Masters, MS/M-Phil, PhD and Others. Mentioned in Table 4.3, results section

3.2.7.4   Work Experience

Work experience composition is done in 6 levels i.e. 0-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, and 26 years or above. Mentioned in Table 4.4, results section

3.2.7.5   Sector

Sector in which respondents are working is divided into 3 categories i.e. Public, Private and Semi-Government. Mentioned in Table 4.5, results section

3.3   Instrumentation

Close ended questionnaires are used for measuring four variables, on 5 point Likert scale from "Strongly Disagree to Strongly Agree". Where 1 belongs to strongly disagree, 2=disagree, 3= neutral, 4= agree, 5= strongly agree. Questionnaire contains 4 demographic variables which includes information of respondent's Gender, Age, Qualification and Experience in the organization.

3.3.1 Project Complexity

To measure project complexity, scale used was developed by (Xia & Lee, 2005) and was used by (Geraldi et al., 2011). Responses are obtained through five point likert scale from (1 to 5) where; 1 is Strongly disagree, 2 is Disagree, 3 is Neutral, 4 is Agree and 5 is Strongly Agree. The items of the scale are:

Project Complexity: (Complexity: the state or quality of being intricate or complex)

1. The project team was cross-functional

2. The project involved multiple external contractors and vendors

3. The project involved coordinating multiple user units

4. The system involved real-time data processing

5. The project involved multiple software environments

6. The project involved multiple technology platforms

7. The project involved a lot of integration with other systems

8. The end-users' organizational structure changed rapidly

9. The end-users' business processes changed rapidly

10. Implementing the project caused changes in the users' business processes

11. Implementing the project caused changes in the users' organizational structure

12. The end-users' information needs changed rapidly

13. Architecture that the project depended on changed rapidly

14. Infrastructure that the project depended on changed rapidly

15. Software development tools that the project depended on changed rapidly

3.3.2 Role of knowledge sharing

The variable role of knowledge sharing is measured by questionnaire from a scale developed by (Wang et al., 2008) and adopted by (Ali et al., 2018). The responses are obtained through Likert scale ranging from (1= Strongly disagree to 5= Strongly Agree). The items of the scale are:

Role of Knowledge Sharing: (Knowledge Sharing: Activity through which knowledge (information, skills, or expertise) is exchanged among people)

1. My organization treats people's skills and experiences as a very important part of knowledge assets.

2. I share information and knowledge with my superiors.

3. I share information and knowledge with my subordinates

4. I often share ideas with other people of similar interest, even if they are based in different departments.

5. There is a great deal of face-to-face communications in my organization.

6. When I need some information or certain knowledge, it is difficult to find out who knows about this, or where we can get this information (reverse coded).

7. There are systems and venues for people to share knowledge and learn from each other in our organization.

8. I use information technology to facilitate communications effectively when face-to-face communications are not convenient.

3.3.3 Project Performance

A six item scale is used to assess Project Performance, developed by (Popaitoon & Siengthai, 2014) and adopted by (Ali et al., 2018) from a scale. The rating scale ranged from (1=Strongly disagree to 5=Strongly Agree). The items are as follow:

Project Performance: (indicator to check whether project has achieved planned goals).

1. Project is meeting operational specifications.

2. Project is meeting technical specifications.

3. Project is meeting time goals.

4. Project is meeting budget goals.

5. Project is fulfilling client needs.

6. Client is satisfied with the project's performance.

3.3.4 Supportive Leadership

Three items developed by (House, 1998) and adopted by (Rodríguez, 2014), is used to measure supportive leadership. The rating scale ranged from (1=Strongly disagree to 5=Strongly Agree). Items are as follow:

Supportive Leadership: (Showing concern for employee's needs).
Project Leader

1. Considers my personal feelings before acting.

2. Behaves in a manner which is thoughtful of my personal needs

3. Sees that the interests of employees are given due consideration

TABLE 3.1: Scales Sources.

No	Variable	Source	Items
1	Project Complexity (IV)	(Xia & Lee, 2005)	15
2	Project Performance (DV)	(Popaitoon & Siengthai, 2014)	6
3	Role of Knowledge Sharing (Med)	(Wang et al., 2008)	8
4	Supportive Leadership (Mod)	(House, 1998)	3

3.4 Statistical Tool

Correlation and linear regression tools are used to examine the relationship between independent and dependent variable i.e. Project complexity (IV) and Project Performance (DV). Both analyses were done by SPSS (version 23) software. Correlation is used to analyze the strength or weakness of the relation between variables. For hypothesis testing regression analysis is used, to check whether hypothesized statements are supported or not supported. Preachers and Hayes method is used (Preacher & Hayes, 2008).

