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IT tools and project value: Mediating role of teamwork and moderating role of top management support

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ABSTRACT

This study aimed to examine how information technology (IT) tools affect the value of construction projects in Pakistan, considering the roles of teamwork and support from top management. Based on theories from previous research, a model was created to explain these relationships. To test this model, data was collected from 130 participants involved in Pakistani construction projects through a survey. The Partial Least Squares Structural Equation Modeling (PLS-SEM) method was used to analyze the data. The findings showed that IT tools have a positive effect on both the value of projects and teamwork. Additionally, teamwork enhances the value of projects and serves as a connecting factor between IT tools and project value. Top management support also plays a crucial role by strengthening the positive effect of teamwork in this relationship. This research contributes to both theory and practice. Theoretically, it offers a new model and improves project management strategies to increase project value. Practically, it assists those involved in managing construction projects, including project managers, contractors, and policymakers, in planning and executing their projects more effectively and achieving better results.

1. Introduction

Due to recent technological advancements and developments, project management (PM) in many contemporary organizations is becoming more practical and realistic than ever before. The use of information technology (IT) has a profound impact on the discipline of PM (Marnewick and Marnewick, 2022; Aljawder, 2020). Numerous organizations are adopting a wide range of IT tools, including the Internet, email, AutoCAD, video conferencing, search engines, and database management systems, among others, to manage their projects with greater efficiency and effectiveness. Additionally, some organizations are employing computer-aided software such as Primavera and Microsoft Project to plan and monitor the progress of projects, facilitate information sharing, and document important insights gained from completed projects. These IT tools and software not only enable the identification and analysis of potential project risks and uncertainties related to cost and time estimates but also contribute to the development of project managers' leadership, communication, social, life, and technical skills (Vial, 2019).

However, IT tools assist project managers in finishing projects on time, within budget, and in alignment with specified requirements. These tools support project managers in producing necessary analytical reports that enable informed and data-driven decisions, thereby contributing to the success of projects. With the aid of IT tools, project managers can more accurately understand the needs of different stakeholders, effectively communicate the current status of projects, offer insights into business strategies, and forecast the expected return on investment (ROI), all of which are essential for making strategic decisions (Morakanyane et al., 2017). These tools provide various benefits to organizations, including increased revenue, enhanced and timely communication with

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stakeholders, focus on strategy and outcome, increased creativity and productivity, and project value (Soriano, 2016).

Construction projects are so complex and fragmented that many participants do not consider them part of these projects (Safapour et al., 2020). Various organizations and individuals with varying backgrounds, expertise, and competing needs are involved in these projects. This demands a close collaboration among various stakeholders to obtain time, cost, and quality goals of such projects (Joslin and Müller, 2016). As a result, construction projects require extensive sharing of data and information among those involved. Consequently, project managers in construction utilize various IT tools to improve project planning, execution, control, and the delivery of value. However, IT tools alone cannot enhance project value without their proper understanding and utilization. If these tools are chosen without due care or misused, they can negatively affect project performance and value. To fully maximize project value, it is crucial to select IT tools thoughtfully based on their appropriateness and relevance to the project. Additionally, proper training, along with effective teamwork and coordination, is essential to fully leverage the benefits of IT tools (Riyaz et al., 2022). Therefore, teamwork is crucial for the successful adoption of these tools. Moreover, the top management role is vital to implementing any technological initiative in organizations because top management provides the necessary resources and support for adopting and implementing technological initiatives (Hwang, 2019).

Nevertheless, several researchers have discussed the adoption and utilization of IT tools in PM. For example, Bardhan et al. (2009) mentioned that aligning IT characteristics to project characteristics enhances project performance. They further mentioned that elementary communication technologies are specifically utilized for exceedingly performing projects, organizational software technologies are suitable for projects in a well-structured and stable environment, and group collaboration technologies are appropriate for projects in less-structured, volatile, and uncertain environments. Raymond et al. (2020) discovered that there is a positive correlation between the quality of project management (PM) information systems, how often they are used, and the performance of projects. Dostie and Jayaraman (2012) argued that workers who use computers demonstrate higher productivity compared to those who do not use computers.

Many previous studies have confirmed the positive effects of IT tools and related software on project and organizational performance. However, the influence of these tools on the value of projects has seldom been explored in past research. Earlier investigations primarily concentrated on how IT tools are intended to be used within organizations rather than examining how widely they are adopted and the advantages they offer in PM. These studies often looked at the adoption of IT as involving just one tool or focused on discussing particular types of technology. For instance, Marion et al. (2014) analyzed the adoption of IT tools for external or intra-organizational associations. Tarutė and Gatautis (2014) considered the adoption of IT tools for organizational performance. Ulmanis and Deniņš (2012) examined the adoption of IT tools for product innovation and development. Moreover, the mediating impact of teamwork in the linkage between IT tools and project value has not been completely understood in previous studies. Furthermore, the moderating role of top management on the mediating role of teamwork in the said association has not been fully grasped in any prior study as per the best knowledge of the researchers.

This study aimed to fill the aforementioned research gaps by the detailed examination of the following research questions.

1. What is the impact of IT tools on project value?
2. What is the impact of IT tools on teamwork?
3. What is the impact of teamwork on project value?
4. To what extent does top management support moderate the association between IT tools and teamwork?
5. To what extent does teamwork mediate the association between IT tools and project value?
6. To what extent does top management support and moderate the mediating impact of teamwork on the association between IT tools and project value?

The study answered the aforesaid research questions using a standard paradigm of empirical research. This was achieved by formulating an explanatory model based on the proposed hypotheses and testing the model using sample data from 130 respondents working on construction projects in Pakistan. The PLS-SEM was applied for data analysis.

2. Literature review and theoretical background

The resource-based view explains that organizations can achieve better business performance by using their unique and valuable resources and capabilities, as noted by Müller and Turner (2010). IT tools are key resources that enhance capabilities such as teamwork. By adopting and using IT tools effectively within a team, projects can attain greater value. The support of top management is crucial for the successful adoption and use of IT tools and for fostering teamwork in projects. Therefore, we propose that IT tools contribute to project value through teamwork when there is support from top management. Below is a brief description of project value, IT tools, teamwork, and top management support.

Project value: It can be stated as the value created in a project for its stakeholders (Zott and Amit, 2010). It is determined by the project benefits in the form of successful outcomes, excellent results, and

positive NPV and ROI (Yang et al., 2012). The project value is conventionally related to financial and social benefits for stakeholders (Patanakul and Shenhar, 2012; Pitelis and Vasilaros, 2010). However, some studies also mentioned value creation in terms of intangible benefits (e.g., Garriga (2014)). The main purpose of developing construction projects is to generate value for the stakeholders through efficient and effective delivery of projects that meet and exceed the needs of stakeholders (Thomas and Mullaly, 2008). Thus, construction projects should be managed strategically through an effective value creation process/system that provides the best value to each of the stakeholders.

