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**Analysing Project Team Commitment through Virtual
Team Efficacy and Locus of Control under Mediation
of Team Cohesion**

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Contents

Abstract.....	3
Chapter 1: Introduction	4
1.1. Introduction:	4
1.2. Problem Statement.....	8
1.3. Research Questions	9
1.4. Research Objectives.....	10
1.5. Theoretical Significance	10
1.6. Practical Significance	11
1.7. Key Terms and Definitions.....	12
1.7.1. Project Team Commitment.....	12
1.7.2. Virtual Team Efficacy	13
1.7.3. Locus of Control	13
1.7.4. Team Cohesion	13
1.7.5. Strategic Management	13
1.7.6. Software Houses	14
1.7.7. Virtual Work Environment.....	14
Chapter 2: Literature Review	15
2.1. Introduction	15
2.2. The Software Industry in Pakistan	15
2.3. Challenges in Managing Virtual Teams.....	16
2.4. Theoretical Framework.....	17
2.4.1. Social Cognitive Theory (Bandura) – Influence of Virtual Team Efficacy.....	17
2.4.2. Locus of Control Theory (Rotter) – Impact on Team Commitment.....	18
2.4.3. Team Cohesion Model – Mediating Role in Virtual Team Performance	19
2.4.4. Strategic Management Theory – Application to Software Houses.....	20
2.5. Project Team Commitment in Virtual Teams	20
2.6. Virtual Team Efficacy and Project Performance	22
2.7. Locus of Control in Team Commitment.....	24
2.8. Mediation of Team Cohesion in Virtual Teams	25
2.9. Strategic Management of Virtual Teams	26
2.10. Conceptual Framework.....	27
2.11. Summary of the Chapter.....	28
Chapter 3: Research Methodology	29
3.1. Introduction	29

3.2.	Research Design.....	29
3.3.	Population and Sampling.....	30
3.3.1.	Sampling Technique.....	30
3.3.2.	Inclusion and Exclusion Criteria.....	30
3.4.	Data Collection Methods.....	31
3.4.1.	Survey Instrument and Structure.....	31
3.4.2.	Data Collection Process.....	31
3.4.3.	Ethical Considerations.....	32
3.5.	Measurement of Variables.....	32
3.6.	Data Analysis Techniques.....	34
Chapter 4: Results and Analysis.....		36
4.1.	Test of Normality.....	36
4.1.1.	Kolmogorov-Smirnov test.....	36
4.1.2.	Multicollinearity Test.....	37
4.2.	Descriptive Statistics.....	38
4.2.1.	Gender Distribution.....	39
4.2.2.	Age Distribution.....	40
4.2.3.	Educational Qualification.....	40
4.2.4.	Work Experience.....	41
4.3.	Reliability Analysis.....	42
4.4.	Correlation Analysis.....	43
4.5.	Regression Analysis.....	45
4.6.	Mediation Effects.....	47
4.7.	Summary of Hypothesis.....	48
Chapter 5: Discussion.....		50
Conclusion.....		57
	Study Limitations.....	58
	Future Research Directions.....	59
References.....		61
Appendix A.....		73

Abstract

The growing prevalence of virtual collaboration in the software industry has created new demands for understanding how psychological and team-based dynamics influence project outcomes. In Pakistan's software sector, where project-based work is increasingly carried out through virtual teams, identifying the drivers of team commitment is essential for strategic management and performance optimization. This study explores the influence of virtual team efficacy and locus of control on project team commitment, with a particular focus on the mediating role of team cohesion. The aim is to identify the psychological and structural factors that support team engagement and performance in virtual environments. The research is grounded in theoretical perspectives including Social Cognitive Theory, which explains how individual and collective confidence influence task engagement, and Locus of Control Theory, which highlights how perceptions of personal control affect motivation and behavior. The Team Cohesion Model and Strategic Management Theory further inform the analysis of interpersonal dynamics and organizational alignment in remote work contexts. Key concepts in this study include team efficacy, internal motivation, trust, cohesion, and strategic leadership within distributed teams. A quantitative research approach was employed to gather data from professionals in the software industry who regularly operate in virtual project teams. The data collection was conducted through a structured questionnaire administered online, targeting IT professionals working in various software houses in Pakistan. A cross-sectional design was chosen to capture a snapshot of the current state of virtual team engagement and commitment. The findings suggest that both virtual team efficacy and internal locus of control are important predictors of project team commitment. Individuals who are confident in their team's virtual capabilities and who believe in their ability to control their work outcomes tend to show stronger dedication to team goals. Although team cohesion is positively associated with commitment, it does not serve as a significant mediating factor between the psychological traits and commitment outcomes. This indicates that commitment in virtual environments may depend more on individual-level motivation and confidence than on group dynamics alone. The study contributes to the field of strategic human resource and project management by providing insights into how software houses can enhance employee engagement in virtual settings. It emphasizes the importance of promoting individual agency and developing confidence in virtual collaboration, while also recognizing the supporting role of cohesive team relationships. These insights may inform recruitment, training, and leadership practices tailored to the needs of distributed software teams.

Keywords: Virtual Teams, Project Team Commitment, Team Cohesion, Virtual Team Efficacy, Locus of Control, Strategic Management, Software Development, Pakistan.

Chapter 1: Introduction

1.1. Introduction:

The IT industry in Pakistan plays an important role in economic growth, with over 15% annual growth in recent years. This sector not only fosters employment and skill development BUT also facilitates technological advancements. Pakistan enacted the Digital Nation Pakistan Act, 2025, focus on promoting IT exports has led to the establishment of technology parks and incentives for software houses, making a regional hub for software solutions (Ullah et al., 2023). But, challenges such as skills gaps and limited strategic planning opportunities still impacting long-term sustainability and competitiveness in the industry (Namazi & Rezaei, 2024). Proper strategic management in industry ensures resource utilization and delivery of project while aligning goals with business and market demands. A well strategic management like as adaptive leadership and collaborative frameworks increase organizational resilience (Alabdullah & Naseer, 2023). Fostering innovation and addressing the global shift toward virtual work environments these strategies are essential (Lali & Chakor, 2023).

The coronavirus pandemic (COVID-19), was one of the deadliest pandemics of the 21st century, which spread rapidly across the globe. Due to Covid-19, Organizations has been a growing reliance on information technology (IT), specifically virtual platforms, to mitigate the impact of the pandemic. Pakistan were already using IT platforms before COVID-19. After lockdown imposed due to the increase of pandemic the adoption of these technologies across nearly all industries to adapt to the new challenges. Covid-19 has posed several challenges for software houses in Pakistan like the shift to remote work required software houses to adapt quickly. Ensuring seamless communication, collaboration, and project management while working remotely has been difficult, particularly for teams that were not accustomed to such setups. Some challenges like increased in demand, constraint on resource, and shift to remote work, have increased the importance of strong project team commitment to ensure timely project delivery, innovation, and adaptability in a rapidly evolving digital landscape.

In a dynamic environment such as software house, Buvik and Tvedt, (2017) have indicated that Commitment of project team is the cradle for successful project delivery. Trust, accountability and a shared sense of responsibility on project teams, which commitment is

responsible for increasing individual and team performance. Team commitment is about teammates' organization with the desire to align their efforts with organizational goals, so as to meet strategic milestones. Hao et al. (2022) emphasise that team commitment, that is, the cohesion and the extent of impact of collaboration, facilitate the positive outcomes project impact directly, in particular in virtual environments where face-to-face interaction is little or absent. Team commitment in software houses is vital for strategic management of projects on a competitive market landscape. According to (Admiral et al., 2021), fostering team commitment is about creating an environment where there is shared objectives, mutual respect and open communications. The factors play a crucial role in ensuring the team alignment with overall strategic priorities. Flavián et al. (2022) discusses that virtual teams rely on digital tools and networks of digital platforms to maintain synergy and concentration.

Virtual team efficacy plays a crucial role in sustaining commitment (Hertel et al., 2005), particularly in software houses that have transitioned to hybrid or fully remote work models. Teams with higher virtual efficacy are better equipped with regards to task management and flexibility along with their resilience in the face of a challenging remote environment. In addition to real time project management platforms and virtual meeting software, advanced communication tools can be integrated to mitigate communication barriers and can keep team members engaged and productive. According to Ghorbani et al. (2022), virtual team efficacy is closely related to effective training programs and structured processes for improving a team's capabilities and commitment. Moreover, Flavián et al. (2022) contend that the virtual team leaders should employ mind techniques of strategic management to strengthen team commitment on the basis of special features of the remote environments, in particular, by guaranteeing psychological security and maintaining the trust. To achieve this, it is necessary to highlight clear communicators of roles, goals and frequent participation that adds up to team cohesion and aligning efforts of people with the organizational strategy. Then, maximized virtual team efficacy leads to accomplishment of the overall project success as it does not only maintain but also increases commitment levels of virtual team members.

Virtual team efficacy is an important factor to ensure effective team performance (Vătămănescu et al., 2022), especially in software houses that operate in hybrid or fully

remote environment. When a team has high levels of virtual team efficacy, it demonstrates excellent performance on the task management and communication tasks, despite geographical barriers. Thus, this efficacy is a reflection of a team's collective confidence that tasks can be completed in an efficient fashion in relation to one another. Chen et al. (2023) as mentioned, adaptability and resilience are key attributes of virtual teams that contribute to the efficacy and maintain continued project continuity despite unforeseen challenges that real teams have to face. Furthermore, the locus of control—that is, the way in which someone perceives who and what are factors that determine success—metric it, contributes to the shaping of team dynamics. In software projects, an internal locus of control is a particularly valuable proponent because it can encourage people to be owner of something (project, task or outcome) and take responsibility for it. Also, members in a team that own an internal locus of control tend to exhibit higher degree of accountability and motivation that result to better decision and problem solving abilities (Hamzah & Othman, 2023). On the other hand, individuals who have an external loci of control may also tend to attribute outcomes to external factors resulting in their proactivity and engagement.

Combining virtual team efficacy and locus of control allows us to harness people's natural strengths to achieve success as a group. In a software house, project success is heavily dependent on the possibly diverse teams' collaboration without any hanging wires in this digital age (Rahmawati et al., 2023). If these factors are incorporated in strategic management, it not only improves team management and improves innovation circle and quality, which is a main point in strategic management of software houses. The combination between virtual team efficacy and locus of control and team membership is mediated through team cohesion, which serves as a vital factor for strengthening a relationship between virtual team efficacy, locus of control, and team commitment. Team cohesion provides a foundation of psychological safety and mutual trust to ground members to even collaborate in virtual environment. By building cohesive teams, conflicts can be addressed constructively and there will be development of mutual understanding while the environment created can support innovation and efficiency (Reizer et al., 2023).

Team cohesion at high levels is also efficient for decision making process since it induces alignment between team and individual objectives (Ndandani, 2024). It means that team efforts are always aligned to operating organizational goals especially in intense and dynamic contexts such as software houses. Team cohesion is the ability of members to merge their talents to create a cohesion between the talent contribution and the overall project outcome. Cohesive teams exert their positive influence by contributing to felt sense of accountability and purpose (Yulianti et al., 2024). Team cohesion is extremely important for handling complex projects through virtual interactions and inter departmental collaboration in the strategic software house management. Structured virtual engagements like team building exercises and collaborative platforms help facilitate team cohesion in order to keep the individual efforts in line with the overall strategic goals of the organization. Not only does this cohesion help bolster team commitment but it also helps amplify the virtual team efficacy and locus of control to come up with a strong, resilient and high performing project environment.

Pakistan has many software houses that are generating around 2 billion per year from software export, and creating job, thus turning its software industry to one of the highly successful industries. Despite this, however, strong barriers remain, including very high project failure rates, poor team collaboration, and large gaps in the strategic project management practice. One of the major reasons for the inefficiency of software houses of Pakistan in the global markets is a lack of effective team dynamics and commitment (Ullah et al., 2023). As international remote and hybrid working trend is growing; the necessity to deal with these challenges becomes even more crucial in terms of how the virtual team efficacy, locus of control, and team cohesion are interrelated. Such a study can throw some light on the transformation of operational and strategic framework of a software house in Pakistan. This may help managers find out such approaches in forming high performing teams by identifying the impact of the psychological factors such as the locus of control on the dynamics of the team and the influence of the virtual team's efficacy on the commitment. Admir et al. (2021) note that to achieve strategic goals in a competitive environment teams should be coached to form team cohesion and team commitment. The study also coincides with the

national vision for knowledge economy since it offers software houses with the means for improving the project success rate and operating efficiency (Yulianti et al., 2024).