3.5 Pilot Testing

For pilot testing, 30 questionnaires were distributed to respondents for initial testing. As per pilot testing results, all variables were reliable, where project complexity cronbach alpha value was 0.89, project performance cronbach alpha value was 0.60, knowledge sharing cronbach alpha value was 0.77 and supportive leadership value was 0.84.

3.6 Data Analysis techniques

Data were collected from 277 respondents and was analyzed on SPSS software. Following steps were done for analysis:

1. Only completely filled responses were considered for analysis, rest responses were discarded.

2. Every variable was coded and coded items were used for analysis

3. Frequency of different sample characteristics is described, and tables are developed for specified demographics.

4. Mean of each variable calculated for analysis.

5. Reliability analysis was done; Cronbach alpha of each variable was calculated.

6. Correlation analysis was done to explore the strength between the variables.

7. Following Preacher and Hayes model, regression analysis was done.

8. Hypothesis testing was done by Preacher and Hayes method, to check whether hypotheses are supported or not supported.

Chapter 4

Results

This Chapter involves study and results done with Statistical Package for Social Science (SPSS), it comprises of frequency distribution, reliability, confirmatory factor analysis (CFA), correlation and regression to find out the effect of project complexity on project performance with mediating role of knowledge sharing and moderating supportive leadership.

4.1 Frequency Distribution

Frequency distribution is simple method used to show the number of occurrences of an event or characteristic; for this purpose SPSS software is used. Frequency of various demographics has been shown in following distribution tables:

TABLE 4.1: Age Distribution

Age	Frequency	percent	Valid Percent	Cumulative percent
25 or below	106	38.0	38.0	38.0
26-30	84	30.3	30.3	68.6
31-35	44	15.9	15.9	84.5
36-40	23	8.3	8.3	92.8
41-45	19	6.9	6.9	99.6
51 or above	1	0.4	0.4	100
Total	277	100	100	

TABLE 4.2: Gender Distribution

Gender	Frequency	percent	Valid Percent	Cumulative percent
Male	194	70.0	70.0	70.0
Female	83	30.0	30.0	100
Total	277	100	100	

TABLE 4.3: Qualification Distribution

Qualification	Frequency	percent	Valid Percent	Cumulative percent
Bachelors	111	40.1	40.1	40.1
Masters	73	26.4	26.4	66.4
MS/M-Phil	69	24.9	24.9	91.3
PhD	6	2.2	2.2	93.5
Other	18	6.5	6.5	100
Total	277	100	100	

TABLE 4.4: Experience Distribution

Experience	Frequency	percent	Valid Percent	Cumulative percent
0-5	131	47.3	47.3	47.3
6-10	75	27.1	27.1	74.4
11-15	35	12.6	12.6	87
16-20	20	7.2	7.2	94.2
21-25	15	5.4	5.4	99.8
26 or above	1	0.4	0.4	100
Total	277	100	100	

TABLE 4.5: Sector Distribution

Sector	Frequency	percent	Valid Percent	Cumulative percent
Public	116	41.9	41.9	41.9
Private	138	49.8	49.8	91.7
Semi-Government	23	8.3	8.3	100
Total	277	100	100	

4.2 Reliability analysis

Reliability analysis discusses the ability of a scale to give the consistent results when tested various times. Reliability analysis is done through Cronbach Alpha, its value ranges from 0-1. According to George and Mallery (2003), value of cronbach alpha is acceptable at 0.50, however it's good to have more or equal to 0.70.

TABLE 4.6: Scales Reliability.

Variables	Cronbach's Alpha	Items
Project Complexity (IV)	0.87	15
Project Performance (DV)	0.65	6
Role of Knowledge Sharing (Med)	0.75	8
Supportive Leadership (Mod)	0.76	3

In this research Cronbach's alpha of Project Complexity is 0.87, Project Performance value is 0.65, the value of Role of Knowledge Sharing is 0.75 and Supportive Leadership Cronbach alpha is 0.76. The value of Cronbach's alpha is greater than 0.7 for Project Complexity, Knowledge Sharing and Supportive Leadership its means the variables are highly reliable.

4.3 Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) is a multivariate statistical method, used to check how accurately specified variables depicts the number of constructs. It is used to test whether data fits into the model or not (Anderson & Gerbing, 1988). AMOS software is used for CFA analysis.

There are four (4) latent variables used to justify the measurement model e.g. Project Complexity, Project Performance, Role of Knowledge Sharing and Supportive Leadership. Different indices were used for model fit which includes RMSEA (Root mean square error of approximation), CFI (Comparative fit index), TLI (Tucker- Lewis index) and χ^2/df (model chi-square). Table 4.7 highlights that four-factor model has good discriminate validity where threshold for model fit values is (χ^2/Df < 3, $CFI \geq .80$ acceptable, RMSEA $< .05$ good, between .05 to 0.10 moderate and > 0.10 bad) (Zainudin, 2012).