IT tools: These tools include various software applications, utilities, and technologies that support the processing and management of information in businesses and other areas. In the field of PM, IT encompasses software and applications dedicated to the effective and efficient handling of projects. These tools enable organizations to create new structures, boost the productivity of both individuals and teams, streamline operations to reduce organizational size, and improve coordination and collaboration both within the organization and with external partners. Dostie and Jayaraman (2012) noted the significant role these tools play in transforming organizational practices and enhancing productivity. The field of PM has grown increasingly reliant on IT, with the use of IT tools in project management expanding rapidly as new methodologies and techniques are developed.

Teamwork: A team can be a group of persons with varying knowledge, expertise, and abilities to accomplish tasks to achieve a common goal (Ji and Yan, 2020). Teamwork represents the capability of a team to work unitedly in a cooperative setting to achieve synergistic results (Iqbal et al., 2017). Project teamwork has been recognized as an essential factor in improving project success (Yang et al., 2013). Systems theory corroborates the importance of teamwork in organizations and projects. Teamwork is a dynamic system through which organizational change can be managed using internal and interrelated processes toward product/service development. It balances a variety of knowledge and expertise among team members, and individuals are required to emphasize only their own knowledge and skills.

Top management support: The terms upper management, executive management, and senior management can be used for top management because these terms are interchangeably applied in management and leadership literature. Top management not only provides visions and strategies but also takes charge of implementing change in organizations due to new and emerging technologies, reducing resistance, and demonstrating commitment through actions (Kulkarni et al., 2017). Hwang (2019) demonstrated that top management support plays an essential role in achieving project outcomes and success. As organizational strategies are frequently implemented through projects, top management support is indispensable to formulate and implement organizational strategies and policies by breaking them down into programs and projects.

2.1. IT tools and project value

The use of IT tools positively impacts organizational performance from various perspectives, including modernizing the governess system (Dostie and Jayaraman, 2012), increasing organizational innovation and performance (Tsou and Chen, 2021), facilitating the organizational communication and coordination (Brynjolfsson and Yang, 1996), and effectively managing the projects (Yang et al., 2012). Many studies revealed that IT tools play a vital role in construction projects and lead to better project performance and success (e.g., Barnes et al. (2020)). IT tools are helpful in tracking resources, time, cost, and activities throughout a project's life and make project managers' jobs efficient and easier (Taylor et al., 2012). These tools facilitate project data integration and interoperability issues and help in decision-making (Pellerin et al., 2022). Project managers and teams can utilize these tools to obtain and sustain project benefits and value in terms of new knowledge, methods, innovation, successful outcomes, and excellent results (Yang et al., 2012). IT has the capability to produce value in projects. Thus, IT tools in PM can yield value for stakeholders in terms of innovative products/services, positive NPV, and ROI (Soriano, 2016). Therefore, it can be concluded that:

H1: IT tools positively impact project value in construction projects in Pakistan.

2.2. IT tools and teamwork

IT tools facilitate communication and coordination-related tasks of project team members to engage them in cooperative work (Chiocchio, 2007). These tools can be used to reduce schedule and coverage among team members, which further leads to enhanced range and depth of information for effective task performance. Previous studies on teamwork and team coordination found that IT tools are effective socio-tech systems for improving knowledge sharing and teamwork (e.g., Tohidi and Tarokh (2006)). Construction projects, like other projects, largely depend on communication and coordination activities among project team members to reach a mutual understanding and obtain a quick response (Dainty et al., 2007). Therefore, the role of IT tools is paramount to enhance communication and coordination activities among team members, which further support synergistic efforts and teamwork. IT tools can strengthen teamwork by sharing designs and visuals in construction projects in an effective manner to obtain consensus and cohesion among team members. These tools can produce the desired results only when project teams have access to these tools. Black and Lynch (2001) found a positive association between IT tools and

teamwork. IT tools can facilitate a team's learning skills and IT-generated teamwork (Rimmington et al., 2015). Therefore, it can be hypothesized that:

H2: IT tools positively impact teamwork in construction projects in Pakistan.

2.3. Teamwork and project value

Teamwork encompasses a set of tasks that contribute to project priorities and benefits (Kazanjian et al., 2000) and enhances the required cooperation through information exchange, knowledge sharing, and dispute eradication among the project team members (Galbraith, 1973). Teamwork performed by intuitive, experienced, and compatible team members enhances project value (Camilleri, 2011), and interdependencies among team members positively influence project value (Hoegl et al., 2004). Project value from an economic perspective is described as the quotient of the project (Laursen and Svejvig, 2016) in which short-term and long-term project benefits are enumerated in monetary and non-monetary forms. Many researchers found that teamwork has a positive association with project success. For example, Afzalur Rahim (2002) revealed that team performance is positively related to project outcomes. Yang et al. (2012) advocated that team cohesiveness is necessary for project success. Oke (2022) argued that project value is one of the important factors that decide the success of construction projects. Therefore, the following hypothesis can be formulated:

H3: Teamwork positively impacts project value in construction projects in Pakistan.

2.4. Moderating role of top management support on the association between IT tools and teamwork

The role of top management is pivotal for the adoption and utilization of technology in organizations. Top management promotes the use of IT tools by creating a supporting and cooperating environment, promoting teamwork, reducing hurdles, and providing necessary resources. Despite the external factors, top management is the ultimate authority to decide where and when to use IT (Elbashir et al., 2011). In order to ensure a circumstance that excites and inspires the usage of IT tools, top management provides necessary support in terms of provisioning resources, eliminating resistance, motivating teams, giving required approvals, and structuring needed mechanisms. When project managers realize the benefits of IT tools, they exert a solid influence on project teams for IT usage. On the other hand, if team managers are not cooperative, the utilization of IT tools fails to generate the required results (Muñoz-Carril et al., 2021). Nevertheless, IT tools positively impact teamwork in PM, and top management influences this impact. Ahmed et al. (2014) revealed that top management support has differential effects on IT adoption and utilization. Liang et al. (2007) revealed that the larger the top management participation, the larger the ERP utilization. Therefore, it is reasonable to believe that IT tools provide the conditions to enhance teamwork in PM, and top management support positively moderates this impact. Based on the above discussion, it can be hypothesized that:

H4: Top management support positively moderates the association between IT tools and teamwork in construction projects in Pakistan.