1.2. Problem Statement

The concern about team performance and commitment in virtual teams in Pakistan's software industry is due to increasingly dependence on virtual teams. Collective confidence by a team in its capacity to finish a task, which is called virtual team efficacy, has a fundamental part to perform regarding effective collaboration and productiveness (Alsharo et al., 2017). Nevertheless, communication boundaries, lack of confidence as well as coordination problems are regular issues encountered with virtual teams, which may have unfavorable results on the performance of tasks (Chen et al., 2023). However, there is little research done in Pakistan's software houses, as remote work has become more common, and studies suggest that high virtual team efficacy results in better collaboration and project execution (Flavián et al., 2022). Lack of knowledge as to how virtual team efficacy affects team commitment is a huge knowledge gap, preventing managers from being able to actively practice effective team management strategies. To succeed in the effort of improving Pakistan's software industry and raising project success rates in a highly competitive global scenario, addressing this issue becomes critical.

An important dimension of team commitment is another critical factor influencing team commitment, which is the locus of control - or the degree to which individual holds that he or she has control over their work outcomes (Kalil et al., 2019). Employee with internal locus of control exhibited more being accountable, proactive, and being engaged compared to an employee with external locus of control is more likely to ascribe success or failure on external circumstances (Hamzah & Othman, 2023). Rahmawati et al. (2023) have investigated the effect of locus of control on employee motivation and job performance, however, there is no research regarding how this factor influences team commitment in virtual setting, and mostly in software houses. Since virtual work environments require self discipline and intrinsic motivation it is important to comprehend the role of locus of control in affecting team commitment and increase the team's efficiency and overall project outcome (Modise, 2016).

Without this understanding, software houses may not be able to create effective leadership and management strategies, and this will result to low team morale and high rate of employee turnover.

Secondly, both locus of control and virtual team efficacy is positively associated with it, and in particular, locus of control is predicted to represent a mediator variable in the process between virtual team efficacy and team commitment. When Trust, Psychological Safety and Team Alignment are all in place, Cohensive Team is able to perform better (Reizer et al., 2023). Team cohesion has been found to enhance decision making and solving problems (Yulianti et al., 2024) deemed however, its role in a virtual software team has not been fully described. With this disengagement as well as a lack of productivity in the team, it can weaken the team cohesion; in other words, there is lack of in person interactions. Closing this gap is therefore important to understand how to move the cohesion in remote work environment, and how to let the software houses reach the maximum performance of their teams.

However, the importance of strategic management in the virtual environment of the team has grown, but it has not yet been integrated with the team management frame of software houses in Pakistan because of psychological and structural aspects. Yet if the efficacy of virtual team was poorly handled, as well as the locus of control of virtual team and cohesion of virtual team, would lower commitment, would project delays and innovation would be possible (Hao et al., 2022). The figurative stiff competition in the software industry that exists in Pakistan is something that can no longer be survived evidence free and it has become essential for the Pakistani software houses to adopt evidence based strategies to increase team commitment and performance. This study attempts to fill the existing research gap in the area of relationship between team efficacy, locus of control and the impact of team cohesion on the team commitment in project team by offering the strategic recommendations through enhancing project team dynamics and success.

1.3. Research Questions

1. How does virtual team efficacy influence project team commitment in software houses in Pakistan?

2. What is the impact of locus of control (internal vs. external) on team commitment in virtual software teams?
3. How does team cohesion mediate the relationship between virtual team efficacy and project team commitment?
4. How does team cohesion mediate the relationship between locus of control and project team commitment?
5. How to implement strategic management practices to improve cohesion and commitment in virtual software project teams?

1.4. Research Objectives

1. To determine the effects of virtual team efficacy in the determination of project team commitment in software houses.
2. The aim was to examine the role of locus of control in determining the commitment of the virtual team.
3. We examine how virtual team efficacy relates to team commitment through team cohesion as a mediator.
4. The team cohesion was to test its mediating role in the relation between locus of control and team commitment.
5. In order to provide strategic suggestions on how to improve team cohesion and commitment in software houses.

1.5. Theoretical Significance

The contribution of this study is in terms of theory in understanding virtual team dynamics, team commitment and strategic management in the software houses in Pakistan. Research expands existing body of literature concerning the psychology of team, virtual collaboration and virtual team efficacy, by integrating theories of locus of control and team cohesion. While the existing studies have investigated the effect of team commitment in traditional work setting (Flavián et al., 2022; Bishop & Scott, 2000), hard little knowledge has been found with

regards to management of team commitment in software development projects within the context of emerging economies such as Pakistan. The gap between psychological and structural factors that affect team commitment in virtual software houses is bridged in this study on the psychology of team commitment.

Furthermore, the study further contributes to Locus of Control Theory that states that the beliefs individuals have about control over their environment influence their motivation and behavior (Hamzah & Othman, 2023). Prior research shows that locus of control correlates with an individual's job performance, however, this study wishes to investigate the impact that locus of control has on individual performance at a team level, particularly in the case of a virtual team where autonomy and self discipline are critical (Modise, 2016). Additionally, this research develops Social Cognitive Theory, which is based on learning and behavior within a group (Yulianti et al., 2024). The study contributes to understanding the ways in which virtual team efficacy supports trust and collaboration, and teams adjust to a digital workspace while maintaining a high rate of performance.

Furthermore, this study also contributes to the literature in organizational behavior through team cohesion being a mediating variable. Past research has indicated cohesion's role in virtual teams (Reizer et al., 2023; Sidorenkov & Borokhovski, 2023), yet this area of research has been less studied. On the basis of empirical evidence, this research demonstrates how individual psychological characteristics of locus of control teams bridge toward the group/team performance level of commitment, establishing a novel conceptual basis for virtual team management. With this, the findings can be used as a basis for future work on work dynamics in the software industry and on remote work management and digital collaboration.

1.6. Practical Significance

The findings of this study hold practical implications for managers, project leaders, and policymakers in Pakistan's growing software industry. As the trend of remote and hybrid work is being grown in software houses, most software houses are struggling to maintain the team at a low engagement rate, high turnover in the organization (Grzegorzczuk et al., 2021). The finding of the main drivers of team commitment of this study facilitates identification of the

measures managers can take to enhance team performance and project outcomes. So, organizations learn to figure out the way they design virtual team training programs, digital tools and leadership strategies to improve team confidence of and efficiency, i.e. virtual team efficacy have contributions to boost collaboration (Chen et al., 2023).

Furthermore, the research gives effective recommendations of how locus of control can be used in team leadership. Employees with internal locus of control tend to initiate their work whereas the employees with external locus of control require extra incentive and structured support (Rahmawati et al., 2023). Managers can use these insights to develop personalised engagement strategies, mentorship programs as well as incentive schemes to make up for lost productivity. In addition, virtual engagement activities like virtual team cohesion will include shared goals, exercises to build trust perceived by Group members, which will boost the overall commitment and morale of the team (Reizer et al., 2023).

From a strategic management hence it will be beneficial to the software houses for human resource strategy to be aligned with the organizational goals. Companies can integrate evidence based team management approaches into the strategic planning area which will be an assurance that virtual teams will be very committed and in line with the company's business objective. Secondly, these findings can indirectly be used for development of such national policies and trainings programmes for the Pakistan's IT sector to improve the efficiency and team dynamics of capabilities of remote work. Such a study will assist in strengthening the competitiveness of Pakistan's Software industry on a global scale, whilst dealing with the key team commitment challenges.

1.7. Key Terms and Definitions

1.7.1. Project Team Commitment

Project team commitment is defined as the extent to which team members are emotionally and psychologically attached to their project and as a result, achieve higher engagement, responsibility, and effort in the project to achieve project goal (Hao et al., 2022). It helps in team cohesion, motivation and performance, and therefore is a big part of successful project execution in software houses that work virtually.

1.7.2. Virtual Team Efficacy

Virtual team efficacy refers to shared belief by team members that they can get together, both in the remote or digital work environment, and effectively execute tasks to achieve the objectives (Chen et al., 2023). It has to do with technological support, communication efficiency and styles of a leadership as a key factor in such smooth collaboration among software development teams.

1.7.3. Locus of Control

Basically, locus of control means that an individual thinks in terms of how much he controls his own success or failure. It is categorized into:

- Internal Locus of Control – Individuals believe that their actions, decisions, and efforts determine outcomes.
- External Locus of Control – Individuals attribute success or failure to external forces, such as luck, fate, or organizational policies (Hamzah & Othman, 2023).

In a software development context, locus of control affects how employees approach challenges, take ownership of tasks, and engage in team activities.

1.7.4. Team Cohesion

Definition: Team cohesion is the degree to which team members feel connected, motivated, and aligned toward a shared goal (Reizer et al., 2023). It involves trust, collaboration, and shared responsibility, which are especially important for virtual teams in software houses. High team cohesion enhances communication, problem-solving, and overall team commitment.

1.7.5. Strategic Management

Strategic management is the use of strategic planning, strategic execution and evaluation of strategies towards long term objectives of an organization. It is the matching of resources, technologies and the human capital towards the maximum performance of the business (Flavián et al., 2022). The virtual teams that have been running in software houses are always possible, strategic management of virtual teams assist the virtual teams run effectively, be committed to deliver projects and to adapt to industry changes.

1.7.6. Software Houses

Software house is a company which works in designing, developing and maintaining of software applications and IT solutions. These organization are startups to large enterprises working in local and international markets (Ullah et al., 2023). It is a tough job managing teams in the software houses with much strong planning and leadership and working knowledge of the dynamics of the virtual work.

1.7.7. Virtual Work Environment

Explanation: The Definition of a virtual work environment can be defined as a digitally integrated working environment where teams work remotely, and are supported in a virtual space of some of the digitally integrated tools and communication mediums. Whereas modern office constraints eliminate its physical office and teams can work across geographies and time zone boundaries (Chen et al., 2023). That said, the success of using the virtual work management depends on the following, which are effective communication and workflow.

Chapter 2: Literature Review

2.1. Introduction

Overview of the Chapter

Undertaken is a comprehensive review of the literature on the area of project team commitment, virtual team effectiveness, locus of control and team cohesion with an emphasis on the strategic management of software houses in Pakistan. The chapter is centered around key aspects of software industry in Pakistan followed by its growth and the issues related to managing software virtual teams. Then, it provides theoretical framework related to the study that is Social Cognitive Theory, Locus of Control Theory, the Team Cohesion Model and Strategic Management Theory. In addition, it studies project team commitment in virtual teams, the impact of the virtual team efficacy on project performance, and the role of the team cohesion as a mediator between these.

2.2. The Software Industry in Pakistan

With the rise of the globalization of business in the IT industry and adoption of virtual work for software design, software design processes (Garro-Abarca et al., 2021) have changed. The software industry has gained momentum in Pakistan, yet absence of a formal structure of managing virtual teams like communication barriers, lack of trust, and inconsistent team commitment became the issue (Ullah et al., 2023). To achieve high levels of efficacy, motivation and productivity, virtual teams require strategic leadership and structured frameworks established by (Hao et al., 2022). It is important to comprehend the psychological and operation factors that can influence a project team's commitment, like locus of control and virtual team efficacy for successful software house project execution and ongoing organizational development (Chen et al., 2023).

Shah et al., (2025) suggest that Pakistan's software industry has become a major player in the global IT outsourcing market, accounting for exports and employment. According to the Pakistan Software Export Board (PSEB), in 2022, the Pakistan IT and IT Enabled Services (ITES) exports came to \$2.6 billion and are expected to increase (Ullah et al., 2023). The growth is fuelled by government incentives, these are the IT parks and increasing investments in the

digital infrastructure (Admiral et.al, 2021). In addition, Pakistan has witnessed a great leap in their startup ecosystem and its freelancing sector such that Pakistan has become the fourth largest freelancing market in the world (Hussain & Rizwan, 2024). Remote teams and virtual collaboration tools are now extensively used by software houses, both small firms as well as large scale enterprises, to fulfill international customer requests (Ghorbani et al. 2022). However, the management and operation of these software houses are still riddled with drastic operational and management problems and especially in the case of team collaboration and commitment.

