**Investigating the impact of task-oriented, relationship-oriented, and innovation-oriented leadership competencies on project success in Pakistan: A moderated model of multi-dimensional senior management support**

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**Abstract**

Although project management is widely used in many organizations, engineering projects often encounter major difficulties that remain a pressing concern to be addressed in the field of engineering and project management. To address such concerns, different clusters of leadership competencies and various types of support from senior management are required. This study aims to investigate the impact of multi-dimensional senior management support on the relationship between clusters of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented) and the success of public sector projects. A survey-based questionnaire was used to collect primary data from 197 project managers and project directors of public sector development projects in Pakistan. The findings reveal a significant and positive relationship between task-oriented, relationship-oriented, and innovation-oriented competencies, project success, and all five dimensions of senior management support. Furthermore, the relationships between task-oriented, relationship-oriented, and innovation-oriented competencies and project success are not strengthened in the presence of providing resources, communication, expertise, and power, whereas structural arrangements have a significant impact on the relationship between innovation-oriented leadership competencies and project success. The finding implies that the adoption of validated leadership competencies and multi-dimensional senior management support enables engineering and project managers to enhance the likelihood of project success.

**Keywords**: Task-oriented competencies, relationship-oriented competencies, innovation-oriented competencies, project success, senior management support, development projects, Pakistan.

**Introduction**

Project management has widely been adopted across many engineering-related industries and organizations over the last few decades. Yet there is no guarantee of projects not encountering difficulties as well as delivering the desired outcomes and long-term objectives with the use of existing project management tools. The necessity of improving project performance is a common concern in engineering projects, in addition to ensuring that project outputs are utilized by the eventual users or customers (Razmdoost & Mills, 2016). In recent times, the level of interest by both researchers and practitioners has been increasing the human aspects of project management, especially the role and significance of competencies in managing projects (Zhang, Yang, Liao, & Chen, 2020). Although, deficiency in leadership competencies of project managers has been identified as a critical success factor of projects, in addition to inadequate support from senior management (Ahmed & Anantatmula, 2017). Indeed, an underestimation of the depth of skills and competencies required by project managers for the successful delivery of projects can cause challenges that may ultimately lead to project failure (Ledford, 2015; Urton & Murray, 2021). Also, the lack of emphasis on the leadership competencies of project managers has been highlighted by scholars that may affect the required knowledge to lead and deliver projects (Denicol, Davies, & Krystallis, 2020). The likelihood of project success cannot be improved without enhancing the competencies of project managers, in addition to ensuring sufficient resources and support is available from senior management (Berg & Karlsen, 2016). Due to the interest of researchers, the focus on competencies and abilities for managing projects has led to an emerging research gap regarding leadership competencies required in various industries and sectors (de Rezende, Blackwell, Denicol, & Guillaumon, 2021). Furthermore, an assessment of critical leadership competencies and the requisite support needed to enhance the rate of project success through a comprehensive analysis encompassing all the relevant features of a project is required (Ahmed & bin Mohamed, 2017; Todorović, Petrović, Mihić, Obradović, & Bushuyev, 2015).

Researchers and practitioners are consistently ascertaining the reasons to overcome the challenges of the low rate of project success and corresponding high project failure (Wang, Fu, & Fang, 2019). This can be viewed as an important requirement where improved engineering management can be deployed to ensure projects are adequately supported. Moreover, various researchers have emphasized that organizations often face challenges in developing the leadership expertise of project managers for the successful implementation of projects (Khoury & McNally, 2016; Megheirkouni, 2018; Megheirkouni & Mejheirkouni, 2020). Such challenges can be addressed by developing the required skills, behaviors, and attitudes, to build an individual’s competencies as well as through training or mentoring (Megheirkouni & Mejheirkouni, 2020). On this matter, organizations need to set clear directions on how to grow in the future and achieve project targets, while the success of development projects heavily depends on meeting the objectives of cost, time, scope, and customer satisfaction (Demirkesen & Bayhan, 2020). However, the success of development projects cannot be achieved without different clusters of leadership competencies and multi-dimensional support from senior management (Ahmed & bin Mohamed, 2017; Ahmed, Philbin, & Cheema, 2021; Limsila & Ogunlana, 2008).

