The Impact of Team Mental Models on Project Team Performance through Information Utilization

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Abstract: *This paper attempts to understand this relationship in the IT industry of a developing country like Pakistan – by considering team mental models, information utilization, and project team performance. The study uses a sample of 365 employees from different IT jobs and a questionnaire on a Likert scale, together with the use of advanced statistical analysis to test its hypotheses. The regulations examine how team mental models—shared team knowledge and cognitive structures – affect the efficient deployment of information resources. Quantitatively, the paper is based on data from project teams in Pakistani IT organizations. The results indicate a positive correlation between information use, team mental models, and project team performance. Research says constructing good mental models in project teams would enable the team to use the information available in a better manner, resulting in better project success in the rapidly changing Pakistani IT sector.*

Introduction

In many studies, the team's mental model is defined as the team's understanding, knowledge, and mental picture of the task or goals. In essence, it is a set of mental models that are constructed by the team members over time as they engage in team activities. TMM is underpinned by common understandings of what is contained within team areas, which is responsible for what, and how work should be completed. It is a cognitive map that guides members' perception of information, decision-making, and cooperative execution of tasks.

The purpose of this text is to present knowledge that can help team leaders and project managers shape an environment that leads to improved project results. A major source of concern is the potential for conflicts or misalignments in Team Mental Models within the project teams. Various interpretations of tasks or objectives may result in misinterpretations, which could hinder the intended effect on information use and project performance. Different 2 types of team mental models exist, focusing on specific aspects like expertise, communication, or coordination. It takes proactive work through knowledge-sharing programs, team-building exercises, and open communication to develop strong team mental models. Project results such as budget adherence, quality, team satisfaction, and completion time can be used to measure the effectiveness of team mental models. Aligning interests and plans is intended to ensure a common direction and routes. As a result, team members' common mental models will make it easier to draw on "well-structured information as a basis for selecting actions that are appropriate, and their actions are consistent and corresponding with those of their associates. (Mathieu et al., 2005).

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Mental models are small-scale models of how (part of) the world operates. Elicited concepts reflect cognitive structure and organization, indicating social-ecological system dynamics (Jones et al., 2011). Mental models of team interactions show how members should communicate with one another. Understanding one another's roles and responsibilities is an essential component of productive communication (Wiedow et al., 2013). Although no two minds are alike, mental models are strictly single to each of their individual containers, while some parts may be shared (Jones et al., 2014; Lynam et al., 2011). Communication and information utilization among team members become challenging when team members quit, and new team participants enter, according to studies (Bjorvatn & Wald, 2018).

Establishing a clear objective and outlining each member's job can be accomplished through exercises like role clarification and interchange training. Individual, team-level, and organizational characteristics are among the antecedents that are described in the inputs as facilitating or impending members' interactions. The procedure typically takes into account interactions between team members who are focused on completing tasks like information sharing and information use (Deeter-Schmelz & Ramsey, 2003). The importance of Team Mental Models (TMM) in leading project teams to improve results is emphasized in this study. TMM functions as a common cognitive framework that the team develops via experience and interaction, influencing how they understand tasks, responsibilities, and efficient means of achieving objectives. The most important 3 contribution of this paper is to provide the team leaders and project managers with guidelines on how to set up favorable project outcomes.

The study utilizes data from several sources, and one of the proposed theories is that although mental models are distinct, they may be comprised of common elements. Change can cause problems in communication in a team, which underlines the importance of clear roles, cross-training, and goals. In conclusion, this study provides valuable data that may be applied to enhance the project management processes. It also underlines the role of TMM in enhancing communication and information management, which leads to the improvement of project team performance.

Literature Review
Team Mental Model

According to this study, the formation of TMMs is thought to benefit from team development. The two main parts of teamwork MMs are interaction and teammate MMs. Teammate mental models show how members of a team are acquainted with one another's abilities and expertise. It can be developed through socialization exercises that strengthen interpersonal connections and increase mutual understanding. Conversely, team interaction mental models show how people comprehend how to communicate with one another. Understanding one another's roles and responsibilities is the cornerstone of productive communication. Activities like role clarification and interchange training can be utilized to define each member's job and create a common objective (Hsu et al., 2011).

It was discovered that team processes acted as a partial mediator in the association between task mental model sharedness and team effectiveness. The quality of those models modulated the multiplicative link between team mental model sharedness and team processes and performance, even though there was no significant linear association (Mathieu et al., 2005).