TABLE 4.7: CFA Measurement Model.

Model	Factors	χ^2	Df	χ^2/Df	RMESA	IFI	TLI	CFI
Hypothesized	Four Factors	1183.47	428	2.76	.082	.80	.76	.80
measurement model								
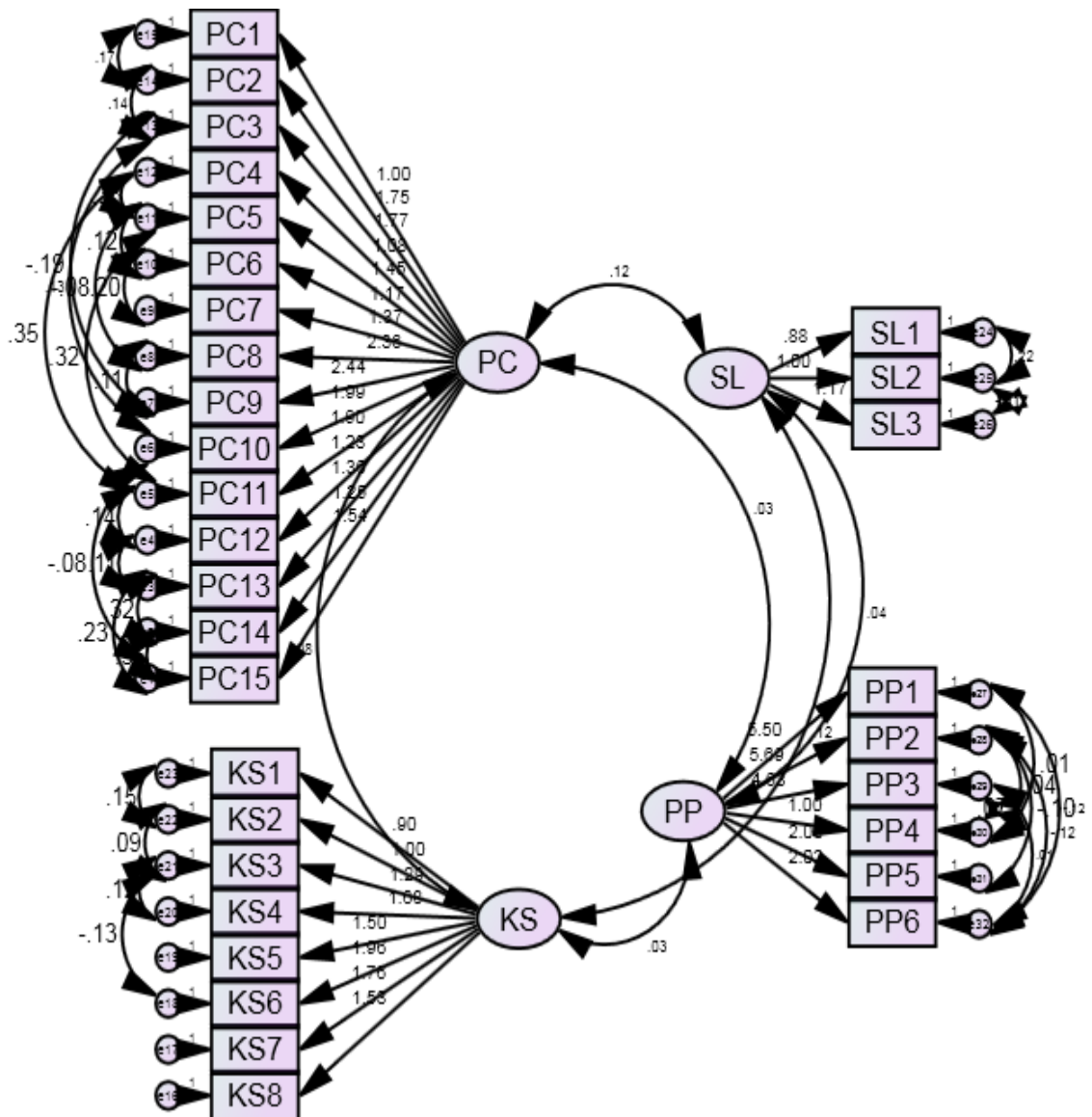
FIGURE 4.1: CFA model

4.4 Covariates

Covariate is the variable that could influence the impact of variables used for research study. (Bradley (2007) explained that experience, gender, age, qualification, size and duration of project have effect on performance of the project therefore these variables are reflected as covariates. (Aga et al. (2016) used age, level of qualification, gender, and experience as covariate. To explore the effect of these variables on outcome or dependent variable, one way ANOVA test is used.