Development projects are implemented to improve the living conditions of society, although such projects often suffer from cost and schedule overruns (Jaifer, Beauregard, & Bhuiyan, 2021). In this context, there is a need to consider the capabilities of project managers and the impact of sufficient backing from senior management in the public sector to ensure the success rate of projects is improved (Shao, 2018). As evident, the poor performance of projects in the public sector of Pakistan has been reported where development projects took 64 months to be completed against the planned schedule of 32 months (Ahmed & bin Mohamad, 2014; Planning Commission, 2011). There has been found that the lack of competent human resources, weak project supervision, and insufficient availability of funds are the main causes of these problems in public sector projects in Pakistan (Irfan et al., 2021). Also, public sector projects implemented in Pakistan under the Public Sector Development Program (PSDP) have suffered from delays and cost overruns due to ineffective human resources and insufficient support from senior management (Ahmed & Lodhi, 2021). As a result, public-sector organizations have started to look for innovative methods for increasing the success rates of projects. Although project management tools and techniques help project managers to reduce the chances of projects becoming unsuccessful, there remains a continued need to rectify this issue for development projects (Qazi, Dikmen, & Birgonul, 2020). Indeed, the success rate of development projects cannot be improved without ensuring the necessary competencies of project managers are in place (Asian Development Bank, 2009) along with the availability of adequate support from senior management (Young & Poon, 2013). However, earlier research appears to have given little or no attention to the competencies of project managers as well as a different type of support from senior management in public sector projects, even though the number of public sector projects is rapidly increasing around the world and thus demands attention (Irfan et al., 2021). Therefore, this study aims to investigate the impact of multi-dimensional senior management support on the link between task-oriented, relationship-oriented, and innovation-oriented competencies and project success.

Although several studies have investigated the effect of various leadership competencies on projects, they were limited to examining the relationship between intellectual, managerial, and emotional competencies with project success (Ahmed & Lodhi, 2021; Cleveland & Cleveland, 2020; de Rezende et al., 2021), investigating the impact of managerial political competencies (Mashavira, Chipunza, & Dzansi, 2021), project leadership competencies (Ahmed & Philbin, 2022), project management competencies (Ahmed & Anantatmula, 2017; da Silva, Jerónimo, & Vieira, 2019; Magano et al., 2020), identifying policy management competencies (Zulkarnaen & Madhakomala, 2020), and behavioral competencies (Alvarenga, Branco, Guedes, Soares, & e Silva, 2019; Asree, Cherikh, & Baucum, 2019; Owusu-Manu, Debrah, Amissah, Edwards, & Chileshe, 2020). However, these earlier studies have neither identified the clusters of leadership competencies nor explored the corresponding relationships among such competencies involved in projects. To address this concern, Ahmed, Philbin, et al. (2021) conducted a comprehensive systematic literature review, which identified three clusters of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented), and recommended further exploration and validation of the relationships between these clusters of leadership competencies and project success. Therefore, empirical research has yet to be conducted to explore the interaction between task-oriented, relationship-oriented, and innovation-oriented competencies and project success. Consequently, there is a paucity of research investigating the link between leadership competencies (namely task-oriented, relationship-oriented, and innovation-oriented) and project success (Alvarenga et al., 2019) and especially in the presence of senior management support as a moderator (Afzal, Khan, & Mujtaba, 2018). Thus, this study aims to fill the aforementioned gap and answer the following research questions:

RQ1: Do task-oriented, relationship-oriented, and innovation-oriented leadership competencies impact on project success?

RQ2: Does the presence of multi-dimensional senior management support strengthen the relationship between task-oriented, relationship-oriented, and innovation-oriented competencies and project success?

This study contributes to the body of knowledge in the field of engineering and project management in terms of knowledge, theory, and practice by exploring and validating the links between three clusters of leadership competencies and project success in the presence of five dimensions of senior management support. This knowledge input is relevant to the discipline of project management and the wider field of engineering management. The novelty and originality of this research lie in the comprehensive and integrated way of assessing leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented) used to manage development projects in the public sector, and the presence of multi-dimensional support provided by the senior management. This approach helps engineering and project managers to identify the necessary leadership competencies required to manage simple to complex developmental projects, and gain the essential associated support from senior management to maximize the likelihood of project success in the public sector environment. Furthermore, this study not only examined the link between leadership competencies and the success of developmental projects, but also highlights the significance of multi-dimensional senior management support in strengthening or weakening the relationship between task-oriented, relationship-oriented, and innovation-oriented competencies and the success of public sector projects.