2.5. Mediating role of teamwork in the association between IT tools and project value

Effective teamwork is paramount for effective utilization of technology to obtain the desired results. A high level of cooperation among team members positively impacts project performance (Tarricone and Luca, 2002). Project effectiveness and efficiency increase when everybody contributes toward organizational goals. Project teams with good cooperative behavior and trained in IT tools may show good performance in project preparation, implementation, monitoring and control, and close-out. IT tools help them to settle goals, resolve conflicts, and add value to the project. As IT tools have become vital for effective and efficient PM and enable project managers to make decisions more accurately and efficiently, these tools are managed through the cooperative behavior of team members as teamwork (Havelka and Rajkumar, 2006). Therefore, teamwork is necessary for the effective adoption and utilization of IT tools so that a sustained project value can be achieved. Tohidi (2011) argued that teamwork is one of the encouraging aspects of PM. IT has the capability to allow project teams to interact, coordinate, and collaborate more commendably to perform teamwork, and teamwork further promotes project performance and value (Yang et al., 2012). This means that IT tools are crucial in PM to enhance teamwork and project value. Therefore, it can be hypothesized that:

H5: Teamwork mediates the association between IT tools and project value in construction projects in Pakistan.

2.6. Moderating role of top management support on the mediating role of teamwork

From the perspective of the PM, top management support provides confidence and self-reliance to project managers for executing projects through effective utilization of resources. Alshamaila et al. (2013) found that top management support, along with other social and technical factors, positively related to project performance. Taylor et al. (2012) described that top management enables project

teams to enhance appearance, accelerate teamwork, empower requirements, increase self-efficacy, and gain performance. Teamwork depends on organizational policies and procedures, combined acts and behaviors of project teams, and information and expectations of stakeholders to achieve a common goal. As teamwork largely influences project value, top management must monitor the aforesaid mechanisms. Green and Sergeeva (2019) argued that project managers mobilize resources to create project value and this can only be possible with the support of senior management. This type of support is crucial to integrate IT strategies through the creation of an appropriate environment in which decisions can be made to enhance team creation and coordination. Zwikael (2008) revealed a positive impact of top management support on the association of IT implementation with team coordination. This type of support is positively related to IT tools and teamwork (Young and Jordan, 2008). Therefore, it is reasonable to hypothesize that top management support positively moderates the mediating impact of teamwork in the association between IT tools and project value. Therefore, the following hypothesis can be formulated:

H6: Top management support positively moderates the mediating impact of teamwork in the association between IT tools and project value in construction projects in Pakistan.

2.7. Research model

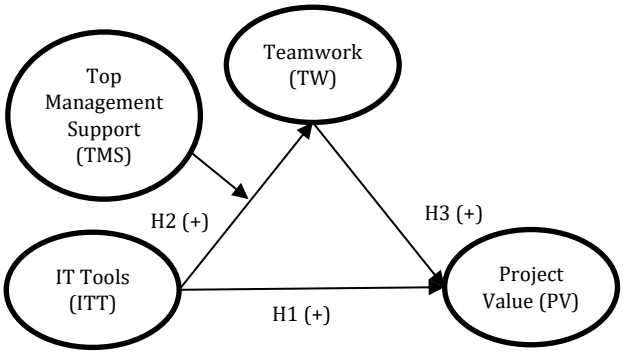
Based on the theoretical background and the proposed hypotheses, a research model was developed, as shown in Fig. 1. The model comprises IT tools as an independent variable, project value as a dependent variable, teamwork as a mediator, and top management support as a moderator. The model was estimated using a PLS-SEM-based data analysis technique.

3. Methodology

3.1. Operational measures

For the purpose of measuring the variables of the model, a questionnaire was constructed depending on the items adapted from the previous studies. The previous studies utilized and measured these items in various contexts and ensured their validity and reliability using different samples. However, we consulted this questionnaire and its items with three industry experts and two academicians to contextualize and localize the questionnaire and its items in the construction projects of Pakistan. The industry experts and academicians suggested some minor amendments to the items. The final questionnaire was carefully amended in line with the provided suggestions.

The scale to assess IT tools was adapted from Yang et al. (2012). The scale comprised 12 items. These items were assessed on a “five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree).” The scale to assess teamwork was adapted from Hoegl and Gemuenden (2001). The scale comprised six items. Each of the items of the scale was measured on a “five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree).” The scale to assess top management support was adapted from Igbaria et al. (1997). The scale comprised five items. All the items of the scale were evaluated on a “five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree).” The scale to assess project value was adapted from Yang et al. (2012) and Pinto and Mantel (1990). The scale comprised six items. Each item of the scale was assessed on a “five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree).”



The hypotheses H4, H5, and H6 related to the mediation and moderation are not shown

Fig. 1: Research model

3.2. Sampling technique and sample

The participants in this study were drawn from various roles within construction projects in Pakistan, including contractors, consultants, clients, architects, project managers, and project team members, involved in building, road, and dam projects. Given the vast number of individuals participating in Pakistan's construction projects, the exact number of potential participants was not known. Therefore, we used the Pakistan Engineering Council (PEC) directory as a source to identify potential respondents, employing purposive sampling to select suitable participants. This method, a specific kind of non-random sampling, allows for the selection of respondents based on specific criteria and recommendations, proving effective in increasing the sample size. The focus of analysis in this study was on the individual level.

To determine an appropriate minimum sample size, we adhered to the guidelines suggested by Marcoulides and Saunders (2006), who proposed calculating the sample size based on the number of variable indicators within the model. According to their "10 times rule," the minimum sample size should be at least ten times the number of indicators for the variable that has the most indicators in the study. In our case, the variable representing IT tools

had the most indicators, totaling 12. Thus, the calculated minimum sample size was 120. Despite this, we distributed 240 questionnaires to ensure a comprehensive sample.

3.3. Data collection

Before starting the data collection process, we carefully considered several ethical guidelines. Firstly, we obtained written agreement from participants, confirming their voluntary participation in the study. Secondly, participants were informed that they could withdraw from the study at any time without needing to provide a reason. Thirdly, we assured participants that their identities would remain confidential both during and after the study. Finally, we promised that the data they provided would be used solely for this study and that we would be cautious in our interpretation of the results to safeguard participant privacy.

The data was collected through survey questionnaires, a method known for its efficiency in gathering substantial amounts of data quickly and cost-effectively. We distributed the questionnaires to participants via mail, email, and in person. Participants were given up to two weeks to complete and return the questionnaires. Those who did not respond within this period received a reminder and were given an additional two weeks to respond. The data collection phase started in April 2023 and was completed by June 2023.