2.3. Challenges in Managing Virtual Teams

Although the software industry of Pakistan is growing rapidly, it is still a challenge to manage virtual teams and it affects the productivity and project success (Ateeq, 2024). Communication barriers such as misunderstandings, lack of clarity and alignment of goals (Morrison-Smith & Ruiz, 2020) is one of the biggest obstacles. Without face-to-face interactions, virtual teams find it difficult to develop effective communication protocols that cause delays in decision making and further hampering the overall efficiency (Reizer et al, 2023). In addition, virtual team collaboration is made more complex by pursuing trust issues (Ford et al., 2017). Due to the fact that team members do not have a physical interaction and more or less one cannot develop trust with colleagues. (Flavián et al., 2022). Employees can't share ideas, won't collaborate effectively or take the accountability for their work without trust (Staples Webster, 2008). Also a challenge in virtual teams is motivation and commitment since the remote employee may feel isolated and disconnected from their organization (Wang et al., 2020). The availability of no in person work environment and real time interaction with other colleagues decreases the feeling of belonging to the employees which lead into low motivation and work commitment (Rahmawati et al., 2023).

Additionally, several software houses in Pakistan are working with foreign clients, and because of this, it leads to the team coordination issues as it entails time zone difference. Adjustment of work schedules of employees is necessary at times due to which they may be prone to burnout and struggle in creating a work life balance (Irfan et al., 2023). One of the major issues is that projects are delayed often due to weakness in the team cohesion and inefficient

workflows (Bick et al., 2017). Because virtual teams coordinate over physically separated people, teams are required to be ordered, have agreed upon processes, and coordinate to complete the project expeditiously. Yet, within the lack of strength team cohesion, software projects are ridden with inefficiency, missed deadlines, and reduced high quality (Yulianti et al., 2024). Effective strategic management, effective leadership and structured engagement strategies to enhance the collaboration, improve the communication and keeping high commitment level inside of the virtual teams are needed to address these challenges.

2.4. Theoretical Framework

Theoretical foundation of the relation between locus of control, team cohesion, virtual team's efficacy and project team commitment has to be strong enough to understand the relationship. To explain the actions of virtual teams and employees, and how managers of software houses get the most out of teams, multiple theories are used from organizational behavior and psychology and strategic management. To explain the factor that affect the virtual team commitment, efficiency, and cohesion, this thesis presents the following models.

2.4.1. Social Cognitive Theory (Bandura) – Influence of Virtual Team Efficacy

Social cognitive theory (SCT) is a well known psychological theory developed by Albert Bandura in 1982; it explains how the individuals and behaviour are shaped in terms of observed behaviour and interaction and based on social environment. SCT is most applicable within the organizational settings, especially in the case of virtual teams where employees require fellow interactions, digital communication and shared experiences for developing their professional skills or building confidence of their ability (Sarker et al., 2011). The performance, decision making, and collaboration styles of employees perform and thrive when their colleagues do the same (Flavián, 2022, in the virtual team efficacy context). Virtual teams, however, under which team members evolve certain conditions over their team, even if they learn that their team mates have skill in problem solving, are flexible and technologically competent, cause team members to internalize team members' behavior and knowledge of the team abilities to succeed (Monday, 2022). When employees believe they have a shared belief that will help them in the project, their commitment, motivation and success in the project increases because they feel empowered and people can trust them.

Virtual teams have high efficacy level, which mean that they will have high adaptability, higher resilience and are more likely to complete projects successfully, to work efficiently and to remain highly committed to their group's goals (Hao et al., 2022). In fact, in the virtual environment where trust and collaboration are essential, a lack of efficacy in the team also contributes to low engagement, ineffective communication, and a very high turnover rate (Choi and Cho, 2019). Consequently, SCT in virtual teams does consider continuous learning, mentorship program and strong leadership to enhance maturity of the team in terms of confidence and commitment.

2.4.2. Locus of Control Theory (Rotter) – Impact on Team Commitment

According to Julian Rotter (1966), Locus Control (LoC) Theory categorizes people according to their perception of whether they can have control on whether or not they succeed or fail. The relevance of this theory in the understanding of employee motivation, employee performance and employee engagement in virtual teams is specially pertinent (Lee-Kelley, 2006). An employee with an internal locus of control believes that his own actions, decisions, and abilities determine his success, so that there is greater motivation, responsibility and commitment (Hamzah & Othman, 2023). They are active and active starters (first to take the initiative, first to find the solution, and first to participate more in the team activities), and are highly valuable team members in virtual teams where the self-discipline and proactive behavior are so needed. Employees who control in an external way attribute their successes and failures to external forces, as these employees believe that all matters are in the hands of others beyond their own (luck, fate, or management decisions: Mali, 2013). They can feel less in control of their work outcomes with respect to work environments that involve remote working and this is what makes it tough for such individuals to be engaged and accountable. As a result, lower team commitment, lower motivation, and more supervision needs may arise (Rahmawati et al., 2023).

The understanding of locus of control in virtual teams is very applicable especially in cases where autonomy and self management is critical as they help managers to identify who needs structured guidance and motivation strategies (Modise, 2016). Supportive of the author's argument, software houses can promote employee commitment regardless of their locus of

control orientation by creating goal oriented incentives, mentorship programs and performance feedback systems (Chowdhury, 2014). This helps make sure that those with the external locus of control feel involved, appreciated, and willing to give their best to contribute to the team's success.

2.4.3. Team Cohesion Model – Mediating Role in Virtual Team Performance

Interpersonal relationships, shared objectives and trust are what this Team Cohesion Model works with to measure team performance and success (Mach et al., 2010). Overall, cohesion is a crucial mediator between virtual team efficacy, locus of control, and team commitment in virtual teams (Cai, 2023). Benefits on high collaboration, better productivity, more trust are available if people involved in the team have strong cohesion (Reizer et al., 2023). The results reported that the higher the level of cohesion in a team, the better problem solving capability in a team, the lower conflict rates and the higher ability a team has in dealing with challenges in the project (Yulianti et al., 2024). Maintaining team engagement, motivation and performance in software houses with time zones, countries and time spent at other locations is very important from team cohesion's perspective.

Cohesion, on the one hand, as well as links the individual psychological trait (locus of control) to individual performance (team commitment), and on the other hand it links the individual psychological trait (locus of control) and collective team performance (team commitment) (Bayne, 2000). For instance, people who have an internal locus of control may be apt to participate in team activities as natural born, while those with an external locus of control would need a strong team environment in which they are given the support and engagement (Ng et al. 2006). This also holds true that as the more the virtual team is effective, the higher team cohesion is because the team members who feel like they can do something, are better capable of collaborating and contribute to the project positively (Paul et al., 2016). For better cohesion of a virtual team, organizations need to promote structured virtual interaction, routine team building activities, and open communication practices (Agarwal, 2024). A feeling of have a common purpose, belonging and trust among the team, which software houses want to create, can increase the team commitment and in the longer term will result in better results.

2.4.4. Strategic Management Theory – Application to Software Houses

Because of this, the strategic management theory is relevant in the optimization of team commitment, alignment of organizational goals and enhancement of team performance in software houses (Parker et al., 2015). Important elements to practices team that help them to be efficient, engaged and aligned to business objective, include structured decision making, resource allocation, and leadership driven strategy (Ghorbani et al., 2022). Strategic management is the implementation of agendas on agile models of work, leadership frameworks and so on to maintain high commitment and productivity of virtual team members (Nguyen, 2013). Working on time and communicating with the remote clients is the typical problem of the software houses and in particular, remote clients and global ones, which turned out to be quite common nowadays.

One of key strategic management practice is Goal oriented Leadership where goal based leadership leads the team to beaten certain goals, which are the goal specific in nature, and this goal will be measurable, linked with organisational goal, and team members will be motivated (Ali & Siddiqui, 2023). There is need implementing of digital collaboration tools, workflow automation and real time tracking systems to achieve an increase in efficiency (Adepoju et al., 2022). Incentives such as rewards, recognition programs, performance based incentives, professional development (Lavy, 2007). Execution and making the decisions of the project based on Scrum, Kanban, and other agile frameworks (Structured Workflows and Agile Methodologies, 2023). Adoption of strategic management by software houses in dealing with the challenges that the virtual teams face, collaboration and retention of employees for a long period of time. To guarantee the success of the virtual teams, structured policies, as well as leadership practices are essential to make the team members feel they are valuable, empowered and supported.

2.5. Project Team Commitment in Virtual Teams

Team members are psychologically and emotionally connected to the goals and responsibilities of the project team. So, they also are called as project team commitment (Bishop, & Scott, 2000). It is a critical factor for team performance itself as well as a critical factor in team motivation and project success. Hao et al. (2022) found committed teams to be

more engaged, more satisfied with their job and more accountable and that contributes to better productivity and innovation. The same reason also applies in case of software houses with continuous collaboration, technical expertise, and strict deadlines (Highsmith, 2013). Lack of strong team commitment can create delays in projects, bad outcome quality and low morale on the teams, all of which can severely affect the sustainability of the project and organization (Olson & Swenson, 2011). In a virtual environment, employees must rely on digital communication tools instead of face-to-face collaboration in order to stay engaged with their work and their colleagues and the importance of project team commitment is heightened even more.

Due to the lack of physical interaction among team members in the software development teams especially in the virtual situations, several factors are responsible for influencing team commitment (Sarker & Sahay, 2003). Clear communication is one of the most important factors in order to have all the team members to have the same vision of the project, in other words of the expectations related to the project, of the responsibilities, of the deadline (Daim et al., 2012). Where there is no communication, misunderstandings will lead to disengagement and inefficiency (Rahmawati et al., 2023). Trust and collaboration is another key factor, teams that form strong professional relations do better in performing their tasks (Patel et al., 2012). Openness, accountability, and mutual respect are necessary in a culture to be developed in virtual teams where trust is established without people working in person (Reizer et al., 2023). Secondly, leadership and motivation also aids in team commitment (Chai et al., 2017). Leaders who are strong lead, they give guidance, a shared sense of purpose, and acknowledge team members' efforts which improves motivation and boosts the employees' willingness to be committed in their job (Yulianti et al., 2024). Regular feedbacks, goal alignment, performance recognition, etc. are few of the leadership strategies that can maintain a virtual team productively and engaged.

In virtual work environment, team cohesion, structured workflows and digital tools of collaboration affect team commitment (Lane, et al., 2024). Therefore, managers must struggle hard to make employees feel a sense of belonging, at all the more so in virtual environment in which it has not been possible so far to nurture a sense of belonging through day to day

interactions between the manager and employees. Engagement strategies are rarely used in virtual teams, and the antecedents to poor motivation, high turnover rates, and higher project inefficiency (Kirkman et al., 2002) are created. To achieve these, these organizations have to structure their team building programs, professional development opportunities and infrastructural support for open communication channels such that the remote employees can feel connected to the work and workmates. There are companies that embrace these engagement strategies and eventually have upward movement of commitment and downtrend of attrition (Reizer et al., 2023; Vance, 2006). Furthermore, digital collaborative platforms which are innovative and the use of such platforms as project management tools, apps of the real time communication and virtual brainstorming session might lead to the creation of an interactive work environment where motivation and the ease for working in teamwork in the software houses (Kordova & Hirschprung, 2023). Thus, commitment in virtual teams is based on multiple concepts of commitment, of which strong leadership, effective communication, commitment, and support in technology, which showed an effect in enhanced team dynamics and project adaptability.

2.6. Virtual Team Efficacy and Project Performance

In this research, virtual team efficacy refers to a team's overall trust in being able to finish tasks assigned remotely (Chen et al., 2023). The basis of this confidence is built from good team interactions, strong leadership support, digital collaboration tools available, but all of which support the productivity and commitment of virtual teams. Being thus effectively virtual teams will be able to adapt very quickly to changing project needs, preserve their resilience against difficulties and accomplish teamwork efficiently between geographically dispersed locations (Swart et al., 2022). Virtual team efficacy is important especially for projects which in many software houses are complex and entail the need to coordinate very much, in order to facilitate workflow efficiency, deliver high quality products and meet project deadlines. Thus, teams with low efficacy may experience miscommunication, low motivation, delays in project execution and subsequently lead to low organization performance (Daim, 2012). Therefore, virtual team efficacy needs to be ameliorated to ensure the success and durability of virtual software development teams.