The structure of this article is as follows. The introduction identified the current gap in the knowledge base and the research questions. The next section reviews the relevant literature to synthesize the research hypotheses. This is followed by details on the methods, population, sampling, data collection, measures of instruments, reliability, and validity measures. Thereafter, descriptive statistics, data analysis, and hypotheses testing are presented, followed by a discussion of the main findings and implications of the study. Finally, conclusions including research contribution, limitations, and future research directions are provided.

**Literature Review and Research Hypotheses**

Project success has been widely discussed and it has received much attention from researchers and practitioners (Alvarenga et al., 2019). Although several studies have been conducted to measure project success more comprehensively and objectively but still the current research on the success of developmental projects is insufficient (Wang et al., 2019). Project success has often been discussed in the project management literature but success criteria have yet to be defined inconsistently. Initially, the criteria for project success were limited to the ‘iron triangle’, which refers to the achievement of cost, schedule, and quality performance (Wang et al., 2019). Project success has become a broader concept as the focus has increased on meeting stakeholder satisfaction (Ahmed & Azmi bin Mohamad, 2016; Wang et al., 2019). Indeed, meeting customer satisfaction and team satisfaction are considered effective measures to improve project performance and increase project efficiency to ensure the likelihood of project success and accomplishment of project goals (Loots & Schutte, 2016; Wang et al., 2019). Moreover, satisfaction is also considered an important criterion for measuring project success from the perspective of stakeholders. Developmental projects involve many project stakeholders, and relationship-oriented leaders focus on quality to increase the satisfaction of stakeholders and thereby achieve success in projects (Wang et al., 2019). Indeed, the involvement of the project manager and senior management has become essential to the success of any project (Bajjou & Chafi, 2020). The successful completion of projects based on success criteria can yield favorable stakeholder satisfaction, despite the results of traditional performance metrics that include cost, schedule, and quality performance (Hughes, Tippett, & Thomas, 2004; Lumseyfai, 2020). In a nutshell, project success is a multi-faceted concept that encompasses project efficiency in terms of cost, time, and scope, as well as customer satisfaction, team satisfaction, business success, and contribution to the development of future projects (Ahmed & bin Mohamed, 2017; Shenhar & Dvir, 2007).

Competencies can be viewed as a combination of knowledge, skills, and behaviors while the influence of leadership competencies has received scant academic attention in the context of development projects (Owusu-Manu, Debrah, Amissah, Edwards, & Chileshe, 2020). Indeed, project managers should not only be directive and task-oriented but also innovative and relationship-oriented since project planning, execution, and monitoring are ultimately determinants of the level of innovation and effective relationships as well as the completion of tasks within teamwork (Ahmed, Philbin, et al., 2021; Fayyaz, Naheed, & Hasan, 2014; Rüzgar, 2018). Furthermore, the contingency theory states that a leader’s efficacy is contingent both on task-oriented and relationship-oriented competencies, where task-oriented leaders focus on deadlines and relationship-oriented leaders focus on creating trust and respect (Henkel, Marion, & Bourdeau, 2019). Although project organizations have adopted project management approaches and governance structures, projects still cannot be consistently delivered without competent project managers coupled with strong support from senior management (Urton & Murray, 2021). Owing to the different nature of projects executed in various cultures and environments, diverse combinations of leadership competencies, including task-oriented, relationship-oriented, and innovation-oriented, are required to ensure project success in dynamic and complex organizations (Henkel et al., 2019).

The resource-based view theory posits that resources are key drivers of project outcomes in organizations (Salman, Ganie, & Saleem, 2020), and the support of senior management for the provision of adequate and timely resources is essential during the lifecycle of projects (Kuratko, Hornsby, & Covin, 2014). Senior management support is the most important component that can enhance the link between project managers’ competencies and project outcomes (Ali et al., 2021). Senior managers in organizations are top decision-makers, including the managing director, chief executive officer, chairman, chief financial officer, president, and vice president (Ahmed, Hussain, & Philbin, 2021). During all project phases, senior management must give attention to the project as well as human and financial resources, autonomy for action, an environment of constructive communication among project stakeholders, and utilize expertise to avoid time delays to ensure successful project implementation (Sicotte & Delerue, 2021). Also, senior management believes that concerns about organizational innovation are more critical than technological issues in determining the success of any project (Sicotte & Delerue, 2021). As a result, researchers looked at the scope of senior management support, emphasizing its multidimensionality - in terms of time, resources, expertise, power, structural planning, and communication (Ahmed & bin Mohamed, 2017; Boonstra, 2013; Sicotte & Delerue, 2021). Moreover, senior management supports the deployment of human and financial resources, and the adoption of processes for the development of new products and services (Sicotte & Delerue, 2021).