Devine (2002) presented a framework that differentiates between 14 types of teams that may exhibit particular distinctions in attaining effectiveness in order to help with the classification of teams for study. Among these are "design workgroups," which are closely related to the teams tasked with creating new information systems and need technical ingenuity and creativity to solve problems for internal or external clients (Schwalbe, 2007). High team performance requires ongoing team learning and increased processes, as evidenced by studies (Santos et al., 2016). Team reflection (Oertel et al., 2014) is one of the most important and researched aspects of team learning and development behaviors. It is a process of critically analyzing and collectively discussing team goals, tasks, and procedures with the intention of improving them (Edmondson, 2002). The foundation for improvement and effectiveness is the team member's ability to identify shifting environmental demands, highlight the unfavorable effects of past actions, and develop insights into performance-relevant plans through regular collective reflections (Kayes et al., 2005).

Interaction Mental Model

The cognitive framework that people use to understand and communicate with systems, especially digital interfaces, is known as an interaction mental model. Users' presumptions, experiences, and expectations about how a system operates and how they should interact with it are all included in this mental model. Because they affect user behavior and how well and successfully users understand and use a system, mental models are important. User satisfaction and performance are increased when logical interactions result from a well-aligned mental model. Mental models of team interactions show how members should communicate with one another (Hsu et al., 2011). Understanding one another's roles and responsibilities is the foundation of productive communication. Establishing a clear objective and outlining each member's job can be accomplished through exercises like role clarification and interchange training. (Hsu et al., 2011)

The team interaction mental model measures how well team members comprehend how a team works as a unit to complete a job (Hsu et al., 2011). Using information effectively is essential for project teams to perform at a high level (Majeed et al., 2023). Team members who adhere to a shared interaction mental model will have a common understanding of the appropriate methods for gathering, sharing, and utilizing knowledge (Hsu et al., 2007). This mutual knowledge facilitates better decision-making overall, minimizes misunderstandings, and cuts down on duplicative work. As a result, teams with well-developed interaction mental models are probably going to use knowledge more efficiently, which will enhance project outcomes and boost performance (Hsu et al., 2011).

The interaction mental model has significant effects on project performance and team mental models. A coherent interaction mental model ensures that all team members know the goals, processes, and tasks of the project, which helps to develop accurate and consistent team mental models (Kneisel, 2020). When there is shared understanding, team members can quickly access and apply relevant information, make good decisions, and effectively organize their activities for effective information use. Therefore, teams with strong mental models of interaction are usually more effective and achieve project goals more efficiently and effectively (Mathieu et al., 2005).

Information Utilization

Information utilization is the process through which people or organizations use information and data they have obtained to solve issues, make decisions, and carry out tasks efficiently. It includes the capacity to understand, evaluate, and act upon information in meaningful ways. It is an essential part of information management. Using information well can provide you with a competitive advantage in a variety of situations, from company strategy to personal productivity. It also improves decision-making and efficiency. The interaction model of job completion knowledge and the companion model of subject information that make up the teamwork mental model will be favorably connected to the use of information (Hsu et al., 2011).

Teams with similar mental models are more adept at optimizing information utilization, as they share a mutual comprehension of pertinent information and its appropriate application. Team members can quickly make decisions because they have a common grasp of how to interpret facts and insights within the same conceptual framework. Moreover, it facilitates the team to capitalize on its combined knowledge and proficiency, resulting in inventive resolutions and improved project results. Information Utilization refers to the use of information transformed by the team (Majeed et al., 2023). To ensure high success in project teams, knowledge must be employed effectively. The teams that are proficient in the use of information may be in a position to respond to changes in the projects, identify issues in advance and take appropriate measures to address them, and make better-informed decisions that enhance the quality and timeliness of deliverables in the project (Tijani et al., 2023). There is a high likelihood that if team members are able to retrieve the information they require readily, then the information will be properly understood and used in the management of the project. This is referred to as effective information utilization. This means that the teams that make information an output priority will be more likely to innovate and implement new concepts or strategies, strategies that can affect consumer satisfaction levels (Deeter-Schmelz & Ramsey, 2003).
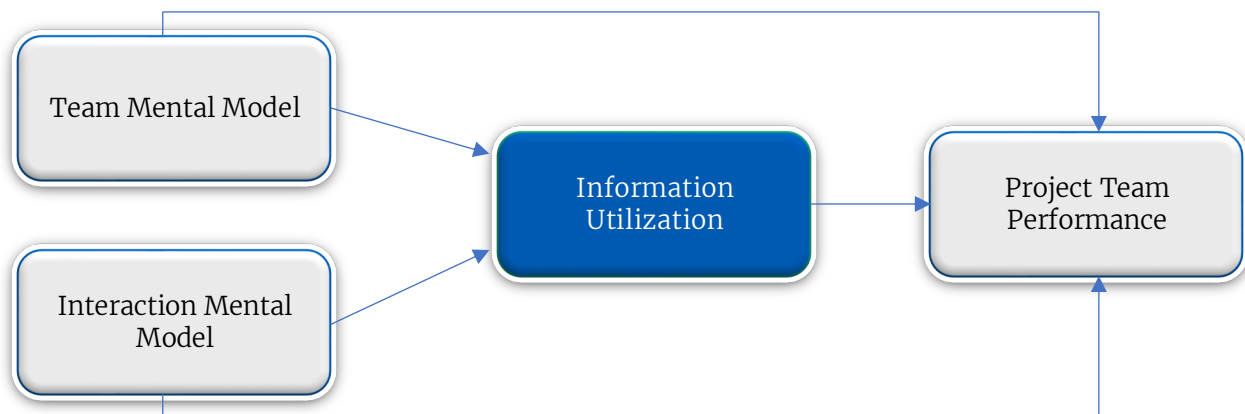
Project Team Performance