3.4. Data analysis

PLS-SEM is a widely used and respected method for analyzing quantitative data. It is particularly useful for examining both straightforward and intricate hypothesized connections among variables. This method can handle complex models that involve many variables, including a variety of mediators and moderators. It focuses on explaining the variance in the data and can analyze quantitative data without requiring the data to follow a normal distribution (Hair et al., 2019). Therefore, we chose to analyze our data using PLS-SEM. Specifically, we opted for SmartPLS 4.0 due to its strong reputation and user-friendly interface.

4. Results and discussion

4.1. Sample characteristics

During the initial 15-day deadline, 68 participants returned their completed questionnaires. Following this, a gentle reminder was sent to those who had not yet responded, encouraging them to submit their filled questionnaires as soon as possible. Thanks to the reminder, an additional 62 participants submitted their questionnaires, bringing the total number of respondents to 130. This resulted in a 65% response rate, which is considered good for studies in the social sciences.

The responses were divided into two groups: those received before the reminder (early responses) and those received after (late responses). This division was made to check for any bias due to non-response, which will be discussed later. The distribution of respondents' roles is shown in Table 1, indicating that 42 (32.31%) were project managers and 24 (18.46%) were contractors, making up over half of the respondents. Additionally, 15 (11.54%) were consultants, 12 (9.23%) were architects, and 10 (7.69%) were clients, highlighting that the majority of respondents were key stakeholders in construction projects with critical insights. The average experience of the respondents was 14 years, showing they had substantial experience and knowledge in emerging technologies relevant to construction project management.

The educational background of respondents varied, with 82 (63.08%) holding master's degrees, 32 (24.61%) having bachelor's degrees, and 16 (12.31%) having other qualifications like diplomas. Age-wise, the majority, 70 (53.85%), were between 31 to 40 years, followed by 27 (20.77%) in the 25 to 30 age group, 22 in the 41 to 50 group, and 11 (8.46%) over 50 years old. No participants were under 25 years of age. The study did not inquire about the gender of the participants, assuming that most individuals involved in construction projects in Pakistan are male, reflecting the country's cultural norms.

Table 1: Sample characteristics

Demographics (n = 130)	Frequency	Percentage
Designation		
Contractors	24	18.46
Consultants	15	11.54
Clients	10	7.69
Architects	12	9.23
Project Managers	42	32.31
Project Team Members	27	20.77
Experience (mentioned in years)	Median	
Experience	9	
Highest degree		
Master degree	82	63.08
Bachelor degree	32	24.61
Others	16	12.31
Age (years)		
Below 25	0	0
25 to 30	27	20.77
31 to 40	70	53.85
41 to 50	22	16.92
Above 50	11	8.46

4.2. Testing non-response and common method bias

In survey research, there are two main types of potential inaccuracies in the data collected: non-response bias and common method bias, as identified by Ali et al. (2021a). It's crucial to address these inaccuracies before proceeding with data analysis for testing hypotheses, as failing to do so can significantly undermine the reliability of the findings. In this study, specific tests were conducted to check for the presence of non-response bias and common method bias in our data.

To assess non-response bias, which occurs when the opinions of those who did not respond to the survey differ significantly from those who did, we employed Levene's Test for Equality of Variances. This test compares early and late responses against demographic variables like experience, age, gender, etc. A lack of significant differences between early and late responses, indicated by a p-value greater than 0.05, suggests that the data is representative of the entire target population, meaning that non-respondents likely share similar views with those who responded. Our findings showed no significant variance ($p > 0.05$), indicating our data is not affected by non-response bias.

To tackle common method bias, which can occur when both independent and dependent variable data come from the same sources, we applied Harman's single-factor test. This test checks if a single factor accounts for most of the variance in the data. A result showing one factor explaining less than 50% (Podsakoff et al., 2003) of the variance, which we found to be 41.92%, and a correlation matrix analysis revealing correlations between variables below 0.9 confirms that our data does not suffer from common method bias (Bagozzi et al., 1991). These steps ensured the integrity and reliability of our data for hypothesis testing.

4.3. Estimating the research model in PLS-SEM

PLS-SEM is highly capable of estimating more complex models with multiple variables, including mediators and moderators. Although moderation and mediation analyses are well employed and understood using PLS-SEM, conditional mediation (CoMe) that involves both moderation and mediation into a single model is less employed and understood using PLS-SEM (Cheah et al., 2021). A CoMe analysis unites both moderation and mediation analyses into a single model to test the hypotheses. This happens when one or more moderators interact with one or more paths of mediation effect. The mediation effect is moderated by some other variable(s). More specifically, a CoMe model is a mediation model that also comes with moderator(s) on one or both of the indirect paths. We not only determine the mediation effect but also see whether the moderator(s) changes the strength of the mediation effect.

The PLS-SEM estimates a research model into two parts: 1) estimation of the measurement model and 2) estimation of the structural model. The former is estimated to ensure reliability and validity, whereas the latter is estimated to test hypotheses.

4.3.1. Estimating the measurement model

The measurement model is estimated by analyzing "reliability," "internal consistency reliability," "convergent validity," and "discriminant validity." The reliability and convergent validity are analyzed through "outer loading," "Cronbach's alpha coefficient," "composite reliability (CR)," and "average variance extracted (AVE)" (Hair et al., 2017). The discriminant validity is analyzed through the "Heterotrait-Monotrait ratio of correlations (HTMT) criterion." The results of the PLS-SEM algorithm are shown in Table 2. The results show that "factor loading" of all the indicators of all the variables is above 0.7, "Cronbach's alpha coefficient" is above 0.7, "CR" is above 0.7, and AVE is above 0.7, which are all above the minimum threshold of 0.7 proposed by Hair et al. (2017). This shows that "reliability," "internal consistency reliability," and "convergent validity" have been ensured. The discriminant validity was analyzed through the "HTMT criterion." The results of the "HTMT criterion" are shown in Table 3. The results show that all HTMT values are lower than 0.85, which is the condition to ensure discriminant validity (Henseler et al., 2014). Thus, discrimination has also been ensured.

4.3.2. Estimating the structural model

The purpose of estimating the structural model is to test the hypotheses. This model is estimated by analyzing the "coefficient of determination (R^2)," "path coefficient strength (β), and "significance (t-value)." Table 4, Table 5, and Table 6 demonstrate the results of PLS bootstrapping. Table 4 shows that 49.2% (R^2 =.492) variance in the endogenous variable teamwork (TW) is explained by the exogenous variable IT tools (ITT), and 52.1% (R^2 =.492) variance in the endogenous variable project value (PV) is explained by exogenous variables IT tools (ITT) and teamwork (TW) which are both higher than the threshold value of 30% (Hair et al., 2017).