In fact, technology and communication constitutes the core of underlying factors that affect the virtual team efficacy because it creates the necessary infrastructure for experiencing team work, task management and making real time decisions (Jony & Hamim, 2024). With real time communication platforms such as Slack, Microsoft Teams and Zoom, team members can have instant discussion, share updates and fix problems real time thus reducing risk of communication and information silos (Flavián et al., 2022). Task management software such as JIRA, Trello, and Asana provides similar functionality by letting teams keep track of progress, assign tasks and improve workflows which means that everyone remains aligned with project goals (Sravan et al., 2024). Also, cloud storage solutions like Google Drive and Dropbox allow remote teams to make use of their project files without any geographical barrier (Belling, 2021). These technological tools have greatly helped in the successful implementation of these technological tools thus directly improving virtual team efficacy by facilitating coordination, reducing errors, and encouraging accountability among team members.

Leverage in strategic leadership practices also have great effect on the efficacy of virtual team, including that leaders are very important in developing an environment of trust, motivation and engagement. To achieve this in the virtual environment, the effective team leaders should set clear expectations, establish structured workflow, and provide continuous feedback to keep the team concentrated and motivated (Reizer et al. 2023). Goals oriented, performance tracking, organizational levels of engagement and increased team efficacy. Along with that, virtual leaders need to build a supportive and inclusive virtual culture, where employees feel entitled, empowered and facilitated to use their expertise. Without leadership, virtual teams may not know the direction they are heading in, morale can be down, communication can be fragmented, commitment can be lower, and project success rates will be lower.

Virtual team efficacy's profound impact on making a difference to team commitment is because it promotes directly trust, team development and ultimately team engagement (Hacker et al., 2019). High efficacy level teams are more adaptable and have stronger problem solving potential, thus being able to perform complex tasks more efficiently, and keep high motivation until the last moment of the lifecycle (Reizer et al., 2023). Strong efficacy on virtual teams can increase the communication among teams, ensure the responsibility is shared

among the team members, and build a relationship with the teams towards project goals (Suchan & Hayzak, 2001). Teams with low efficacy, on the other hand, deal with doubt, low participation, disengagement, delays, inefficiencies and relatively low total performance (Kozlowski & Ilgen, 2006). It's crucial for software houses to keep training programs with continuous learning in place, leadership development initiatives, and performance incentives to keep long term engagement and efficacy of virtual teams. Organizations can improve their project success in remote work environments by considering that virtual teams do not necessarily need to cooperate well if they are not well equipped with the necessary skills, tools and leadership support to do so.

2.7. Locus of Control in Team Commitment

It is always associated with a basic psychological attribute i.e. locus of control (LoC) as it refers to "whether the events and outcome that can occur in professional and personal lives are under personal control" (Ng et al., 2006) . This is external and internal locus of control. People who have an internal locus of control believe that they effect their own outcomes by their own actions and efforts, so the exposed person will be more proactive, accountable and more self driven for tasks (Ajzen, 2002). On the other hand, an external locus of control are the individuals who believe as their achievement or failures being based on luck, fate or organizational policies (Hamzah & Othman, 2023). This is very important for the junior members of the virtual team as they will be working in extremely an isolated and less supervised environment to be committed to the goals of the project.

Previous literature on organizational behavior (Li et al., 2015) in various research blessed notion of the performance at work which has been psychologically influenced by locus of control. Gangai et al. (2016) said that internal control locus individuals are individuals with the higher job satisfaction, a higher commitment and because they have higher performance (as they have more autonomy and responsibility of the task). But those who have an internal locus of control may have less engagement and less motivation, since they believe they are successful because of the circumstances that are outside of their control. As it is a common scenario within the software houses to exploit such knowledge for providing a tailored motivation plan to motivate his employees 'more and different' than the usual stuff.

Thus, locus of control plays even more importance than virtual teams (Allen, 2005) on team commitment in virtual teams where supervision can be physical minimal. To assume that internal locus of control is effective in remote team task, employees with internal locus of control should be more ready to take the initiative, to communicate well, to be actively involved in remote team tasks. Yet, people who have an external locus of control, may require more motivation, structured workflows, and more feedback to stay on the virtual workforce train (Warner et al., 2024). Amongst all these, a balanced and committed virtual workforce approach helps the managers to understand and realize these behavioral tendencies, as well as to apply leadership approaches in between the internals for autonomy and externals for guidance (Reizer et al., 2023).

2.8. Mediation of Team Cohesion in Virtual Teams

The degree of unity, trust and working in collaboration among members of team determines to which degree team effectiveness and their dedication to the project are (Paul, Drake & Liang, 2016). In virtual teams, consisting of members that do not necessarily have to be geographically close to each other and rely to a great extent on digital communication tools, team cohesion becomes a determining factor for keeping engagement and preventing disengagement or isolation (Flavián et al., 2022). Psychological safety, which is created by strong team cohesion, brings psychological safety for workers, so they can share ideas, resolve conflicts, and not deviate from project goals. Cohesive team dynamics are key to Software house's strategic management where team members are motivated and engaged and interested to stay accountable (Parker, 2011).

Organizational psychology has paid much attention on the relationship between team cohesion and team commitment. The research found that the teams that have higher cohesion level perform much better than teams with lesser cohesion levels, have lower rate of turnover, and increased of job satisfaction (Yulianti et al., 2024). According to (Owonikoko, 2016), cohesion, to a great extent, becomes the basis for effective communication, building trust and mutual accountability among team members as these aid in team commitment. The cohesive teams will tend to support one another, align organizational goals, and work

harmoniously to address challenges, serving as one vital mediating factor of virtual work environment (Agarwal, 2024).

A mediator between virtual team efficacy, locus of control, and team commitment is team cohesion through which team cohesion strengthens the relationships between the variables. The efficacy of virtual teams relates to the confidence and the right set of skills to be effective; locus of control has everything to do with the amount of motivation and engagement an individual harbors (Triplett & Loh, 2018). Nevertheless, these factors might not lead to long term commitment and performance (Rahmawati et al., 2023). To support virtual projects, software houses can foster strong team cohesion through collaborative tools, team building activities, and structured virtual interactions in order to increase the team commitment.

2.9. Strategic Management of Virtual Teams

Virtual team strategy management is vital to enabling organizations in meeting their project objectives while maintains high levels of team commitment and cohesion (Jiang et al., 2018). In software houses where numerous teams handle various software development processes, strategic management of resources is necessary to align the resources, bestow on maximum performance as well as get innovative thinking, (Ghorbani et al., 2022). Thus, without strategic planning to coordinate, organise and provide guidance regarding all the functional areas of the work process, virtual teams may suffer from low engagement of the employees, improper communication, untimeliness and limited quality of work and therefore lead to the failure of the project (Lee-Kelley & Sankey, 2008). The leadership strategies to increase team commitment in the virtual environments are: clear goal setting, structured workflow, and trusting mechanisms (Jassem, 2023). To facilitate engagement, leaders have to go for adaptive leadership approaches, which emphasize on transparency, autonomy and open communication. Managing virtual teams means that strong digital leadership takes place, basically covering continuous feedback, team members' achievements recognition and creation of a collaborative work culture (Flavián et al., 2022). Furthermore, ways to be implemented could consist of performance based incentives and professional development opportunities which will motivate and commit team.

2.10. Conceptual Framework

The basis for this study is conceptualized as the interaction among virtual team efficacy, locus of control, team cohesion and project team commitment. It asserts that locus of control and virtual team efficacy affect team commitment, but through team cohesion.

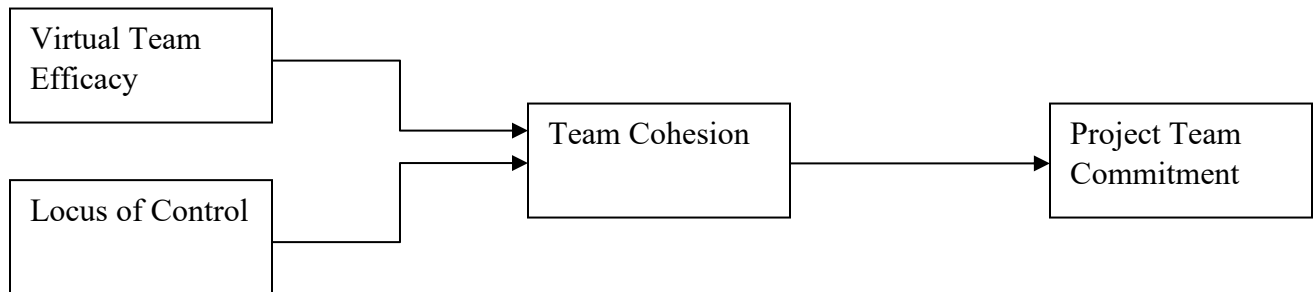


Figure 1: Conceptual Framework

The hypotheses development is grounded on existing literature that provides support for the direct and indirect effects of these variables on the team commitment. The study hypothesizes the following:

- **H1:** Virtual Team Efficacy is positively related to Project Team Commitment.
- **H2:** Locus of Control is positively related to Project Team Commitment.
- **H3:** Virtual Team Efficacy is positively related to Team Cohesion.
- **H4:** Locus of Control is positively related to Team Cohesion.
- **H5:** Team Cohesion mediates the relationship between Virtual Team Efficacy and Project Team Commitment.
- **H6:** Team Cohesion mediates the relationship between Locus of Control and Project Team Commitment.
- **H7:** Team Cohesion is positively related to Project Team Commitment

In order to explain the relationship of virtual team efficacy, locus of control and team cohesion with project team commitment diagrammatically shown in Fig 1 we represent how virtual

team efficacy and locus of control influence project team commitment using the path of team cohesion.

2.11. Summary of the Chapter

The details of the literature to virtual team management, the team commitment and the psychological factors of team performance were reviewed in this chapter. The document started by describing the growth and challenges of Pakistan's software industry and the necessity of a strategic management in the teams working remotely. The chapter went on to examine theoretical frameworks such as Social Cognitive Theory, Locus of Control Theory, the Team Cohesion Model and the Strategic Management Theory to understand the relationship of the virtual team commitment.

Discussion on team commitment and virtual team efficacy suggested high level of communication, trust and leadership strategies plays a crucial role in maintaining high degree of team commitment. Motivation and performance in virtual work environments were examined in terms of the effect of locus of control on motivation and performance, as personality traits impact on engagement in virtual work environments. Additionally, a balance was found with the mediation of team cohesion, which proved to be necessary for improving collaboration and team commitment.

The chapter concludes with strategic management insights, best practices for the virtual team management, and a conceptual frame work which illustrates the relationships between the key theoretical variables. The rest of the chapters of this study are born out of gaps identified as research gaps that indicate the necessity of empirical verification of these relationships on the context of software houses in Pakistan.

Chapter 3: Research Methodology

3.1. Introduction

In this chapter, virtual team efficacy and locus of control combine under the mediation of team cohesion to constitute project team commitment as an investigation methodology through software houses of Pakistan. The data was collected in a structured questionnaire of IT professionals working in virtual teams. The research design, population and sampling strategy as well as data collection procedures are described in the chapter. This also describes why the quantitative approach was chosen, the reason for the selection of sample and also the means of data gathering. This methodology helps that such study findings are reliable, valid and generalizable to the current population of IT professional working in software houses.

3.2. Research Design

The research design adopted is quantitative in that it collects data on numerical forms and go for statistical analysis to prove the hypothesized. This survey based approach gathered insights about IT professionals' experiences in virtual teams, perceptions of team commitment, and virtual team efficacy and locus of control as contributors to their engagement in software development projects. The structured questionnaire was the major data collection tool, which would enable uniform responses from participants and consistency of measurement and statistical analysis (Hirose & Creswell, 2023).

A cross section study design was adopted having data collected at a single point rather than over a period of time. This design is ideal for testing relationships in variables at a particular point in time and in this case, for evaluating the state of team commitment and a state of work in virtuality in Pakistan's software industry (Saunders et al., 2022). Facing the rapid development of the modern technologies and the large-scale implementation of remote work in the software houses, the purpose of this study is to make the real time assessment of factors that influence the project team commitment.