The collective effectiveness and efficiency with which a project team achieves its goals, enabled by the alignment of team members' mental models and the strategic use of information, is referred to as project team performance. Teams that can effectively combine efficient information utilization with a shared understanding of the project (mental models) to support decision-making, problem-solving, and task execution are considered high-performing. By improving team cohesion through team mindfulness, social learning encourages workers to participate in socially desirable behaviors, such as project team performance (Majeed et al., 2023). Effective team leaders improve the results of team cohesion in the form of project team performance through their direction and facilitation (Lyubovnikova et al., 2017). Project team performance, as impacted by mental models, is the efficiency and efficacy with which a team uses its members' shared cognitive frameworks to accomplish project goals. Mental models are important because they assist team members in predicting their coworkers' desires and actions, which enhances collaboration and problem-solving (Hsu et al., 2007). More and more studies stress the significance of team mental models in enhancing the performance of project teams, particularly as it pertains to the information-utilization mechanism. Team mental models are the cognitive frameworks that are common to team members, and they help the members predict and understand each other's actions to enhance collaboration and problem-solving. These shared mental models facilitate efforts and problem-solving, and they are vital for the best team performance. If teams have a good mental model, they perform better because there are no misunderstandings and conflicts, and everyone knows what tasks, goals, and processes are (Tijani et al., 2023).

Conceptual Framework
Figure 1
Conceptual Framework

Research Hypotheses

H1: There is a positive association between teammate mental model and project team performance

H2: There is a positive relationship between the interaction mental model and project team performance

H3: There is a positive relationship between the teammate mental model and information utilization

H4: There is a positive relationship between the interaction mental model and information utilization

H5: There is a positive relationship between information utilization and project team performance

H6: Information utilization mediates the relationship between teammate mental model and project team performance

H7: Information utilization mediates the relationship between the interaction mental model and project team performance.

Data and Methodology
Research Methodology

This research aims to gain a comprehensive understanding of the positive effects of team mental models on project team performance in the IT sector in Pakistan. The researcher adopts a positive approach to explore ways to enhance project team performance. Positive thinking is purportedly employed as a research

philosophy in the scientific sciences. According to the philosophy, when questions are analyzed objectively, the resulting conclusions tend to be highly definitive (Brand 2009).

Research approach

Researchers have suggested various methodologies to gain access to the community and acquire a sufficient sample size for conducting a study. Each strategy has advantages and disadvantages in this context, and the most suitable approach will vary depending on the type of study being conducted (Zikmund et al., 2010). The survey strategy will be implemented as one of the data collection methods used in this study, given the widespread use of surveys in research. The research questions of the survey are modified through discussions and communications with the respondents to evaluate the study variables (Malhotra et al., 2006).

Questionnaires were delivered directly to participants, while an internet-based method, such as virtual access, was obtained through the utilization of email and social media platforms. Utilize a system based on chance to choose the person who responded and gather the data using a web-based Google form. The questionnaire is a highly prevalent method for collecting data in the survey approach (Saunders et al., 2016).

Data and Population

Data collection in the investigation was conducted using an online questionnaire mechanism. Hence, the self-administered survey utilized in various research studies was modified and employed in the current study. Pilot tests are conducted during the final stage of questionnaire development. Ensuring the accurate collection of data is essential. Hence, pilot tests are conducted to elucidate any ambiguities perceived by the respondents (Aslam et al., 2020).

The research population comprises IT company managers who are active in Pakistan's IT sector. The data for this research was gathered from various registered companies, including project managers, project leaders, and team leaders associated with the Pakistan Software Export Board (PSEB). According to the Ministry of Information Technology and Telecommunication (MOITT) Pakistan Software Expert Board (PSEB), As of March 2023, this includes over 2,500 software houses that employ more than 350,000 IT professionals. There are 5,109 IT and IT companies registered with the Pakistan Software Export Board (PSEB) representing the exporters. Major Tech hubs of IT and IT's industry are Lahore (36.4 percent), Karachi (28 percent), and Islamabad/ Rawalpindi (27 percent) of PSEB registered companies.