Table 5 shows the direct relationships among the variables. It is clear from Table 5 that IT tools (ITT) are positively related to project value (PV) (β = 0.6465, t = 4.7727). This indicates that H1 is supported. Also, IT tools (ITT) are positively related to teamwork (TW) (β = 0.7571, t = 5.4454). This indicates that H2 is supported. Teamwork (TW) is positively related to project value (PV) (β = 0.4867, t = 3.4561). This indicates that H3 is supported. Moreover, the interaction effect of IT tools (ITT) and top management (TMS) is positively related to teamwork (TW) (β = 0.2705, t = 2.9873). This indicates that H4 is supported. In this way, the hypotheses (H1 to H4) related to the direct effects are supported in this study.

Table 6 shows the indirect relationships among the variables. It is clear from Table 6 that the indirect effect of IT tools (ITT) on project value (PV) through teamwork (TW) is significant (β = 0.3685, t = 2.5567). The results in Table 5 have already revealed that the direct effect of IT tools (ITT) on project value (PV) is significant (β = 0.6465, t = 4.7727). Hair et al. (2017) mentioned that if both direct and indirect effects are significant, then mediation exists in the model. However, they specified that the magnitude or strength of mediation depends on the value of "variance accounted for (VAF)." They further

mentioned that VAF ≤ 0.20 means no mediation, 0.20 < VAF < 0.80 means partial mediation, and VAF ≥ 0.80 means full mediation. The VAF is calculated as "VAF = Indirect effect/Total effect, where Total effect = Direct effect + Indirect effect." Based on our results, "VAF = 0.3685 / (0.6465 + 0.3685) = 0.3631." This unveils that 36.31% of ITT's effect on project value (PV) is explained by teamwork (TW) as a mediator. In other words, ITT transmits its 36.31% effect on project value (PV) through teamwork (TW) as a mediator. This ensures that mediation exists in the model. However, the magnitude or strength of mediation depends on the value of VAF. VAF in this study is between 0.20 and 0.80, so a partial mediation exists. Therefore, H5, although partially, is supported in this study.

Table 2: Reliability and convergent validity

Variables	Indicators	Outer loading	CR	Cronbach's alpha	AVE
IT Tools (ITT) (12-items)	ITT1	0.832	0.876	0.873	0.616
	ITT 2	0.957			
	ITT 3	0.950			
	ITT 4	0.775			
	ITT 5	0.781			
	ITT 6	0.942			
	ITT 7	0.952			
	ITT 8	0.948			
	ITT 9	0.945			
	ITT 10	0.738			
	ITT 11	0.754			
	ITT12	0.741			
Teamwork (TW) (3-items)	TW1	0.754	0.873	0.858	0.629
	TW2	0.723			
	TW3	0.912			
	TW4	0.754			
	TW5	0.731			
	TW6	0.892			
Top Management Support (TMS) (5-items)	TMS1	0.816	0.901	0.832	0.602
	TMS2	0.747			
	TMS3	0.817			
	TMS4	0.751			
	TMS 5	0.764			
Project Value(PV) (6-items)	PV1	0.875	0.816	0.803	0.652
	PV2	0.875			
	PV3	0.853			
	PV4	0.756			
	PV5	0.779			
	PV6	0.819			

Table 3: HTMT Criterion

	ITT	TW	TMS	PV
ITT				
TW	0.470			
TMS	0.576	0.459		
PV	0.615	0.569	0.694	

Table 4: Coefficient of determination (R^2)

Endogenous variable	R^2
TW	0.492
PV	0.521

Table 5: Direct relationships

Direct relationships	β	t-value	Hypothesis
ITT→ PV	0.6465	4.7727	Supported
ITT→ TW	0.7571	5.4454	Supported
TW→ PV	0.4867	3.4561	Supported
ITT*TMS→TW	0.2705	2.9873	Supported

In order to test the moderation effect of top management support (TMS) on the mediation effect of teamwork (TW) in the relation between ITT and PV, also known as the CoMe effect or moderated mediation effect, the research applied the criterion suggested by Cheah et al. (2021). According to this criterion, low, high, mean, and index values are analyzed to note the CoMe effect. The results related to these values are presented in Table 6, which shows that the index value of TMS for moderated mediation effect is significant [index = 0.0628, CI = 0.0304 - 0.0714)]. It is also obvious from Table 6 that at a greater level of TMS, the indirect effect of ITT on PV through TW is larger (β= 0.1693, p < 0.001) as compared to the indirect effect at a lower level of TMS (β= 0.1189, p < 0.001). This shows that with an increase in TMS, the indirect effect of ITT on PV through TW is increased. Hence, H6 is also supported.

4.4. Discussion

The results indicated that all the six proposed hypotheses have been supported in this study. More specifically, the results indicated that IT tools positively impact project value. This makes sense because IT tools are crucial for project scheduling and cost estimation more accurately and efficiently. IT tools help project managers to set targets and trace progress against the settled targets. These tools increase possibilities for managing projects through new methods, techniques, and create opportunities for innovative products. This finding has also been corroborated by the study of Hemmati and Hosseini (2016). The results demonstrate that IT tools positively impact teamwork. This is understandable because IT tools enhance communication and collaboration among the project team members and facilitate dissemination of information and project status updates more rapidly. The use of the Internet and email is crucial for teamwork as these IT tools keep the project team(s) well informed about the

latest developments in the projects in terms of schedule, cost and specifications. Through email, project teams may collaborate with vendors, contractors, clients and other stakeholders for timely information and requirements.

Table 6: Indirect relationships

Indirect relationships	Direct effect	Indirect effect	Confidence interval low/high	P-value	Hypothesis
ITT→ TW→PV	0.6465 (4.7727)	0.3685 (2.5567)	0.1720/0.4076	0.000	Supported
Probing moderated indirect relationships					
Low level of TMS		0.1189	0.2341/0.7552	0.000	Supported
High level of TMS		0.2197	0.1504/0.3199	0.000	
Mean level of TMS		0.1693	0.1130/0.2387	0.000	
Index of moderated mediation		0.0628	0.0304/0.0714	0.023	

Through video conferencing, they can meet with each other and other stakeholders to share their views and discuss options. This makes the decision-making process more fast and effective. Through information portals, project teams can be kept up to date to enhance team cohesion that is vital for team effectiveness and performance. This finding has also been supported by Ali et al. (2021b). The results also indicated that teamwork positively impacts project value. This is due to the fact that through project teamwork, new knowledge, methods, ideas, and inventions are generated in the projects. Project team members with varying background, knowledge, skills, and expertise produce innovative and excellent results that meet clients' needs and requirements. Through teamwork, projects achieve better project value due to synergistic efforts of the team. The result is similar to the study of Iqbal et al. (2017).