Although a few studies have focused on capturing the importance of the development of individual competencies in the organizational context, however, little attention has been paid to determining the influence of competencies on the success of projects (de Rezende et al., 2021; Salman et al., 2020). Further, there is a dearth of research in this area as earlier studies were limited to just a few research settings; for instance, the study by Tabernero, Chambel, Curral, and Arana (2009) was limited to the influence of task-oriented behavior and relationship-oriented behavior on group performance; research by Alvi and Rana (2019) was restricted to the relationship between task-oriented leaders and organizational performance; the study by Fayyaz et al. (2014) was limited to the effect of relationship-oriented and task-oriented styles on employee performance in the presence of communicator competence; Henkel et al. (2019) explored task-oriented and relationship-oriented leadership approaches adopted by the managers, and Rüzgar (2018) found an insignificant effect of task-oriented leadership as well as a significant effect of relationship-oriented leadership on the self-oriented dimension of Leader-Member-Exchange (LMX). However, the link between task-oriented, relationship-oriented, and innovation-oriented leadership competencies and project success in the presence of senior management support has not yet been investigated (Ahmed, Philbin, et al., 2021; Cleveland & Cleveland, 2020; da Silva et al., 2019). Therefore, this study is an effort to find the link between task-oriented, relationship-oriented, and innovation-oriented competencies and project success in the presence of multi-dimensional senior management support.

***Task-oriented competencies and project success***

Task-oriented competencies are based on a combination of skills, qualities, and attitudes that are required to focus on the results and achievement of the goals and objectives of the project. Indeed, task-oriented leaders focus on developing the required level of managerial and leadership expertise to ensure the successful completion of projects (Geoghegan & Dulewicz, 2008). Task-oriented leaders transform project short-term and long-term objectives into action plans through forward-looking planning, regular monitoring of project team members’ work, providing constructive and honest feedback, and ensuring the availability of resources to improve project performance (Razmdoost & Mills, 2016). Task-oriented project managers focus on the delivery of the project’s desired outcomes on schedule, within budget, and according to the specification and quality parameters. Moreover, when a task-oriented leader focuses on project achievement, the ultimate goal is to deliver the project at a minimum cost and meet quality standards (Andersen, 2016). The overall performance of a project can be highly dependent on how the project commences and whether the project manager can adequately initiate the project and secure the necessary resources. Research has revealed that at the beginning of the project, task-oriented leaders can provide a strong direction for the project and assign roles and responsibilities to project team members so that project tasks can be completed according to the schedule (Henkel et al., 2019).

Task-oriented leaders focus on tasks that are planned to be performed effectively to achieve the desired level of performance (Rüzgar, 2018). Furthermore, task-oriented competencies enable one to understand the capabilities of the people who achieve certain targets through task management and coordinated activities. This goal-oriented approach tends to focus more on tasks rather than considering the people dimensions (Henkel et al., 2019; Rüzgar, 2018). Indeed, task-oriented leaders have a consistent influence on project performance, which builds a positive attitude across the project team (Tabernero et al., 2009). In task-oriented projects, subordinates believe that their managers are capable and have supporting knowledge of completing project tasks and therefore have confidence in the performance of the project manager (Sherwood & DePaolo, 2005). Therefore, the following hypothesis is proposed:

***Hypothesis 1:*** There is evidence of a significant link between task-oriented competencies and project success.

***Relationship-oriented competencies and project success***

For the successful delivery of a complex project, relationship-oriented project leaders have distinct competencies that can be suitable (Ahmed, Philbin, et al., 2021). Indeed, relationship-oriented leaders focus on supporting, motivating, and developing the relationships among team members to encourage good project teamwork and collaboration along with positive interactions and efficient communication. Project managers having relationship-oriented qualities focus on rich communication within the project team and with other project stakeholders to develop an improved understanding and minimize project conflicts (Andersen, 2016). Relationship-oriented leaders prioritize the welfare of team members and try to meet the individual needs of all those involved in the project. This also involves avoiding team conflicts and having more casual interactions to learn about team members’ strengths and weaknesses as well as creating a non-competitive and transparent work environment and leading in a personable or encouraging manner (Henkel et al., 2019).