TABLE 4.8: Covariates

variables	Role of Knowledge Sharing		Project Performance	
	F Value	Sig.	F Value	Sig.
Age	3.00	0.01	0.69	0.62
Gender	1.23	0.26	0.30	0.58
Qualification	2.78	0.02	4.32	0.00
Experience	3.63	0.00	1.62	0.15
Sector	0.35	0.70	0.76	0.46

Table 4.8 shows the results of control variable, There is significant difference between age and role of knowledge sharing (F=3.00 , P=0.01) and insignificant difference between age & project performance (F=0.69, P=0.62), insignificant difference between gender and project performance (F=0.30 , P=.58) and insignificant difference between gender and role of knowledge sharing (F=1.23, P=0.26), significant difference between qualification and project performance (F=4.32 , P=0.00) and significant difference between qualification and role of knowledge sharing (F=2.78, P=0.02),insignificant difference between experience and project performance (F=1.62 , P=0.15) and significant difference between experience and role of knowledge sharing (F=3.63, P=0.00), insignificant difference between sector and project performance (F= 0.76,P=0.46) and insignificant difference between sector and role of knowledge sharing (F= 0.35, P=0.70).

4.5   Results for Hypothesized Variable

4.5.1   Descriptive Analysis

Descriptive analysis is brief description or summary of coefficients that measures the data. Tabular form or graphical representation is used to describe the data. Descriptive analysis includes population sample, minimum and maximum value, mean and standard deviation.

TABLE 4.9: Descriptive Analysis

Variables	N	Min	Max	Mean	SD
Project Complexity	277	2.07	5.00	3.23	0.56
Project Performance	277	1.75	5.00	3.95	0.54
Role of Knowledge Sharing	277	1.0	5.00	3.89	0.72
Supportive Leadership	277	2.0	5.00	4.07	0.53

Table 4.9 represents the standards deviation and mean value, minimum and maximum of hypothesis variable of this study. First column shows all the four variables used in this study e.g. Project Complexity, Project Performance, Role of Knowledge Sharing and Supportive Leadership, Likert scale was used to rate these variables. Two other columns show minimum and maximum value of each variable. The independent variable (Project Complexity) has mean of 3.23 and standard deviation of 0.56. Dependent variable (Project Performance) has mean of 3.95 and standard deviation of 0.54. Role of Knowledge sharing that is used as mediator shows mean of 3.89 and standard deviation of 0.72. Supportive Leadership used as moderator has reported value of mean 4.07 and standard deviation 0.53.

4.6 Correlation Analysis

Correlation analysis is used to identify the strength and direction of the variables. Correlation analysis helps to find out the connection between variables researcher is considering for study. Both relations could exist in analysis direct and inverse. Correlation can be positive or can be negative. Direct relation in analysis shows that increase in one variable will also increase the effect in other variable, and decrease in one variable will decrease the effect in other variable. Inverse relationship means that increase in one variable will decrease the effect in other variable and vice versa.

Values of correlation range from -1 to +1, where +1 indicates the perfect positive correlation and -1 indicates the perfectly negative correlation, and '0' value shows that there is no correlation between variable. The sign with the value shows the direction or positive/negative relationship between variables.

TABLE 4.10: Correlation Analysis

S.No	Variables	1	2	3	4
1	Project Complexity	1			
2	Project Performance	0.634**	1		
3	Role of Knowledge Sharing	0.620**	0.511**	1	
4	Supportive Leadership	0.451**	0.346**	0.455**	1

*$P < 0.05$, **$p < 0.01$, ***$p < .001$ N=277 **Correlation is significant at the 0.01 level (2-tailed).*

Correlation table shows correlation between different variables. According to above table there is positive and significant relationship between Project Complexity and Project Performance, where r = 0.63 at p < 0.01. Third row of above table represents there is positive and significant relationship between Project Complexity and Role of Knowledge Sharing, where r = 0.62 at p < 0.01 and according to table Role of Knowledge Sharing has also positive relationship with Project Performance with r= 0.51 at p < 0.01.

As per above results represents that Supportive Leadership and Project Complexity have positive and significant where r = 0.45 at p < 0.01.Fourth row of table shows that there is positive and significant relationship between Supportive Leadership and Project Performance with r = 0.34 p < 0.05 and Supportive Leadership shows significant and positive relationship with Role of Knowledge Sharing whereas r=0.45 at p < 0.05.

4.7   Regression Analysis

Regression analysis is used to describe the relationship between variables. Regression analysis is method that is used to explore the impact among variables. This analysis helps in understanding the relationship between independent and dependent variable.

TABLE 4.11: The mediating effect of Role of Knowledge Sharing .