Moreover, the results indicated that top management support positively moderates the impact of IT tools on teamwork. This is because top management provides the necessary resources for project implementation and removes hurdles to accelerate project performance. Although IT tools improve and accelerate teamwork, top management support strengthens this relationship by providing necessary resources, guidelines, and encouragement. This improves the confidence of project teams in using IT tools for PM. Furthermore, the results exhibited that teamwork mediates the association between IT tools and project value. This means that IT tools are not sufficient to increase project value, but teamwork is necessary to get the full advantage of IT tools in creating project value. Therefore, project managers should give special attention to teamwork while using IT tools. This might be due to the fact that IT tools at individual levels or different tools by different people may create understandability and interoperability issues, which further hinder the project's progress. Finally, the results indicated that top management support positively moderates the mediation effect of teamwork in the association between IT tools and project value. This is the important result of this study. As teamwork is vital for enhancing project value by using IT tools, top management support is still necessary. Without top management support, teamwork is not sufficient to enhance project value. IT tools are only effective for creating project value when these tools are implemented at the team level, used by project teams, and supported by top management. This is the major finding and novelty of this study. Previous studies rarely investigated these types of relationships using PLS-SEM (Cheah et al., 2021). The study provides many theoretical and managerial implications, which will be discussed in the next subsections.

4.4.1. Theoretical implications

The study provides many theoretical insights which are vital for researchers and academicians. First, it focuses on the theoretical aspects of PM and enhances understanding of project value. Prior studies mainly emphasize project performance or project success instead of project value. The project value is one of the PM aspects that deals with the utilization of new knowledge, methods, and innovation in developing projects and also involves excellent results, successful outcomes, and overall project benefits to meet and exceed stakeholders' needs (Barnes et al., 2020). Thus, the study adds to the project value management literature through an explanatory model that is novel and new. Second, the study focuses on the importance of teamwork in using IT tools in PM to create project value. This corroborates the importance of IT tools and teamwork in creating project value and advances the existing methodologies of PM. Third, the study focuses on the moderating role of top management support on the mediation effect of teamwork in the association between IT tools and project value. Previous studies have not investigated the role of top management support, i.e., the CoMe effect. In this way, the study contributes to and advances the existing frameworks and theories of PM. Lastly, future researchers, academicians, and students interested in construction PM can use the model and methodology of this study to extend it to other contexts. They can test and extend the model with more and new data by including more organizations and countries so that the generalizability of the results can be enhanced. They can test the model with other moderating and mediating variables and even with various permutations of the CoMe model to develop new theories. Overall, the study is significant for researchers, academicians, and PM students to understand and learn new knowledge and insights for developing projects in the context of a developing country.

4.4.2. Managerial implications

This study offers several practical insights that are important for professionals in the field. Firstly, construction project managers in Pakistan can use these findings to better understand what contributes to the value of a project. Recognizing the critical factors that drive project value, they can strategically focus on these areas to enhance the worth and stakeholder satisfaction of construction projects. Specifically, by appreciating the role of IT tools in project management, managers can foster a stronger team dynamic, which is essential for the successful completion of projects. Teamwork, in conjunction with IT tools, is key to maximizing project value, emphasizing that while IT tools alone are not enough, their full potential is unlocked through collaborative efforts. Additionally, the backing of top management is highlighted as a vital element that positively influences teamwork, the use of IT tools, and, ultimately, project value, underscoring the interconnected nature of these factors.

Secondly, managers can leverage these insights to assess the relative importance of each determinant of project value. This enables them to allocate their limited resources more effectively, focusing on the most critical areas for enhancing project value. Thirdly, the outcomes of this research can guide project managers in developing new project management strategies, business models, or improving existing frameworks, tailored to boost project performance and value.

Lastly, the findings of this study have implications beyond Pakistan, offering valuable lessons for other developing countries with similar conditions. This means that the insights derived from this study can assist project teams, managers, and decision-makers in these nations to plan and execute their construction projects more efficiently, fostering greater project success.

5. Conclusions

This study investigated how support from top management affects the role of teamwork in linking IT tools with project value in construction projects in Pakistan. A research model, known as the moderated mediation model or CoMe model, was crafted to explore the relationships among these variables. Based on this framework, six hypotheses were set forth, leading to the creation of an explanatory research model grounded in these hypotheses. The hypotheses were tested using data from 130 participants in Pakistani construction projects through PLS-SEM. The findings revealed that IT tools have a positive effect on both project value and teamwork. Additionally, teamwork enhances project value and serves as a bridge between IT tools and project value. Top management support further strengthens the positive influence of teamwork in this dynamic.

The study emphasizes the critical roles of top management support and teamwork in the successful management of construction projects. It points out that teamwork is essential for realizing the full potential of IT tools in project management. Without effective teamwork, the beneficial impact of IT tools on project value might not be fully realized. Project value is maximized when project teams utilize IT tools collaboratively. The study also highlights that alongside promoting teamwork, it's crucial for project managers to ensure strong support from top management. Both teamwork and top management support are key to enhancing the adoption and effective use of IT tools in creating project value.

Despite the meticulous approach and comprehensive analysis, the study acknowledges certain limitations. It focuses solely on construction projects in Pakistan, suggesting that including projects from different industries and countries could broaden the applicability of the findings. The cross-sectional nature of the data collection presents another limitation, with the suggestion that a longitudinal approach could offer a deeper understanding of the studied phenomena. Additionally, the study primarily relies on quantitative data, and incorporating qualitative data could provide richer insights. The study recommends considering organization type and experience as control variables for more nuanced results and suggests including training as an additional moderating factor to explore the impact of IT tool training on the use of these tools in project management. Finally, it proposes replacing the general term 'IT tools' with 'project management software' to more accurately reflect the specific technologies used in project management.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Afzalur Rahim M (2002). Toward a theory of managing organizational conflict. International Journal of Conflict Management, 13(3): 206–235. https://doi.org/10.1108/eb022874

Ahmed R, Mohamad NA, and Ahmad MS (2014). Effect of multidimensional top management support on project success: An empirical investigation. Quality and Quantity, 50(1): 151–176. https://doi.org/10.1007/s11135-014-0142-4

Ali A, Iqbal S, Haider SA, Tehseen S, Anwar B, Sohail M, and Rehman K (2021a). Does governance in information technology matter when it comes to organizational performance in Pakistani public sector organizations? Mediating effect of innovation. SAGE Open, 11(2): 1-16. https://doi.org/10.1177/21582440211016557

Ali H, Chuanmin S, Ahmed M, Mahmood A, Khayyam M, and Tikhomirova A (2021b). Transformational leadership and project success: Serial mediation of team-building and teamwork. Frontiers in Psychology, 12: 689311.