Form used was the Google Forms for convenience, efficiency and accessibility. The use of online surveys is common in business and management research since professionals in IT

fields familiar with digital communication tools (Dillman et al., 2023) are an easy target for analogy. Also, self administered questionnaires reduce interviewee bias and provide ease to the participants in completing the survey.

3.3. Population and Sampling

As a target population for this study, we have chosen IT professionals employed in the software houses of Pakistan who are working on in the virtual or remote teams setup. Because of the focus of the study on team commitment of virtual teams, the participants were chosen based on their experience in remote collaboration, project based experience and Software development activity. The use of this population is chosen because software professionals often work on distributed teams that are best suited to taking part in measuring the effectiveness of virtual teams and creating locus of control and cohesion within teams on behalf of project commitment.

3.3.1. Sampling Technique

Participants were recruited using a non probability convenience sampling method. It was owing to its practicability, cost effectiveness and presence of relevant IT professionals in the areas of home approximation through online platforms (Etikan et al., 2024). The convenience sampling is preferred when the study calls for the data obtained from readily available and willing participants who fit the study's inclusion criteria, such as working professionals.

The questionnaire was filled in by checking the Google Forms and the sample was 156 valid responses. Based on previous researches in organizational behavior and virtual team, the minimum of 150–200 responses will be appropriate to perform the regression and mediation tests (Hair et al., 2019). In the sample, IT professionals who worked for different software companies located in Pakistan have been included, thereby reflecting a wide range of experience regarding virtual work environments.

3.3.2. Inclusion and Exclusion Criteria

To ensure the relevance of responses, the following criteria were applied:

- **Inclusion Criteria:**

- IT professionals currently working in Pakistani software houses.
- Employees involved in virtual or remote team-based projects.
- Individuals with at least six months of experience in virtual teams.
- **Exclusion Criteria:**
 - IT professionals working in non-software industries.
 - Employees working exclusively in on-site teams with no remote collaboration experience.
 - Incomplete or duplicate survey responses.

3.4. Data Collection Methods

3.4.1. Survey Instrument and Structure

An instructional questionnaire was designed to obtain information from IT professionals on their experiences in virtual team, perceptions of team commitment and factors determining software house engagement. A questionnaire seeking to collect both demographic and scale based questions was taken which measured key study variables through using that Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The questionnaire was made up of several sections.

3.4.2. Data Collection Process

The data collection process was entirely online, to collect the data Google Forms was used where participants could fill in the survey at any time. So after distributing the survey link to professional networks, it forum, and email to IT professionals working in various software houses across the country. Respondents were reassured that their responses were voluntary (and as such, as a condition of confidentiality and anonymity, their responses would not be disclosed to any one).

First the responses were procured; 175, but after data cleansing (saving only complete and unique responses), we were left with 156 data for the analysis. "Overall the research was

efficient because the data collection of real time data was achieved through use of Google Forms and data from those forms can integrate with statistical analysis software very easily .

3.4.3. Ethical Considerations

To ensure ethical integrity in data collection, the following principles were followed:

- **Informed Consent:** Before starting the questionnaire, participants were provided with an informed consent statement, explaining the study's purpose and ensuring voluntary participation.
- **Confidentiality:** No personally identifiable information was collected, and responses were stored securely.
- **Right to Withdraw:** Participants were informed that they could exit the survey at any time without providing a reason.

3.5. Measurement of Variables

The study examines the Mediation of Team Cohesion in software houses in Pakistan on Project Team Commitment through Virtual Team Efficacy and Locus of Control. A structured questionnaire was designed for these variables to find new measures using scales that have been previously validated in standard studies. Therefore an instrument used was a likert scale from 1 (Strongly disagree) to 5 (Strongly agree) to the extent that the data collection will also be consistently. The below describes how each variable was measured by a collection of items.

Virtual Team Efficacy

The definition of virtual team efficacy is a team's aggregate belief in how effective the team can be in a remote environment. It measures a team's level of understanding of how to work on assignments as a virtual team, overcoming the obstacles that arise while working in a virtual environment and how the team collaborates as team. Hardin, Fuller and Valacich (2006) were used to adapt four items to measure virtual team efficacy. The items selected are the ones that evaluate the perceptions of the team members with respect to their ability to coordinate, solve problems, and still maintain efficiency in virtual collaboration. A

measurement scale is used to ensure that responses address the shared belief level of team members in their collective ability to deliver remote work dynamics.

Locus of Control

This is known as locus of control or the individual's self belief on whether the situation is out of their control in terms of success or failure at the workplace. An employee with an internal locus of control will believe that his or her own personal efforts are the reason for outcomes, whereas an employee with an external locus of control will blame his or her outcomes on factors that are beyond his or her control, for example, fate, or organizational policy. For measuring locus of control, three adapted items from Shaver (2004) were employed. The items consider if individuals would accept personal responsibility of their performance in the virtual teams or feel that external factors to be the primary contributing factors for their success and failures. As a variable to be understood, the impact that members of a team's psychological orientations bring to their commitment and motivation in the virtual work environments must be evaluated.

Team Cohesion

Team Cohesion refers to the level of a connection and sense of trust among team member that they are seen to perceive are. This is a very good point of a team commitment, how a team made the performance and how an engaged team will work in the long run in a software house. A strong cohesion, which is relatively easy to achieve by assigning talent and resources, increases collaboration, generates knowledge sharing and conflict solving and consequently improves project outcomes. In measuring team cohesion in this study, six items taken from Michalisin, Karau and Tangpong (2004) were employed. In the items were the measures that include the aspects of perception by the team member in terms of trust in virtual environment, interpersonal relationships, common objectives, and overall group unity. Since team cohesion functions as an intermediary for the relationship between virtual team efficacy and locus of control to team commitment, the accurate measuring of amount of team cohesion and amount of team integrations and operations in virtual work environment is necessary to know what level of team is working and team cohesion.

Team Commitment

There is commitment of team which means the level of dedication, motivation and the psychological attachment of the team members towards their project and team. This is the key determining factor as to how many employees will be retained in the software house, how satisfied are they to carry out the jobs and also how well the software house can perform. Highly committed team means a team which collaborates a lot, works for long hours achieving a goal and all with minimum requirement. Team commitment was measured using eight of the items used by Bishop and Scott (2000). These items tell you just how much employees emotionally invest in, spend time with, and identify with the organisation, as well as how they will do extra to ensure the success of the project. But it is essential to comprehend that the commitment of the team is directly related to the performance, innovation and team most stability in the virtual program computer.

3.6. Data Analysis Techniques

Therefore the IBM SPSS Statistics 29 was used as the primary means of analyzing the collected data. The main reason why SPSS was chosen to perform data processing was because SPSS can process data robustly, why SPSS is reliable when conducting hypothesis testing and why SPSS is efficient when processing research based on survey. The process of analysis was systematic where data are cleaned and validated, then descriptive and inferential statistical techniques applied to establish the relationships between variables.

Descriptive Statistics

Summary and description of the dataset's key characteristics was by descriptive statistics. This included:

- Central tendency and dispersion of responses: a measurement using Mean and Standard Deviation.
- Demographic data analysis like age, experience, job roles and work setting of IT professionals in software houses is done on Frequency Distribution basis.

Reliability and Validity Analysis

Cronbach's Alpha was calculated for each variable to check that the measurement scales were internally consistent and reliable. A Cronbach's Alpha exceeding 0.7 was considered acceptable for reliability (Hair et al. 2019). It was also conducted to factor analysis to validate the construct validity of the measurement scale that the survey items are measuring accurate theoretical constructs.

Hypothesis Testing Methods

To examine the relationships between variables, various statistical tests were performed:

- **Correlation Analysis:** Pearson's correlation coefficient was used to assess the strength and direction of relationships between virtual team efficacy, locus of control, team cohesion, and team commitment.
- **Regression Analysis:** Multiple regression was conducted to test the direct effects of virtual team efficacy and locus of control on team commitment.
- **Mediation Analysis:** To test whether team cohesion mediates the relationship between virtual team efficacy, locus of control, and team commitment, Hayes' PROCESS macro for SPSS was used. Mediation was confirmed if the indirect effect was statistically significant.

Software Used

SPSS 29 was else employed in all statistical analyses because it offered a structured and more efficient manner of processing, analyzing, and interpreting the survey data. This software proved useful in hypothesis testing; thus, it enabled the detailed testing of the research model of the study and the relationships between important variables.

Chapter 4: Results and Analysis

This chapter has analyzed and used SPSS version 29 to analyze the empirical results on the data of this study. To determine if the study variables are unique and to prove that there is no measurement error, Test of Normality was adopted. Descriptive, correlation, direct path and mediation analysis were done using SPSS and mediation using process by Hayes to assess the relationship between variables.

4.1. Test of Normality

The dataset is normality checked to check whether it follows a normal distribution, a very important assumption for most parametric statistical tests, regression analysis and correlation tests, for example. Kolmogorov-Smirnov (K-S) test is the test that is used for testing normality very commonly (mainly for large datasets i.e $n > 50$) as it measures the difference between the sample distribution and the normal distribution (Biu et al., 2020). A null hypothesis (H_0) of the K-S test states that the data are normally distributed, while the alternative hypothesis (H_1) says that the data is to some extent anyway not normally distributed. If pvalue (Sig.) is greater than 0.05, we do not fail to reject the null hypothesis, and the data is nor clearly or they are normally distributed. On the other hand, we reject the null hypothesis if p value is less than 0.05, which indicates that the data does not have normal distribution.

4.1.1. Kolmogorov-Smirnov test

The p values of the Kolmogorov Smirnov test results for this study are below 0.05 for all the variables including Virtual Team Efficacy (VTE), Locus of Control (LOC), Team Cohesion (TC) and Project Team Commitment (PTC). Specifically, Virtual Team Efficacy (0.000), Locus of Control (0.000), Team Cohesion (0.000), and Project Team Commitment (0.000) all show significant deviations from normality. As all p values are less than the 0.05 threshold, we reject null hypothesis and concludes that data is not normally distributed. If strict normality assumptions are required then this would suggest that non parametric statistical or transformations may be necessary. However, CLT should be applied in this case, as the sample

size is more than 30, therefore, many of the parametric statistical tests, like regression, can still be used effectively.

Table: 4.1 Kolmogorov-Smirnov Test

Variables	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Virtual Team Efficacy (VTE)	.175	156	.000
Locus of Control (LOC)	.159	156	.000
Team Cohesion (TC)	.111	156	.000
Project Team Commitment (PTC)	.219	156	.000

a. Lilliefors Significance Correction

4.1.2. Multicollinearity Test

The term multicollinearity pertains to a situation where independent variables in a regression model are strongly correlated with other independent variables, making it difficult for their effects to be determined in estimating the effect of the dependent variable (Lindner et al., 2020). Also, multicollinearity of predictors leads in the presence of high multicollinearity to unreliable coefficient estimates as well as problems with identifying the unique contribution which each predictor variable makes. Two key statistical indicators of multicollinearity are used to detect multicollinearity; these are Tolerance and Variance Inflation Factor (VIF). Tolerance is the proportion of the variance of an independent variable is not accounted for within the model, by other independent variables within the model. If the Tolerance value is below 0.10, other predictors have strong correlation with the result and problems of multicollinearity are likely. Furthermore, the VIF value behind Multicollinearity is reciprocal of Tolerance. If there are multicollinearity, then VIF greater than 10 indicates severe multicollinearity; VIF between 5 and 10 indicates moderate multicollinearity. Usually, the value of a VIF below 5 is considered acceptable (Akinwande et al., 2015).

In this study the results of Multicollinearity test show that if the independent variables are Virtual Team Efficacy (VIF=3.539, Tolerance=0.283), Locus of Control (VIF=3.598,

Tolerance=0.278) and Team Cohesion (VIF=1.057, Tolerance=0.946) then they all have VIF value less than 5 and are not regarded as having a severe multicollinearity. Since the VIF values for Virtual Team Efficacy and Locus of Control are slightly high over 3, they are fine but still within the acceptable limits of multicollinearity, so the regression analysis can proceed. Additionally, the values of Tolerance are greater than 0.10, which also indicates that multicollinearity is not an issue in this study.