			β	se	t	p
Project complexity	$\rightarrow$	**Project Performance**	.601	.044	13.56	.00
Project complexity	$\rightarrow$	**Role of knowledge Sharing**	.586	.047	12.31	.00
Role of Knowledge Sharing	$\rightarrow$	**Project Performance**	.195	.057	3.04	.00

	LL 95% CI	**UL 95% CI**
Bootstrap results for indirect effect	0.494	.199

Note. Un-standardized regression coefficient stated. Bootstrap sample size 5000. LL =lower limit; CI = confidence interval; UL = upper limit. N=277, * P <.05; ** P <.01

From Table 4.11, it is concluded there is significant and negative association between Project Complexity and Project Performance, hence according to un-standardized regression co-efficient (B= 0.60, t= 13.56, P= 0.00), hypothesis H_1 i.e. "Project Complexity is negatively influenced with Project Performance." is supported. Results also shows that there is a positive and significant relationship between Project Complexity and Role of Knowledge Sharing as showed by un-standardized regression co-efficient (B= 0.58, t=12.31 , P= 0.00), hence the hypothesis $H2_a$ i.e. "Project Complexity is positively influenced with Role of Knowledge Sharing" is supported.

It is predicted from the table 4.11 that Role of Knowledge Sharing and Project Performance also have a significant relationship between each other. Evidence is provided through the un-standardized regression co-efficient as (B= 0.19, t= 3.04, P= 0.00) and from given values it is concluded that $H2_b$ i.e. "Role of Knowledge Sharing is positively influenced with project performance" is supported.

Results indicates that Role of knowledge sharing mediates the relationship between Project Complexity and Project Performance, as the indirect effect of Project Complexity on Project Performance through Role of Knowledge Sharing has the upper and lower limits of 0.49 and 0.19 and doesn't contain zero in the boot-strapped 95% confidence interval, thus it is concluded that the hypothesis i.e. $H2_c$ "Role of Knowledge Sharing positively mediates project complexity and project performance" is supported.

TABLE 4.12: The moderating effect of Supportive Leadership.

			β	se	t	p
Int_term	$\rightarrow$	**Project**	-.104	0.472	-.219	.8262
		Performance				
			LL 95% CI		**UL 95% CI**	
Bootstrap results for indirect effect			-0.10		0.08	

Note. Un-standardized regression coefficient stated. Bootstrap sample size 5000. LL =lower limit; CI = confidence interval; UL = upper limit. N=277, * P <.05; ** P <.01

It has been concluded from the Table 4.12, that Supportive Leadership doesn't act as a moderator between Project Complexity and Project Performance, as indicated by the un-standardized regression analysis (B= -0.10, t= -0.21, P= 0.82), therefore hypothesis H_3 i.e. "Supportive Leadership positively moderates the relationship between Project Complexity and Project Performance" is not supported because P= 0.82 is showing an insignificant value and zero is present in the bootstrapped 95% of the confident interval as its upper and lower limit (0.08, -0.10) contains opposite signs which indicates the presence of zero that leads to the rejection of the H_3 hypothesis.

4.8   Summary of Accepted/ Rejected Hypothesis

TABLE 4.13: Hypotheses Summarized Results.

Hypothesis	Statements	Results
H_1	Project Complexity is negatively influenced with Project Performance	**Supported**
$H2_a$	Project Complexity is positively influenced with Role of Knowledge Sharing.	**Supported**
$H2_b$	Role of Knowledge Sharing is positively influenced with project performance.	**Supported**
$H2_c$	Role of Knowledge Sharing positively mediates project complexity and project performance.	**Supported**
H_3	Supportive Leadership positively moderates the relationship between Project Complexity and Project Performance.	**Not Supported**

Chapter 5

Discussion and Conclusion

5.1 Introduction

Discussion chapter includes the detailed justification of hypothesis acceptance and rejection. It also discusses theoretical and practical implications, limitations of the study, future directions and conclusion.

5.2 Discussion

The primary purpose of this research is to find out the answers of questions relevant to project complexity and project performance in Pakistan's context. Along with variables Role of Knowledge Sharing taken as mediator and Supportive Leadership considered as moderator between Project Complexity and Project Performance.

Data for the study is collected from construction sector project based organizations of Pakistan. H_1 that shows project complexity negatively influence the performance of project is supported by study results. Knowledge is said to be important for any organization and sharing experience and knowledge required for efficient performance within teams give competitive edge and effects the organization as a whole. Therefore H_{2a}, H_{2b} are also supported by study results and shows significant and positive relationship with Project Complexity and Project Performance.