https://doi.org/10.3389/fpsyg.2021.689311
PMid:34557131 PMCid:PMC8453157

Aljawder M (2020). Impact of manager's role and information and communication technologies (ICT) on the construction projects. International Journal of Computing and Digital Systems, 9(3): 377–389. https://doi.org/10.12785/ijcds/090304

Alshamaila Y, Papagiannidis S, and Li F (2013). Cloud computing adoption by SMEs in the North East of England. Journal of Enterprise Information Management, 26(3): 250–275. https://doi.org/10.1108/17410391311325225

Bagozzi RP, Yi Y, and Phillips LW (1991). Assessing construct validity in organizational research. Administrative Science Quarterly, 36(3): 421–458. https://doi.org/10.2307/2393203

Bardhan I, Mithas S, and Lin S (2009). Performance impacts of strategy, information technology applications, and business process outsourcing in U.S. manufacturing plants. Production and Operations Management, 16(6): 747–762. https://doi.org/10.1111/j.1937-5956.2007.tb00293.x

Barnes PT, Vu AT, Matsumoto T, Kobayashi SI, Nguyen TL, Chahade T, Schober KU, Morillas L, Byers EA, and Amezaga JM (2020). BIM for project managers. ICE Publishing, London, UK. https://doi.org/10.1680/bimpm.65291

Black SE and Lynch LM (2001). How to compete: The impact of workplace practices and information technology on productivity. Review of Economics and Statistics, 83(3): 434–445. https://doi.org/10.1162/00346530152480081

Brynjolfsson E and Yang S (1996). Information technology and productivity: A review of the literature. Advances in Computers, 43: 179–214. https://doi.org/10.1016/S0065-2458(08)60644-0

Camilleri E (2011). Project success: Critical factors and behaviours. Gower Publishing, Ltd., Aldershot, UK.

Cheah JH, Nitzl C, Roldán JL, Cepeda-Carrion G, and Gudergan SP (2021). A primer on the conditional mediation analysis in PLS-SEM. ACM SIGMIS Database: The DATABASE for Advances in Information Systems, 52(SI): 43–100. https://doi.org/10.1145/3505639.3505645

Chiocchio F (2007). Project team performance: A study of electronic task and coordination communication. Project Management Journal, 38(1): 97–109. https://doi.org/10.1177/875697280703800110

Dainty A, Moore D, and Michael M (2007). Communication in construction: Theory and practice. Routledge, Oxfordshire, UK. https://doi.org/10.4324/9780203358641

Dostie B and Jayaraman R (2012). Organizational redesign, information technologies and workplace productivity. The B.E. Journal of Economic Analysis and Policy, 12(1): 4. https://doi.org/10.1515/1935-1682.2802

Elbashir MZ, Collier PA, and Sutton SG (2011). The role of organizational absorptive capacity in strategic use of business intelligence to support integrated management control systems. The Accounting Review, 86(1): 155–184. https://doi.org/10.2308/accr.00000010

Galbraith J (1973). Designing complex organizations. Addison-Wesley, Boston, USA.

Garriga E (2014). Beyond stakeholder utility function: Stakeholder capability in the value creation process. Journal of Business Ethics, 120(4): 489–507. https://doi.org/10.1007/s10551-013-2001-y

Green SD and Sergeeva N (2019). Value creation in projects: Towards a narrative perspective. International Journal of Project Management, 37(5): 636–651. https://doi.org/10.1016/j.ijproman.2018.12.004

Hair JF, Hult GT, Ringle CM, and Sarstedt M (2017). A primer on partial least squares structural equation modeling (PLS-SEM). SAGE, Newcastle, UK.

Hair JF, Risher JJ, Sarstedt M, and Ringle CM (2019). When to use and how to report the results of PLS-SEM. European Business Review, 31(1): 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Havelka and Rajkumar (2006). Using the troubled project recovery framework: Problem recognition and decision to recover. E-Service Journal, 5(1): 43–73. https://doi.org/10.2979/esj.2006.5.1.43

Hemmati M and Hosseini H (2016). Effect of IT application on project performance focusing on the mediating role of organizational innovation, knowledge management and organizational capabilities. Engineering, Technology and Applied Science Research, 6(6): 1221–1226. https://doi.org/10.48084/etasr.769

Henseler J, Ringle CM, and Sarstedt M (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1): 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hoegl M and Gemuenden HG (2001). Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. Organization Science, 12(4): 435–449. https://doi.org/10.1287/orsc.12.4.435.10635

Hoegl M, Weinkauf K, and Gemuenden HG (2004). Interteam coordination, project commitment, and teamwork in multiteam R&D projects: A longitudinal study. Organization Science, 15(1): 38–55. https://doi.org/10.1287/orsc.1030.0053

Hwang MI (2019). Top management support and information systems implementation success: A meta-analytical replication. International Journal of Information Technology and Management, 18(4): 347–361. https://doi.org/10.1504/IJITM.2019.103050

Igbaria M, Zinatelli N, Cragg P, and Cavaye AL (1997). Personal computing acceptance factors in small firms: A structural equation model. MIS Quarterly, 21(3): 279–305. https://doi.org/10.2307/249498

Iqbal SMJ, Nawaz MS, Bahoo S, and Abdul ML (2017). Impact of project teamwork on project success in Pakistan. South Asian Journal of Management, 11(1): 1-13. https://doi.org/10.21621/sajms.2017111.01

Ji H and Yan J (2020). How team structure can enhance performance: Team Longevity's moderating effect and team coordination's mediating effect. Frontiers in Psychology, 11: 1873. https://doi.org/10.3389/fpsyg.2020.01873
PMid:32849099 PMCid:PMC7411077

Joslin R and Müller R (2016). The relationship between project governance and project success. International Journal of Project Management, 34(4): 613-626. https://doi.org/10.1016/j.ijproman.2016.01.008

Kazanjian RK, Drazin R, and Glynn MA (2000). Creativity and technological learning: The roles of organization architecture and crisis in large-scale projects. Journal of Engineering and Technology Management, 17(3-4): 273–298. https://doi.org/10.1016/S0923-4748(00)00026-6

Kulkarni U, Robles-Flores J, and Popovič A (2017). Business intelligence capability: The effect of top management and the mediating roles of user participation and analytical decision making orientation. Journal of the Association for Information Systems, 18(7): 516–541. https://doi.org/10.17705/1jais.00462

Laursen M and Svejvig P (2016). Taking stock of project value creation: A structured literature review with future directions for research and practice. International Journal of Project

Management, 34(4): 736–747. https://doi.org/10.1016/j.ijproman.2015.06.007

Liang H, Saraf N, Hu Q, and Xue Y (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. MIS Quarterly, 31(1): 59-87. https://doi.org/10.2307/25148781