Table 4.2: Multicollinearity Test

Coefficients^a

Model		T	Sig.	Collinearity Statistics	
				Tolerance	VIF
1	(Constant)	-1.826	.070		
	Virtual Team Efficacy (VTE)	4.062	.000	.283	3.539
	Locus of Control (LOC)	3.350	.001	.278	3.598
	Team Cohesion (TC)	2.348	.020	.946	1.057

a. Dependent Variable: PTC

4.2. Descriptive Statistics

Descriptive statistics give information about the dataset being studied and its central tendencies and variability of the key variables in the study. In this research, mean and standard deviation of four main constructs, namely Virtual Team Efficacy (VTE), Locus of Control (LOC), Team Cohesion (TC) and Project Team Commitment (PTC) were analyzed to understand the perceptions of the participants. Mean values for each variable is an average response and SD represents the range of variation in response.

As shown in table 4.3 the results show that Virtual Team Efficacy (M = 4.38, SD = 0.55) and Locus of Control (M = 4.40, SD = 0.51) have the highest mean scores, indicating that respondents generally have high confidence in their ability to work effectively in virtual teams and perceive themselves as having a strong sense of control over their work outcomes. The relatively low standard deviation for both variables suggests that responses were consistent

among participants. Team Cohesion ($M = 4.14$, $SD = 0.50$) also has a high mean, reflecting that most respondents feel a strong sense of trust and collaboration within their teams. However, Project Team Commitment ($M = 4.26$, $SD = 0.69$) shows a slightly lower mean compared to the other variables, with a higher standard deviation, indicating more variability in commitment levels among respondents. These findings suggest that while virtual team efficacy and locus of control are strongly perceived, commitment levels may vary due to individual differences in motivation and work engagement.

Table 4.3: Descriptive Statistics

	Mean	Std. Deviation	N
Virtual Team Efficacy (VTE)	4.3846	.55749	156
Locus of Control (LOC)	4.4017	.51322	156
Team Cohesion (TC)	4.1421	.50510	156
Project Team Commitment (PTC)	4.2620	.69847	156

4.2.1. Gender Distribution

From table 4.4 it also seen that that the sample consisted of 83 males (53.2%) and 73 females (46.8%) which indicates that there is equal representation of male and female respondents in the study. The information provided by this distribution indicates that the software industry in Pakistan has a significant number of female IT professionals working in it, which is a good sign for the gender variety in the field. As both genders participate equally, the study considers points of views from different workforce, which is more inclusive and generalizable.

Table 4.4 : Gender

		Frequency	Percent
Valid	Male	83	53.2
	Female	73	46.8
	Total	156	100.0

4.2.2. Age Distribution

The age distribution reveals that the majority of respondents belong to the 26-33 age group (42.9%), followed by 18-25 years (39.1%), and 34-41 years (17.9%) as shown in table 4.5. The dominance of younger professionals in the sample highlights that Pakistan's software industry is driven by a relatively young workforce. This trend aligns with global IT industry patterns, where younger employees are more actively involved in virtual teamwork and technology-driven collaboration. The lower representation of individuals above 34 years suggests that experienced professionals may hold managerial or strategic roles that involve less direct participation in virtual teams.

Table 4.5: Age

		Frequency	Percent
Valid	18- 25	61	39.1
	26–33	67	42.9
	34-41	28	17.9
	Total	156	100.0

4.2.3. Educational Qualification

In terms of educational background, 41.0% of respondents hold a Master's degree, while 40.4% possess a Bachelor's degree. Additionally, 13.5% have an MS/M.Phil. Qualification, and 2.6% hold a PhD. The predominance of graduates and postgraduates in the sample indicates that higher education is a key requirement for IT professionals in software houses. Given the technical nature of software development and virtual collaboration, the strong representation of individuals with Master's and M.Phil. qualifications suggests that employees in the industry possess advanced knowledge and expertise in their respective domains.

Table 4.6: Qualification

		Frequency	Percent
Valid	Bachelor	63	40.4

Master	64	41.0
MS/M.Phil	21	13.5
PhD	8	5.1
Total	156	100.0

4.2.4. Work Experience

The analysis of work experience shows that 45.5% of respondents have 1-5 years of experience, while 44.9% have 6-10 years of experience. This suggests that most IT professionals in the sample are early to mid-career professionals. A smaller proportion of respondents have 11-15 years (4.5%), 16-20 years (2.6%), or more than 20 years (2.6%) of experience as shown in table 4.7. The dominance of less experienced professionals reflects the rapid expansion of the software industry in Pakistan, with younger employees entering and growing within the sector. Additionally, the lower percentage of highly experienced individuals suggests that senior professionals may have moved into leadership or consultancy roles, engaging less in operational virtual teamwork.

Table 4.7: Experience

		Frequency	Percent
Valid	1-5	71	45.5
	6-10	70	44.9
	11-15	7	4.5
	16-20	4	2.6
	20 and above	4	2.6
	Total	156	100.0

Descriptive analysis explains very well the study variables and demographic characteristics of the respondents. This ultimately means that the mean values of Virtual Team Efficacy, Locus of Control and Team Cohesion are high which implies that as a rule of thumb, IT professionals belonging to the software industry in Pakistan have confidence in virtual collaboration, are

convinced they have control over the work outcomes and experience very high cohesion in the teams. While these measures vary quite a bit, though, the slightly lower mean and higher standard deviation for Project Team Commitment signify that employees are giving different levels of dedication and motivation toward virtual teams.

The findings of demographic evidence shows that the software industry in Pakistan is mostly oriented in young professionals and have a balanced gender representation. The educational qualification and experience level of respondents prove that the industry is academically competitive with individuals having advanced degrees. As they represent the growing influence of the young professionals in the IT workforce, the majority of the participants fall within early to mid career category. This completes a strong foundation for further analysis on how demographic factors impact on virtual team efficacy, team cohesion and commitment.

4.3. Reliability Analysis

Reliability analysis evaluates the reliability and internal reliability of researchers' key variables through the use of measurement scales (Izah et al., 2023). The most commonly used reliability coefficient that also finds out how well the items of a construct are correlated and measures the concept of interest is Cronbach's Alpha. Hair et al. (2019). Generally speaking, a Cronbach's Alpha value above 0.70 is considered acceptable, a value above 0.80 highly reliable. When reliability score is lower than 0.60, it means that scale may require revision or improvement. The values of the study variables' reliability results are as in table 4.8.

Table 4.8: Reliability

No	Variable	Cronbach Alpha
1	VTE	.822
2	LOC	.706
3	TC	.615
4	PTC	.942

The results indicate that the measurement scales used for VTE, LOC, and PTC exhibit acceptable to excellent reliability, confirming that these constructs are consistently measured in the study. Virtual Team Efficacy (0.822) shows high internal consistency, suggesting that respondents had consistent perceptions regarding their team's collective confidence in virtual collaboration. Locus of Control (0.706) meets the acceptable reliability threshold, indicating that respondents' self-perceptions of control over work outcomes were measured consistently.

However, Team Cohesion (0.615) has a moderate reliability score, which is lower than the generally accepted threshold of 0.70. This suggests some variation in how respondents perceive their team's cohesion and unity. While the reliability is still within an acceptable range for exploratory studies, it indicates that some items within the Team Cohesion scale may need refinement in future research. The highest reliability is observed for Project Team Commitment (0.942), indicating strong internal consistency and that respondents consistently answered questions related to their commitment to virtual teams.

4.4. Correlation Analysis

Correlation analysis examines the strength and direction of relationships between the study variables (Schober, Boer & Schwarte, 2018). Pearson's correlation coefficient (r) is used to determine the relationship between Virtual Team Efficacy (VTE), Locus of Control (LOC), Team Cohesion (TC), and Project Team Commitment (PTC). The significance levels are indicated as follows: $p < 0.01$ (0.01 level, 2-tailed) = Strong statistical significance. $p < 0.05$ (0.05 level, 2-tailed) = Moderate statistical significance. r -values range from -1 to +1, where: +1 indicates a perfect positive correlation (strong direct relationship). 0 indicates no correlation (no relationship). -1 indicates a perfect negative correlation (strong inverse relationship). The correlation matrix results are as follows:

Table 4.9 Correlations

	VTE	LOC	TC	PTC
VTE	1			

LOC	.847**	1		
	.000			
TC	.195*	.232**	1	
	.015	.004		
PTC	.718**	.712**	.286**	1
	.000	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

This correlation is highest between Virtual Team Efficacy and Locus of Control ($r = 0.847$, $p = 0.000$), which shows a very significant and high positive relationship. It then means that if IT professionals believe that the virtual teams work high, it implies that they have an internal locus of control, that is they believe that personal efforts help team success. Such a strong correlation indicates that in Pakistan's software industry, virtual team confidence and individual belief in control over work process outcome are very closely related.

A significant positive correlation is found between VTE and PTC ($r = 0.718$, $p = 0.000$, moderate to strong). Consequently, the stronger team players are their commitment to their projects as their confidence in the capabilities of their virtual collaboration increases. Similarly, Locus of Control (LOC) is strongly correlated with Project Team Commitment (PTC) ($r = 0.712$, $p = 0.000$), suggesting that individuals who believe they control their own success are more likely to remain dedicated and committed to their virtual team projects.

Team Cohesion (TC) has weaker correlations with other variables, but the relationships are still statistically significant. TC is positively correlated with Virtual Team Efficacy ($r = 0.195$, $p = 0.015$) and Locus of Control ($r = 0.232$, $p = 0.004$), indicating small but meaningful relationships. This suggests that while team cohesion plays a role in team effectiveness and perceived control, it is not as strong of a predictor as Virtual Team Efficacy and Locus of Control. However, Team Cohesion and Project Team Commitment ($r = 0.286$, $p = 0.000$) show

a moderate positive correlation, confirming that higher cohesion levels improve commitment in virtual teams.

The reliability analysis confirms that Virtual Team Efficacy, Locus of Control, and Project Team Commitment exhibit acceptable to excellent internal consistency, ensuring that the measurement scales are reliable. However, Team Cohesion shows moderate reliability (0.615), suggesting potential variability in respondents' perceptions of group unity.

The analysis of correlation shows strong positive relationships between Virtual Team Efficacy and Locus of Control as well as Project Team Commitment, implying that team employees are confident in virtual collaboration and possess control over the work outcome, which would lead to strong commitment to their teams. Despite significantly positive correlation with other variables, the association with Team Cohesion becomes smaller, thus suggesting that other variables than collective cohesion affect to a greater degree the project commitment. These findings present a strong basis for further regression and mediation analysis on these variables, on the direct and indirect effects of these variables to project team commitment in software houses.

4.5. Regression Analysis

We conducted regression analysis of Virtual Team Efficacy (VTE), Locus of Control (LOC), Team Cohesion (TC) and Project Team Commitment (PTC) to analyze both the direct and indirect relationships between the two variables. Table 4.10 summarizes the regression results in which the coefficient (Coeff), the standard error (SE), t-value (T) and the significance level (p-value) of each hypothesized relationship are reported. Findings offer a view of the relative strength with which the independent variables affect team commitment and cohesion in virtual software teams.

Table 4.10: Regression Analysis - Direct Relationship

Hypothesis	Coeff	SE	T-Value	P Value
VTE ----->PTC	.8626	.0702	12.2862	.0000

LOC -----→PTC	0.9291	.0781	11.8925	.0000
VTE -----→TC	0.1768	.0716	2.4688	0.147
LOC -----→TC	.2282	.0771	2.9584	.0036
TC -----→PTC	.2100	0.775	2.7101	.0075

It is found that Project Team Commitment (PTC) is significantly positively affected by Virtual Team Efficacy (VTE) (Coeff = 0.8626, SE = 0.0702, T = 12.2862, p = 0.0000). That means, an enhanced belief in their virtual collaboration abilities of the team members lead to increased commitment of team members to project teams. This relationship is statistically significant since the p-value is less than 0.01 and the high t-value (12.2862) implies that this relationship is significant. These findings concur with previous research that associates virtual team confidence in contributing to work motivation and engagement in remote work contexts (Hardin et al., 2006). Likewise, Project Team Commitment has a positive relation to Locus of Control (Coeff = 0.9291, SE = 0.0781, T = 11.8925, p = 0.0000). This leads me to believe that the employees who believe that they have the control over their work output will be highly committed to their projects. Possibility for a higher autonomy and responsibility as far as virtual teams are concerned contributes to motivation and dedication in work tasks (Shaver, 2004). This also is further supported by the high t-value (11.8925) and low p-value (p < 0.001).