Likewise, Role of Knowledge Sharing acts as mediator between the relationship of Project Complexity and Project Performance, therefore H_{2c} is supported through study results, because complex projects are said to be more interdependent. Change in one activity influences the whole system/project. If knowledge is not properly shared it will make things more complex. Necessary and effective awareness will help members to cope up with the critical situation. Lastly analysis shows that Supportive Leadership is not acting as moderator, therefore H_3 is not supported by study results.

Detailed discussion on each hypothesis is as following:

5.2.1 Hypothesis H_1: Project Complexity is negatively influenced with Project Performance

H1, hypothesis got supported. Current study shows significant relationship where (B=0.60, t= 13.56, P= .00).

Project Complexity has the t-value of 13.56; it represents high significance level of the relationship between variables. According to results t-value is greater than 2, which shows relationship is significant. Therefore t-value i.e. 13.56 shows statistically significant relation of Project complexity with Project Performance. And the β co-efficient comes out to be 0.60 which shows that one unit change in Project Complexity will bring 60% change in Project Performance.

Hence, the above mentioned results are consistent on the basis of the past literature (Baccarini, 1996; Iles, 1997; Belout, 1998; Shenhar & Dvir, 2007; Geraldi, 2011; Takim et al., 2003; Thomas & Mengel, 2008; Shenhar & Holzmann, 2017), which also provides evidenced that relationship exists between project complexity and project performance. Construction projects are considered to be more complex in nature because there are more different interrelated parts involved, which make construction business more risky and complex. If not handled accordingly it will definitely effect the outcome, and project may not achieve the desired result. If desired results are not achieved it will influence overall performance of the project and project will be considered as failure.

Results of the study also illustrate that if complexity is not analyzed properly it will impact the project performance negatively. As end goal of the project is to achieve success where performance is considered to be criteria for success; for different projects, success is measured differently e.g. some projects want desired result on basis of quality, some consider success in completing within estimated time and some may consider completing within cost as a success factor. Though we cannot neglect any of three factors time, cost or quality in any project, project manager needs to balance these factors according to the requirements given by the customer, as end product/service is for customer.

5.2.2 Hypothesis H_{2a}: Project Complexity is positively influenced with Role of Knowledge Sharing.

Hypothesis H_{2a} got supported. As per results there exists significant relationship where (B= 0.58, t=12.31, P= 0.00).

Project Complexity has the t-value of 12.31, which indicates high significance level between variables. As per results t value that is greater than 2 indicates the significance of results. According to t value 12.31 there is statistically significant relation exists between Project Complexity with Role of Knowledge Sharing. The co-efficient comes out to be 0.58 which shows that if one unit change occurs in project complexity, it will bring 58% change in knowledge sharing.

Hence, the above mentioned results are aligned with the past literature (Alavi & Leidner, 1999; Stock, 2000; Nonaka & Takeuchi, 1995; Pektasx & Pultar, 2006; Hoegl & Schulze, 2005; Wang and Hou 2015; Omatayo, 2015 Navimipour & Charband, 2016) which also describes positive relationship between project complexity and role of knowledge sharing.

As every project requires knowledge sharing and knowledge management, it helps in resolving problems and issues effectively. Higher project complexities require more knowledge sharing within the teams. It is important to understand the importance of knowledge sharing within complex projects, high level of complexity involves more and more knowledge as risks and interdependencies are high as

compared to normal projects. Aim of the knowledge sharing is to fill the existing gap within the project teams and to give new ideas for successful results.

Gaps in complex projects are considered to be high as compared to normal projects, uncertainties are high therefore it is important to share right knowledge, at right time and in an appropriate way. Knowledge sharing is considered to be optimistic approach to deal in complex and risky situations, experienced members of team can minimize the negative effect of complexities by sharing their previous experience of managing the uncertainties and complexities.

5.2.3 Hypothesis H_{2b}: Role of Knowledge Sharing is positively influenced with project performance.

Hypothesis H_{2b} got supported. Results shows significant relationship where (B= 0.19, t= 3.04, P= .00). Knowledge sharing has t-value 3.04, which indicates the significance level of the relationship. As per results t-value that is greater than 2 indicates the significance of results. Therefore t-value of 3.04 indicates positively significant relation between knowledge sharing and project performance. Co-efficient thats 0.19, which shows if there is one unit change occur in knowledge sharing, there is a probability that project performance will be changed by 19%.

Hence, the above mentioned results, on the basis of the past literature support the positive relation of knowledge sharing with project performance ((Constant et al., 1994; Herbsleb & Moitra, 2001; Chowdhury, 2005; Christensen, 2007; Li & Li, 2008 Isfahani et al., 2013; Chen et al., 2017; Ali et al., 2018).

It is believed that performance can be improved by providing or utilizing adequate resources. Knowledge is also considered as a resource to any organization and effectively sharing knowledge within team/organization can easily give competitive advantage to an organization. It creates sense of motivation among team; knowledge sharing depicts the willingness to achieve targets and contributing towards organization.