Sampling Technique and Measurement Scale

Sampling is a methodology used by researchers to select a subset of items or individuals from an established group for experiments or observations. This is done in order to make it consistent with the goals of their investigation (Sharma, 2017). A grand total of 370 questionnaires were disseminated among project leaders, project managers, and team members in the IT sector of Pakistan with the objective of carrying out the investigation. The investigation utilized the Simple Random Sampling methodology. The queries used a Likert scale with points that ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), which has also been utilized in previous studies.

Table 1

Construct	No of items	Sources
Project Team Performance	18	Majeed et al., (2023)
Interaction Mental Model	3	Jack et al.,(2009)
Information Utilization	4	Jack et al.,(2009)
Teammate Mental Model	3	Jack et al.,(2009)

Descriptive Statistics

Descriptive Statistics In our research, a total number of responses received is 303, and data screening is applied to all of these responses. There was no missing data or wrongly entered data, as show in the table below

Table 2

	N	Minimum	Maximum	Mean	Std Deviation
TMM	303	1.00	4.739	4.26	.738
IMM	303	1.00	4.857	4.27	.677
IU	303	1.00	4.936	4.28	.655
PTP	303	1.00	4.924	4.45	.606

Hypothesis Testing

Preacher and Hayes (2008) technique was used for data analysis.

Step 1: Teammate Mental Model and Project Team Performance
Step 1 shows a positive relationship between Teammate Mental Model and Project Team Performance

Table 3

β	R^2	Se	T	p	LLCI	ULCI
.6870	.1864	.2107	3.2602	.0012	.2723	1.1016

Step 2: Interaction mental model and project team performance
Step 2 shows there is a positive relationship between the interaction mental model and project team performance

Table 4

β	R^2	Se	T	p	LLCI	ULCI
.8249	.0712	.1578	5.2263	.0000	.5143	1.1355

Step 3: Teammate mental model and information utilization
Step 3 shows there is a positive relationship between teammate mental model and information utilization

Table 5

β	R^2	Se	T	p	LLCI	ULCI
.3096	.0671	.0666	4.6515	.0000	.1786	.4406

Step 4: Interaction mental model and information utilization
Step 4 shows there is a positive relationship between the interaction mental model and information utilization

Table 6

β	R^2	Se	T	p	LLCI	ULCI
.2679	.0867	.0501	5.3464	.0000	.1693	.3664

Step 5: Information Utilization and project team performance
Step 5 shows there is a positive relationship between information utilization and project team performance

Table 7

β	R^2	Se	T	p	LLCI	ULCI
1.0305	.1864	.1735	5.9381	.0000	.6890	1.3720

Step 6: Mediating role of teammate mental mode land project team performance
Step 6 shows Information utilization mediates the relationship of teammate mental mode land project team performance.

Table 8

The direct effect of teammate mental model on project team performance.

Effect	Se	t	p	LLCI	ULCI
.6870	.2107	3.2602	.0012	.2723	1.3720

Indirect effect(s) of teammate mental model on project team performance:

	Effect	BootSE	BootLLCI	BootULCI
Total	.0910	.0522	.0141	.2038
IU	.3557	.2444	.0480	.9235

Step 7: Mediating role of interaction mental model and project team performance.
Step 7 shows Information utilization mediates the relationship of interaction mental model and project team performance.

Table 9

Direct effect of interaction mental model on project team performance.

Effect	Se	T	p	LLCI	ULCI
.8249	.1578	5.2263	.0000	.5143	1.1355

Indirect effect(s)of interaction mental model on project team performance:

	Effect	BootSE	BootLLCI	BootULCI
Total	.0928	.0505	.0179	.2043
IU	.2760	.1895	.0442	.7456

Conclusion

The study examines how the alignment of mental models among teammates and their interaction with mental models influence project team performance in the IT sector, with a particular focus on the role of information utilization. Interaction mental models refer to the knowledge that is common within a team regarding the processes and activities of the team, while teammate mental models refer to the perception that team members have regarding each other's roles, abilities, and actions. The study findings show that teams can better understand each other's expectations, synchronize activities, and adapt to changes in the project when the mental models are congruent, which leads to better performance.

In this relationship, information usage is a key intervening variable. This means that aggregation of information makes it easier to make good decisions and solve problems since only the right information is given to the right people at the right time. IT projects are often complex and fast-changing, and that is why the ability to process and use information is very important in this field. This paper identified that teams that have robust mental models are in a better position to leverage information as these models provide a guide to what information is relevant and how it can be utilized. This enhanced information use leads to enhanced team coordination, innovative ideas and solutions, and increased project outcomes.

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