Both of these impacts, however, are not statistically significant (Coeff = 0.1768, SE = 0.0716, T = 2.4688, p = 0.147). Therefore, our study shows that virtual team efficacy does not significantly predict on team cohesion, because p value (0.147) is greater than 0.05. The finding may imply that not only have virtual team members confidence in their own abilities, but one or more other factors, such as interpersonal trust and organizational culture, may also influence team cohesion (Michalisin et al., 2004). On the other, Locus of Control significantly predict Team Cohesion (Coeff=0.2282, 0.0771, 2.9584, 0.0036). This entails that people who think that they are the cause of their own success will more often exhibit cohesive team behaviors and develop healthy relationships with their colleagues. This result is supported by

the statistically significant p value ($p < 0.01$) that shows that team members who are accountable for their work outcomes have a positive impact on a cohesive team.

Thirdly, Team Cohesion has a strong positive effect on Project Team Commitment (Coeff = 0.2100, SE = 0.0775, T = 2.7101, $p = 0.0075$). This indicates that when teams foster a strong sense of unity, trust, and collaboration, members become more committed to their projects. The positive t-value (2.7101) and p-value ($p < 0.01$) suggest that strong team cohesion enhances commitment levels, reducing disengagement in virtual work environments.

4.6. Mediation Effects

The relationship between VTE, LOC and PTC was examined to determine whether Team Cohesion (TC) mediated the association. The indirect effects, SE, LLCI and ULCI are given in Table 4.10. In case of the indirect effect of Virtual Team Efficacy on Project Team Commitment via Team Cohesion, the coefficient is 0.0371 with a standard error of 0.0395. The confidence interval ($-0.0030, 0.1472$) does not contain zero, and hence it indicates that the mediation effect is not statistically significant. Therefore, it implies that while Virtual Team Efficacy has a great direct impact on Project Team Commitment, its influence on it is not by means of Team Cohesion.

In the same way, for example, the coefficient in the indirect effect of Locus of Control on Project Team Commitment through Team Cohesion is 0.0404 (SE 0.0417). Furthermore, zero lies within the confidence interval (LLCI = -0.0025 , ULCI = 0.1515) that also includes zero, so that Team Cohesion does not significantly mediate the relationship between Locus of Control and Project Team Commitment. The result of this suggests although internal locus of control individuals make an important contribution to team cohesion, it has little to do with their level of commitment to virtual teams.

Table 4.10: Mediation Analysis - Indirect Relationship

Hypothesis	Effect	SE	LLCI	ULCI
TC ----->VTE----->PTC	.0371	.0395	-.0030	.1472

TC ----->LOC----->PTC	.0404	/0417	-.0025	.1515
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Analysis confirm that significant as predictors for Project Team Commitment (PTC) is Virtual Team Efficacy (VTE) and as strong positive predictors with Locus of Control (LOC). Committed virtual team members are those that trust in their virtual teamwork abilities and with a sense of personal control over work outcomes. Similarly, Locus of Control is observed as a significant factor for Team Cohesion as can be seen, individuals with higher autonomy and responsibility tend to have much higher team collaboration. Nevertheless, Virtual Team Efficacy does not significantly explain Team Cohesion, which implies that confidence in virtual teamwork cannot necessarily strengthen interpersonal relationships.

The result of the mediation analysis indicates that Team Cohesion is not significantly mediating the effect of the Virtual Team Efficacy and Locus of Control on Project Team Commitment. This indicates that direct factors such as confidence in remote collaboration and individual responsibility have more influence on the team's commitment to this type of team, rather than its cohesion itself. At the same time, while cohesive teams can help drive motivation, efficacy and control are the primary drivers of commitment in virtual environments.

First, they have important managerial implications for software houses, and the first of which is to increase virtual team confidence and promote personal accountability at the employee level. To maintain high levels of project commitment in remote work environments, organizations should set firm leadership strategies in place, regular continuous professional development, and establish an environment that supports virtual team collaboration.

4.7. Summary of Hypothesis

The hypothesis testing results are summarized in this table, with which hypothesis was accepted or rejected according to the result of regression and mediation analysis. The investigation confirms that the perception of Virtual Team Efficacy and Locus of Control clearly

affects Project Team Commitment, whereas Team Cohesion is related to Project Team Commitment only directly, and that there is no mediation through other relationships.

Table 4.11: Hypothesis Testing Results

Hypothesis	Statement	Decision
H1	Virtual Team Efficacy is positively related to Project Team Commitment.	Accepted
H2	Locus of Control is positively related to Project Team Commitment.	Accepted
H3	Virtual Team Efficacy is positively related to Team Cohesion.	Rejected
H4	Locus of Control is positively related to Team Cohesion.	Accepted
H5	Team Cohesion mediates the relationship between Virtual Team Efficacy and Project Team Commitment.	Rejected
H6	Team Cohesion mediates the relationship between Locus of Control and Project Team Commitment.	Rejected
H7	Team Cohesion is positively related to Project Team Commitment.	Accepted

Chapter 5: Discussion

The aim of this study was to investigate whether virtual team efficacy and locus of control mediate the relationship between team cohesion on commitment of project team in software houses in Pakistan. Because of the increasing tendency of the software industry to virtual teams, the understanding of the psychological and structural factors influencing the team commitment plays an important role in ensuring project success. This study was motivated to fill the gap in the literature as to how virtual team efficacy and locus of control are related to project team commitment via team cohesion as a mediator. It also looked into strategic management practices that may promote team cohesion and commitment in virtual software development.

Virtual team efficacy and locus of control are found to affect project team commitment and thus confirmed the role of team confidence and individual responsibility in keeping commitment. However, these findings indicate that the relationship between virtual team efficacy and project team commitment is not mediated by team cohesion, and other factors better explain the link between these variable. As opposed, team cohesion found to have a direct positive relation with the project team commitment which signifies the significance of trust, collaboration, and common objectives in virtual teams. Based on the finding, the next research questions and hypotheses are critically discussed in the following sections.

Influence of Virtual Team Efficacy on Project Team Commitment

In other words, first research question has been answered about how Team Efficacy Efficacy (TEE) affects either commitment of project team or a subjective index of team success. Furthermore, results strongly support Hypothesis 1 (H1) that Virtual Team Efficacy is positively associated with Project Team's commitment ($\beta = 0.8626$, $p = 0.0000$). This points to a situation where when team members understand the strength of their collective capability in working efficiently in a virtual setting, they are more likely to continue with dedication, commitment and dedication to projects.

This matches previous research (Hardin et al., 2006) that team efficacy is a critical variable of motivation, cooperation, and commitment in virtual environments. Virtual team efficacy is important in software houses where the tasks are more related to high levels of coordination, problem solving, as well as remote collaboration and employees feel capable and confident enough to execute their tasks efficiently. Having high levels of team efficacy decreases uncertainty and hesitation, which encourages employees to perform proactively in the decision making and solving problem (Flavián et al., 2022).

Despite this, high virtual team efficacy is positively associated with project team commitment, but is not positively associated with interpersonal relationship. While some studies imply that even if team members consider themselves to be competent, they might still vary in emotional attachment to the team (Reizer et al., 2023). This finding is especially important for Pakistani software houses where virtually located teams connect with each other, without much informal social interaction for promoting commitment. Training programs and performance feedback that address the effective use of virtual teams should be put in place within software houses. Team based skill development activities for knowledge sharing environment should be encouraged by the managers such that employees can increase their technical expertise and problem solving abilities. Through developing a culture of confidence and collaboration, organizations can enable both team efficacy and commitment, so that employees feel engaged and motivated whilst the project is in its lifecycle.

Impact of Locus of Control on Project Team Commitment

The second research question dealt with the effects of locus of control (internal vs. external) on team commitment in virtual software teams. According to Hypothesis 2 (H2), the results supported ($\beta = 0.9291$, $p = 0.0000$) that Project Team Commitment is positively related to Locus of Control. This means that employees with internal locus of control or that they feel they have control of their work outcome are committed more than those who don't have an internal locus of control.

Rotter's (1966) Locus of Control Theory predicts that individuals who have an internal locus of control engage more in team behaviors because they are more proactive, more motivated and

more goal driven (Shaver, 2004). Those employees who feel that they are accountable for their own success tend to stay more committed to the work of the team project, are more inclined to take the initiative and participate actively in the problem solving (Campbell, 2000). On the other hand, employees who possess an external locus of control may feel disengaged or de-motivated, they might believe that it is external circumstances that determine the work that they perform rather than their own effort.

Internal locus of control is critical because self management and autonomy are so central to engagement in virtual teams (Hamzah and Othman 2023). Employees that are an intrinsic motivation to completing their tasks will generally not feel as isolated as remote work settings, and those with a strong internal locus of control. On the other hand, the people who have an external locus of control may need more structured management interventions, more clear goal setting and performance monitors to stay committed. Recruitment and team formation in virtual teams are pivotal for the choiceness of the system. Personality assessments should be considered for software houses to hire those who have the higher indices of internal locus of control and place them in the autonomous virtual team positions. Furthermore, performance based incentive systems and self leadership training program can also make employees to have more internal locus of control, which can lead to greater commitment to virtual teams in the long run. Organizations can enhance both individual and team engagement by creating a supportive work environment that provides them with an opportunity to be empowered.

Mediating Role of Team Cohesion in the Relationship between Virtual Team Efficacy and Project Team Commitment

Thirdly, the team cohesion was examined as a mediator to the relationship between project team commitment, and virtual team efficacy. The results are in favor of rejecting Hypothesis 3 which stipulates that Team Cohesion does not have any significant relationship with Virtual Team Efficacy ($\beta = 0.1768$, $p = 0.147$). Likewise, H5 is also rejected for mediation of Team Cohesion, which does not mediate Virtual Team Efficacy to Project Team Commitment ($\beta = 0.0371$, LLCI = -0.0030, ULCI = 0.1472).

Virtual team efficacy increases commitment, but in this case commitment does not seem to correlate with stronger team cohesion. This is because team confidence and competence do not automatically generate to interpersonal trust and collaboration (McNeese et al., 2021). Yet, members in a virtual team may not partake in strong social ties due to they have to be distant in space, communicate formally much less, and different cultures (Reizer et al., 2023).

Moreover, since virtual teams usually communicate with each other virtually as a form of digital media, the factor 'team effectiveness' may not be as akin to influence the team cohesion as the organizational culture, the leadership style and efforts to create structured teams to enhance the team working. It is found that confidence to work in a virtual team is an individual level characteristic whereas team cohesion requires purposeful effort and shared experiences. However, this is a challenge that needs to be dealt with in remote teams by building organically by performing activities to develop interpersonal cohesion as well as developing informal communication channels and doing virtual collaborative projects. These organized virtual networking events, virtual pioneer programs, peer to peer coaching, and so on, help building and maintaining trust and interpersonal bonds and thus make the virtual teams competent and cohesive.

Mediating Role of Team Cohesion in the Relationship between Locus of Control and Project Team Commitment

The fourth research question examined if team cohesion was a mediator of the relationship between locus of control and project team commitment. The results fit with Hypothesis 4 (H4) that Locus of Control is positively related to Team Cohesion ($\beta = 0.2282$, $p = 0.0036$). Nevertheless, Hypothesis (H6) is rejected because the mediation analysis indicates that the relationship between Locus of Control and Project Team Commitment does not significantly mediate via Team Cohesion ($\beta = 0.0404$, LLCI = -0.0025, ULCI = 0.1515).

This study shows that employees with an internal locus of control, that is, they believe that their actions influence outcomes directly, are more oriented to behavioral team engagement, thus generating team cohesiveness in virtual teams. That is consistent with previous research that internal drive individuals are more proactive in being communicative, problem solving

and collaborative and therefore higher team cohesion (Utomo et al 2024). Employees with an internal locus of control will be able to build trust among the teammates, contribute in building consensus and support for team objectives, thereby increasing strength of unity in virtual teams (Khanagha et al., 2022).