Smooth flow of information and relevant knowledge will help whole team to deal with the situation; every member has different types or level of expertise, when

all these expertise will be combined, it will result in positive outcome. Specifically complex projects need motivated and skilled team, because without adequate resources it will be difficult to deal with critical and uncertain situations.

5.2.4 Hypothesis H_{2c}: Role of Knowledge Sharing positively mediates project complexity and project performance.

H_{2c} hypothesis got supported. The results shows significant relationship of role of knowledge sharing as a mediator between Project Complexity and Project Performance, as the upper and lower limit (0.49, 0.19) indicated by the un-standardized regression co-efficient are both positive and 0 does not exists in the bootstrapped 95% interval around the indirect effect of the relationship of project complexity and project performance through knowledge sharing.

Communication is considered one of the most vital arts that a manager should consider while leading any project or team for achieving the desired outcome. In case of project's human resource, employees may be working on different projects and with different teams simultaneously, which may make some members uncomfortable. It could result in low team interaction and members are may be reluctant to share their expertise or knowledge with other team members, considering, it might give others edge over them. Manager should deal with this situation strategically. Results of this study and different other studies shows the importance of appropriate knowledge sharing and how it effects the performance (Nonaka, 1994; Patrick, 2003; Lin and Lee, 2005; Ipe, 2013; Liao, 2018).

5.2.5 Hypothesis H_3: Supportive Leadership positively moderates the relationship between Project Complexity and Project Performance.

H_3 hypothesis is not supported by study results. According to the results of the present study there exists insignificant relationship, where (B= -0.104, t= -.219,

P=0.82). Supportive Leadership has t-value of -0.219, which indicates insignificant relationship between variables. As per results t-value is less than 2, it shows the insignificance of results. According to results t-value of -0.219 indicates statistically insignificant relation of supportive leadership as a moderator between Project Complexity and Project Performance. Co-efficient comes out to be -0.104 which shows that if one unit change occurs in supportive leadership it will bring negative impact of 10% in the relationship between Project Complexity and Project Performance.

In this study, moderating effect of supportive leadership is not supported by the results; mostly literature supports supportive leadership and its impact on performance but in case of complexity literature found that project manager should think more critically and manage resources strategically (Muller & Turner, 2009), it isn't necessary that supportive leadership always works. Leadership support is required in difficult or complex situations but it is more important for manager to take right decision. Different projects require different types of leadership styles because of different project nature. Lenient and supportive attitude may not work in every project especially where risks and interdependencies are high.

5.3 Research Implications

5.3.1 Practical and Theoretical Implication

Current study has contributed towards a new domain in previous literature, where relation of project complexity is tested and analyzed with variables such as project performance, role of knowledge sharing and supportive leadership. This study has added significant aspects of project complexity towards the past literature by analyzing its impact with project's performance. As performance is considered main outcome of project, hence this study has illustrated the importance of analyzing complexity along with effective sharing of knowledge and how it impact overall performance.

In this study, new associations have been examined which are important for achieving the competitive advantage in dynamic environment of projects. The study has contributed in a significant way in the literature by demonstrating the role of knowledge sharing as a mediator between project complexity and project performance. Current study suggests that managers should also consider knowledge sharing as an important factor for achieving desired performance.

5.4 Limitations of Research

Limitations exist in every research; current study also has some reservations which includes time and resources constraints. For current research data were gathered from the project based organization of Pakistan, outcomes may be different if the information will be gathered from different domains of organization in Pakistan.

Sampling technique that is used is also considered as limitation, as convenience sampling limits the generalizability, because it is used to gather data from randomly large population. Therefore results may not be generalized widely. Quantitative technique for data collection is also considered as limitation because of time constraint.

5.5 Future Research Directions

Current study tested the model to explore the effect of project complexity on project performance, in future these variables could be tested with other variables such as innovation and dimensions of complexity e.g. considering types of complexity such as dynamic, structural, uncertainty, pace and socio-cultural.

Still certain gaps exist for future research, as hypothesis which is not supported can be re-analyzed by using different sector or domain of project management i.e. supportive leadership as a moderator. Further research can be done to examine the other domains in which supportive leadership play significant role in existing needs for projects.

Moreover, the study on project complexity and project performance needs more attention of researchers, because these variables can further be studied in other sectors where analyzing complexity is necessary i.e. telecommunication sector, IT sector etc. For future study qualitative research can also be conducted considering the present study model. This study could be further enhanced by following the future research guidelines.