Marcoulides GA and Saunders C (2006). Editor's comments: PLS: A silver bullet? MIS Quarterly, 30(2): 3-9. https://doi.org/10.2307/25148727

Marion TJ, Barczak G, and Hultink EJ (2014). Do social media tools impact the development phase? An exploratory study. Journal of Product Innovation Management, 31(S1): 18–29. https://doi.org/10.1111/jpim.12189

Marnewick C and Marnewick AL (2022). Digitalization of project management: Opportunities in research and practice. Project Leadership and Society, 3: 100061. https://doi.org/10.1016/j.plas.2022.100061

Morakanyane R, Grace A, and O'Reilly P (2017). Conceptualizing digital transformation in business organizations: A systematic review of literature. In the Proceedings of the 30th Bled eConference: Digital Transformation—From Connecting Things to Transforming our Lives (BLED 2017), Bled, Slovenia: 427–443. https://doi.org/10.18690/978-961-286-043-1.30

Müller R and Turner R (2010). Leadership competency profiles of successful project managers. International Journal of Project Management, 28(5): 437–448. https://doi.org/10.1016/j.ijproman.2009.09.003

Muñoz-Carril PC, Hernández-Sellés N, Fuentes-Abeledo EJ, and González-Sanmamed M (2021). Factors influencing students' perceived impact of learning and satisfaction in computer supported collaborative learning. Computers and Education, 174: 104310. https://doi.org/10.1016/j.compedu.2021.104310

Oke AE (2022). Project value: A measure of project success. In: Oke AE (Ed.), Measures of sustainable construction projects performance: 61-66. Emerald Publishing Limited, Bingley, UK. https://doi.org/10.1108/978-1-80382-997-520221015

Patanakul P and Shenhar AJ (2012). What project strategy really is: The fundamental building block in strategic project management. Project Management Journal, 43(1): 4–20. https://doi.org/10.1002/pmj.20282

Pellerin R, Perrier N, Guillot X, and Léger PM (2022). Project characteristics, project management software utilization and project performance: An impact analysis based on real project data. International Journal of Information Systems and Project Management, 1(3): 5–26. https://doi.org/10.12821/ijispm010301

Pinto JK and Mantel SJ (1990). The causes of project failure. IEEE Transactions on Engineering Management, 37(4): 269–276. https://doi.org/10.1109/17.62322

Pitelis CN and Vasilaros V (2010). The determinants of value and wealth creation at the firm, industry, and national levels: A conceptual framework and evidence. Contributions to Political Economy, 29(1): 33–58. https://doi.org/10.1093/cpe/bzq003

Podsakoff PM, MacKenzie SB, Lee JY, and Podsakoff NP (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5): 879–903. https://doi.org/10.1037/0021-9010.88.5.879 **PMid:14516251**

Raymond L, Bergeron F, Croteau AM, Ortiz de Guinea A, and Uwizeyemungu S (2020). Information technology-enabled explorative learning and competitive performance in industrial service SMEs: A configurational analysis. Journal of Knowledge Management, 24(7): 1625–1651. https://doi.org/10.1108/JKM-12-2019-0741

Rimmington A, Dickens G, and Pasquire C (2015). Impact of information and communication technology (ICT) on construction projects. Organization, Technology and Management in Construction: An International Journal, 7(3): 1367–1382. https://doi.org/10.5592/otmcj.2015.3.4

Riyaz R, Sachar A, and Singla S (2022). Project management of an automotive industrial building using MS project and Primavera. International Journal of Innovative Research in Engineering and Management, 9(1): 14–18. https://doi.org/10.55524/ijirem.2022.9.1.3

Safapour E, Kermanshachi S, and Tafazzoli M (2020). Selection of best practices for mitigating complexity in construction projects. In the Construction Research Congress 2020: Project Management and Controls, Materials, and Contracts, American Society of Civil Engineers, Reston, USA: 667-675. https://doi.org/10.1061/9780784482889.070

Soriano JL (2016). Maximizing benefits from IT project management: From requirements to value delivery. CRC Press, Boca Raton, USA. https://doi.org/10.1201/b11293

Tarricone P and Luca J (2002). Employees, teamwork and social interdependence – A formula for successful business? Team Performance Management: An International Journal, 8(3/4): 54–59. https://doi.org/10.1108/13527590210433348

Tarutė A and Gatautis R (2014). ICT impact on SMEs performance. Procedia - Social and Behavioral Sciences, 110: 1218–1225. https://doi.org/10.1016/j.sbspro.2013.12.968

Taylor H, Woelfer JP, and Artman E (2012). Information technology governance in practice. International Journal of Information Technology Project Management, 3(3): 14–30. https://doi.org/10.4018/jitpm.2012070102

Thomas J and Mullaly M (2008). Researching the value of project management. Project Management Institute, Atlanta, USA.

Tohidi H (2011). Teamwork productivity and effectiveness in an organization base on rewards, leadership, training, goals, wage, size, motivation, measurement and information technology. Procedia Computer Science, 3: 1137–1146. https://doi.org/10.1016/j.procs.2010.12.185

Tohidi H and Tarokh MJ (2006). Productivity outcomes of teamwork as an effect of information technology and team size. International Journal of Production Economics, 103(2): 610–615. https://doi.org/10.1016/j.ijpe.2005.12.002

Tsou HT and Chen JS (2021). How does digital technology usage benefit firm performance? Digital Transformation Strategy and organisational innovation as mediators. Technology Analysis and Strategic Management, 35(9): 1114–1127. https://doi.org/10.1080/09537325.2021.1991575

Ulmanis J and Deniņš A (2012). A management model of ICT adoption in Latvia. Procedia - Social and Behavioral Sciences, 41: 251–264. https://doi.org/10.1016/j.sbspro.2012.04.029

Vial G (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2): 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Yang LR, Chen JH, and Wang HW (2012). Assessing impacts of information technology on project success through knowledge management practice. Automation in Construction, 22: 182–191. https://doi.org/10.1016/j.autcon.2011.06.016

Yang LR, Wu KS, and Huang CF (2013). Validation of a model measuring the effect of a project manager's leadership style on project performance. KSCE Journal of Civil Engineering, 17(2): 271–280. https://doi.org/10.1007/s12205-013-1489-0

Young R and Jordan E (2008). Top management support: Mantra or necessity? International Journal of Project Management, 26(7): 713–725. https://doi.org/10.1016/j.ijproman.2008.06.001

Zott C and Amit R (2010). Business model design: An activity system perspective. Long Range Planning, 43(2–3): 216–226. https://doi.org/10.1016/j.lrp.2009.07.004

Zwikael O (2008). Top management involvement in project management. International Journal of Managing Projects in Business, 1(3): 387–403. https://doi.org/10.1108/17538370810883837