Nevertheless, although the relationship of Locus of Control with Team Cohesion is highly significant, team cohesion does not mediate project team commitment. In other words, conducting team cohesion does not lead towards higher engagement on the part of team members with an internal locus of control. One explanation for this is that the social team dynamics do not serve to bring about the commitment, but rather there is more emphasis on the individual motivation and control over work outcomes. Previous research (Erikstad et al., 2018; Hamzah & Othman, 2023) reflect on stronger predictors of commitment than team cohesion as autonomy, goal setting, self regulation.

The second is that cohesive behaviour in virtual teams operates in a different way to that which we associate with cohesion in traditional offices. Team cohesion often causes higher organizational commitment in physical workplaces via relationships and informal social interactions. Yet, in the virtual context, the relationship between team cohesion and commitment may be not that strong as employees tend to pay more attention to their individual performance, deadlines, and the completion of tasks than on social interaction (Flavián et al., 2022). Organizations should focus on structuring collaboration as a means to encourage team cohesion within virtual environments as well as trust building activities. Team check-ins, brainstorming sessions, and problem-solving exercises provided by a social work team may engage employees with an internal locus of control more than before the pandemic. Organizations also need to pay attention to leadership driven engagement strategies by active managers, who take active part in participant engagement, encouragement, recognitions of contributions and psychological safe environment provision. Team cohesion on its own won't directly induce commitment, as another vital element in ensuring team collaboration and morale in the virtual teams.

Strategic Management Practices for Enhancing Team Cohesion and Commitment in Virtual Software Project Teams

The fifth research question was therefore, to what extent strategic management practices assist virtual software teams with team cohesion and commitment. The result is supported by hypothesis 7 (H7), that team cohesion is positively associated to project team commitment ($\beta = 0.2100$, $p = 0.0075$). It then indicates that there is a relationship between team cohesion and level of commitment of virtual team members, which indicates that trust, collaboration, sharing of objectives in remote work situation is important factor.

These findings are in line with previous research providing evidence of the link between cohesive teams and the three essential dimensions related to greater commitment (Shankar & Tewari, 2023; Waseem, 2025), which are psychological safety, job satisfaction, and organizational loyalty and collectively improve commitment. In virtual teams with communications, time zone and technological barriers, strong team cohesion makes people feel they belong and share a purpose which boosts engagement and commitment (Morrison-Smith, 2020).

Henceforth, with the allied positive relationship between team cohesion and projected team commitment, organizations must use strategic management practice that urges a culture of teamwork, trust, engagement. Following are the strategies to act to fabricate both commitment and team consistency in virtual software team: Leadership plays an essential part in making team dynamics and taking a role in forming of collaboration. Effective virtual leaders should:

Facilitate Open Communication: Managers and the entire level of directorate would create an environment wherein team members could be expressive of their ideas, concern and the feedback easily without any apprehension. Regular virtual meetings and check ins can continue to keep this alignment and engagement (Whillans et al., 2021). When we define clear 'Team Goals and Expectations' that allows the employees to be focused and committed to the project. The SMART framework is to goal set and can aid with clarity and motivation (Weintraub et al., 2021). **Recognition & Reward:** For the contributions, Employee commitment

is reinforced. Daudi (2021) points out that performance based incentives, virtual recognition programs and peer appreciation program improve morale and engagement.

Therefore, organizations can support cohesion among virtual teams by using such tools as: Using Advanced Digital Collaboration Tools: There are advanced digital tools that make real time communication effective and ease in task management as well as tracking the progress of a task (Ajiva et al., 2024). Online Team Building Exercising, Virtual Brainstorming Meeting and Unscripted Socializing Among Employees: This could assist the employees to strengthen the bonds and reduce isolation which is generally associated with remote work (Yamijala et al., 2025).

If we want to keep team commitment in place, we must create a culture that enables us to feel like we belong: A culture of e VS, collaboration, sharing, learning etc. There are various things going virtual that can make you feel you belonged to remote teams: virtual onboarding sessions, mentorship programs and company's wide digital events (Homem, 2023). Giving them flexibility over what schedule to work and working around their own personal schedules promotes higher engagement and motivates them. If employees feel trust and have the power of decision as well, they are more likely to 'stay' in a given team or project (Krog, 2015).

By providing leadership driven strategy, digital collaboration tools and culture initiatives, software houses in Pakistan can lead with a combination of these 3 tools to help them improve both cohesion and commitment of their team. A project can be successfully executed if virtual team is able to maintain a high level of commitment and performance based on which it has an appropriate engagement, trust and recognition work environment.

Conclusion

The main aim of this study was to examine the effect of team cohesion on the commitment of virtual teams in the software house on construction in Pakistan under mediation of team cohesion and the effect of locus of control effect on the commitment of the virtual team and the effect of team efficacy respectively. With increasing proportion of software developers working remotely, especially increased by the COVID-19 pandemic, and collaborating virtually, it has become an urgent question relating to the nature of psychological and organizational variables that influence worker commitment, individual performance as well team performance. In the research study, a quasi quantitative research design was used to collect 156 valid responses from the partition of IT professionals living in various software houses of Pakistan.

Results indicated that both VTE and LOC had strong impact on PTC (those who are comfortable with work of their team virtually and that are privileged to be responsible for their success are more committed in their projects). While the authors of the study do not find a significant relationship between Virtual Team Efficacy and Team Cohesion (so higher confidence does not equal closer relationships), Team Efficacy is not the same as Team Cohesion. Nevertheless, Locus of Control is positively associated with Team Cohesion i.e. internal locus of control people will have a positive impact in the cohesive, collaborative team dynamics.

The mediating variable of Cohesion of a Virtual Team did not affect the relationship between Virtual Team Efficacy and Project Team Commitment as well as the relationship between Locus of Control and Project Team Commitment. Thus, these teams have a higher degree of interdependence and autonomy in comparison to collective versus get togetherness because the commitment in such virtual teams is mostly depended upon the individual rather than social cohesion. It was also found that Project Team Commitment was positively impacted through the direct relationship between, Team Cohesion and the idea that strong interpersonal relationships and team unity equal overall project team commitment in virtual settings .

This paper provides some useful managerial ideas that can be developed by software houses on how to enhance team confidence, make personal responsibility, set structured team engagement strategies to preserve commitment and performance within a virtual team.

Study Limitations

However, this study also has several limitation that should be noted, even with its contributions.

- 1. Generalizability:** The generalizability for this study is limited, as this was carried out in Pakistani software houses only. Therefore, relationships may exist between virtual team efficacy, locus of control, team cohesion and commitment depending on which country you are in, i.e. work cultures, managerial practices, and technological infrastructures differ, so these could impact relationships between virtual team efficacy, locus of control, team cohesion and commitment. Future research needs to extend the results to other industries and geographic locations to validate in other work settings.
- 2. Self Reported Data:** Since the self reported data is also to be considered because it can suffer from social desirability bias and subjective perception; Self reported survey responses. It is impossible to exclude the possibility that participants fully answered accurately or that they responded in a manner that would appear favorable to the researchers. In addition, employee response will not always be a product of his her own emotions but can be also affected by temporary emotions or situational factors and they will not be reliable. Future studies can validate answers by using triangulation, such as managers' judgments or peer reviews, provided that the appropriate conditions exist.
- 3. Cross-Sectional Research Design:** This study employed a cross-sectional research design, meaning that data was collected at a single point in time. As a result, the study cannot establish causal relationships between the variables. For example, while the findings suggest that virtual team efficacy leads to higher commitment, a longitudinal study would be needed to confirm whether changes in team efficacy over time actually lead to sustained commitment levels. Future research should adopt longitudinal designs to analyze how these relationships evolve.

4. **Exclusion of External Factors:** The study focused solely on individual and team-level psychological factors (efficacy, locus of control, cohesion, and commitment) but did not account for external factors such as leadership styles, technological infrastructure, organizational support, or job satisfaction. These elements could play a significant role in shaping team commitment. Future research should integrate additional variables, such as leadership effectiveness, job autonomy, and work-life balance, to provide a more comprehensive understanding of commitment in virtual teams.
5. **Sample Size Constraints:** While the study included 156 valid responses, a larger sample could provide greater statistical power and generalizability. Future studies should aim for larger and more diverse samples, incorporating responses from multiple software houses and international virtual teams to enhance the robustness of findings.

Future Research Directions

Based on the findings and limitations, several avenues for future research can be explored. Future studies should replicate this research in other industries, such as finance, education, healthcare, and consulting, where virtual teams are also prevalent. Additionally, examining how cultural differences influence virtual team dynamics across different regions could provide valuable insights into how workplace norms and leadership styles affect team efficacy, cohesion, and commitment. Leadership plays a crucial role in shaping team commitment and cohesion, especially in virtual environments. Future research should investigate how different leadership styles (e.g., transformational, servant, or transactional leadership) influence virtual team commitment. Understanding the impact of leader-member exchange (LMX) theory in remote teams could provide practical recommendations for managers on how to enhance engagement and motivation in distributed workforces.

Since commitment and cohesion evolve over time, future research should conduct longitudinal studies to analyze how virtual team dynamics change across different project phases. Studying teams over an extended period can help understand whether team efficacy and cohesion fluctuate based on project complexity, deadlines, and leadership interventions.

As technology plays a central role in virtual collaboration, future research should explore how the use of different digital tools (e.g., AI-based project management systems, real-time analytics, and remote work platforms) influences team commitment and efficiency. The impact of cybersecurity concerns, data privacy, and digital fatigue on virtual team engagement should also be investigated.

While this study focused on team efficacy, locus of control, and cohesion, future research should explore additional factors such as emotional intelligence, psychological safety, work-life balance, and job satisfaction, which may also contribute to project team commitment. Understanding how stress management, conflict resolution, and interpersonal trust impact virtual team performance could provide deeper insights into improving team effectiveness. With many organizations shifting to hybrid work models, future studies should examine how hybrid teams (a mix of virtual and in-office employees) function differently compared to fully virtual teams. Research should explore how physical presence affects team cohesion and whether hybrid work arrangements impact commitment levels differently.

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Appendix A

Questionnaire

Please provide following information.

	1	2
Gender	Male	Female

	1	2	3	4	5
Age	18- 25	26–33	34-41	42-49	50 and above

	1	2	3	4
Qualification	Bachelor	Master	MS/M.Phil	PhD

	1	2	3	4	5	6
Experience / Years	1 – 5	6-10	11-15	16 – 20	21 –25	26 and above

Please tick the relevant choices: **1 = Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree**

Virtual Team Efficacy						
1	I believe my team can effectively use communication tools to collaborate with remote team members in our projects.	1	2	3	4	5
2	I believe my team is capable of performing effectively in a distributed work environment with access to appropriate IT tools and technologies.	1	2	3	4	5

3	I believe my team can successfully share and exchange information using technology with remote colleagues.	1	2	3	4	5
4	I believe my team can efficiently utilize communication technologies to work with teammates who are unable to meet in person.	1	2	3	4	5

Locus Of Control						
1	I find it easy to build and maintain professional relationships with my colleagues.	1	2	3	4	5
2	When I make plans for my tasks, I am confident in my ability to see them through successfully.	1	2	3	4	5
3	When I achieve my goals, it is usually because of the effort and hard work I put into them.	1	2	3	4	5

Team Cohesion						
1	I enjoyed collaborating with my team members on our projects.	1	2	3	4	5
2	I would prefer to be part of a different team (reverse-scored for PCA).	1	2	3	4	5
3	Our team demonstrated strong collaboration and worked well together.	1	2	3	4	5
4	Everyone actively participated and contributed to the team's discussions.	1	2	3	4	5
5	The team spent significant time on unproductive activities (reverse-scored for PCA).	1	2	3	4	5
6	I trust that my team members will complete their assigned tasks responsibly.	1	2	3	4	5

Team Commitment						
1	I often speak highly of this team to my colleagues and friends as a great team to be part of.	1	2	3	4	5
2	I would be willing to accept almost any assignment to continue working with this team.	1	2	3	4	5
3	I feel that my values closely align with the values of this team.	1	2	3	4	5
4	I am proud to share with others that I am a member of this team.	1	2	3	4	5
5	This team motivates me to perform at my very best in my role.	1	2	3	4	5
6	I am extremely satisfied to have chosen this team to work with over other teams.	1	2	3	4	5
7	I genuinely care about the success and well-being of this team.	1	2	3	4	5
8	I believe this team is the best possible team to work with.	1	2	3	4	5