5.6 Conclusion

Complex projects need more attention for successful outcome or desired performance. Therefore each and every factor should be properly managed whether its managing knowledge, managing human resource or its about managing finances. Systems approach describes that how every activity that is interlinked in a system affects whole project. Uncertainties and risks are high in complex scenarios, leadership or team conflicts can affects projects performance drastically.

Purpose of this study was to explore the effect of complexity on project performance. Current study has demonstrated the role of knowledge sharing as a mediator between project complexity and project performance. Considering supportive leadership as moderator between project complexity and project performance.

Questionnaires were used for data analysis, which are distributed among different project based organization of Pakistan. This study and proposed hypotheses are being supported through System theory. Total 350 questionnaires were distributed out of 350, 277 were used for data analysis which were fully filled and contain full information required for research.

Present study found that complexity has adverse effects on project performance. Also role of knowledge sharing which acts as a mediator is much crucial and it also has an effect on performance, which is difficult to manage. There are chances that members may not be willing to share their experience or expertise within project team. Finally, it is found that leadership is needed according to the situation and circumstances, it's not necessary that every time supportive behavior

of leader works. He/she needs to think strategically, which strategy will be needed to achieve desired outcome.

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Appendix-A

Survey Questionnaire

Dear respondent,

I am MS (Project Management) research student at Capital University Science and Technology (CUST), Islamabad; I am collecting data for my thesis. "Quantification of Project Complexity on Project Performance". It will take your 10-15 minutes to answer the questions and to providing the valuable information. I assure you that data will be strictly kept confidential and will only be used for academic purposes.

Thank you.

Section-1: Demographics

	1	2	
Gender	Male	Female	
	1	2	3
Age	25 or below	26-35	36-45
	4	5	6
	46-55	56 or above	
	1	2	3
Total Experience (**Years**)	05 or below	06-10	11-15
	4	5	6
	16-20	21-25	26 or above
	1	2	3
Sector	Public	Private	Semi-Government
	1	2	3
Highest Level of Education	Bachelors	Masters	MS/M.Phil
	4	5	
	PhD	Other	

Section-2

Project Complexity: (Complexity: the state or quality of being intricate or complex)

1	The project team was cross-functional	1	2	3	4	5
2	The project involved multiple external contractors and vendors	1	2	3	4	5
3	The project involved coordinating multiple user units	1	2	3	4	5
4	The system involved real-time data processing	1	2	3	4	5
5	The project involved multiple software environments	1	2	3	4	5
6	The project involved multiple technology platforms	1	2	3	4	5
7	The project involved a lot of integration with other systems	1	2	3	4	5
8	The end-users' organizational structure changed rapidly	1	2	3	4	5
9	The end-users' business processes changed rapidly	1	2	3	4	5
10	Implementing the project caused changes in the users' business processes	1	2	3 3	4	5
11	Implementing the project caused changes in the users' organizational structure	1	2	3	4	5
12	The end-users' information needs changed rapidly	1	2	3	4	5
13	Architecture that the project depended on changed rapidly	1	2	3	4	5
14	Infrastructure that the project depended on changed rapidly	1	2	3	4	5
15	Software development tools that the project	1	2	3	4	5

	depended on changed rapidly					

Role of Knowledge Sharing: (Activity through which knowledge (information, skills, or expertise) is exchanged among people

1	My organization treats peoples skills and experiences as a very important part of knowledge assets.	1	2	3	4	5
2	I share information and knowledge with my superiors.	1	2	3	4	5
3	I share information and knowledge with my subordinates	1	2	3	4	5
4	I often share ideas with other people of similar interest, even if they are based in different departments.	1	2	3	4	5
5	There is a great deal of face-to-face communications in my organization.	1	2	3	4	5
6	When I need some information or certain knowledge, it is difficult to find out who knows knows about this, or where we can get this information (reverse coded).	1	2	3	4	5
7	There are systems and venues for people to share knowledge and learn from each other in our organization.	1	2	3	4	5
8	I use information technology to facilitate communications effectively when face-to-face face communications are not convenient.	1	2	3	4	5

Supportive Leadership: (Showing concern for employee's needs)

Project Leader

1	Considers my personal feelings before acting	1	2	3	4	5
2	Behaves in a manner which is thoughtful of my personal needs	1	2	3	4	5
3	Sees that the interests of employees are given given due consideration	1	2	3	4	5

Project Performance: (indicator to check whether project has achieved planned goals)

1	Project is meeting operational specifications.	1	2	3	4	5
2	Project is meeting technical specifications.	1	2	3	4	5
3	Project is meeting time goals.	1	2	3	4	5
4	Project is meeting budget goals.	1	2	3	4	5
5	Project is fulfilling client needs.	1	2	3	4	5
6	Client is satisfied with the project's performance.	1	2	3	4	5

Thank you for your time and cooperation