Relationship-oriented leaders can be highly personable, are open, and have a genuine interest in the well-being of the team. Project team members are supported and looked after in a way that enables them to perform to the best of their abilities, free from distractions and emotional burdens. Harmony within the workforce is often good as social cohesion is promoted. Moreover, there are more chances of project success when a project manager is experienced and has a positive attitude. Among others, the most critical competencies for a project manager are communication and developing teams to efficiently and effectively manage the project resources (Ahmed, Philbin, et al., 2021). Relationship-oriented leadership focuses on skills and interaction with people. Such leaders inspire and motivate subordinates to achieve support and project targets. Relationship-oriented leaders are approachable, friendly and understand the needs of team members and try to fulfill their expectations (Henkel et al., 2019). Therefore, the following hypothesis is proposed:

***Hypothesis 2:*** There is evidence of a significant link between relationship-oriented competencies and project success.

***Innovation-oriented competencies and project success***

Innovative leaders are creative thinkers who bring uniqueness to an existing idea or provide a new vision and have the competencies to attract people and bring a new conceptual idea into reality (Vlok, 2012). Innovative leaders possess various leadership competencies (Al Mamun, Fazal, & Muniady, 2019), which can be classified into the following: a) knowledge that everything can be learned from educational/formative systems and training courses, which involves cognitive processes (i.e. perception, learning, communication, association, and reasoning). This represents the theoretical understanding of something, such as a new or updated method or procedure; b) know-how, which relates to personal experiences and working conditions that are learned through practice and experience. This is practical knowledge about “how to get something done”; and c) behavior that is about individual characters, talent, human traits, or qualities that drive someone to act or react in a certain way under certain circumstances. Furthermore, an individual possesses several innovative competencies that impact project activities and patterns of organizational evolution and change. Indeed, specific competencies are required to execute the activities and tasks as well as optimize the performance of projects.

Innovation-oriented leaders efficiently manage and guide project team efforts; monitor team progress; anticipate barriers and changes needed to achieve goals; and provide appropriate feedback concerning the group and individual performance, including the areas of improvement. Consequently, the skills needed for a particular activity may change depending on the specific leadership level in project organizations. According to the competency approach, organizations can determine the positions at which specific levels require certain innovative competencies. Innovative-related competencies can have greater influence due to organizational complexities and the involvement of people at different levels with a wide range of roles and responsibilities (Al Mamun et al., 2019). The capability of conducting certain actions or accomplishing job activities in a set environment and completing tasks in a pre-defined manner is a key competency of an innovation-oriented leader (Koeppen, Hartig, Klieme, & Leutner, 2008). The focus on the development of innovation-oriented competencies and skills can enhance the likelihood of project success. Therefore, the following hypothesis is proposed:

***Hypothesis 3:*** There is evidence of a significant link between innovation-oriented competencies and project success.

***Impact of senior management support***

Project management theories have recognized the importance of senior management support due to its central role in project development (Boonstra, 2013), in addition to identifying the task-oriented competencies of project managers required to define project tasks and activities for team members (Fayyaz et al., 2014). An efficient level of task management is critical in projects and the responsibilities of project managers can vary from administrative work to the work of team leadership (Huemann, Keegan, & Turner, 2007)*.* To judiciously performproject activities, task-oriented project managers with the support of senior management create an environment of effective communication among team members and other project stakeholders (Ahmed & Azmi bin Mohamad, 2016). Otherwise, the success of projects cannot be achieved due to unclear or ambiguous communication among project stakeholders (Abu-Hussein, Hyassat, Sweis, Alawneh, & Al-Debei, 2016). To minimize the chances of schedule delays and cost overruns, senior management utilizes their leadership expertise to facilitate the performance of project managers and team members. Indeed, task-oriented competencies play an effective and positive role in guiding team members to achieve high-quality project outputs and eventual outcomes (Sakkar Sudha & Shahnawaz, 2019), which can be further enhanced through the support and guidance from senior management (Breevaart & de Vries, 2019). Senior management provides structural support to ensure that management processes run smoothly (Novianty & Law, 2019), and organizational processes are transformed by task-oriented project managers that allow prospective business challenges to be resolved through the successful implementation of projects (Lee, Park, & Lee, 2013). Moreover, senior management provides sufficient resources and delegates power to project managers through the organizational governance structures to deliver project tasks efficiently. Therefore, the following hypothesis is proposed:

***Hypothesis 4:*** There is evidence of a significant impact of senior management support on the link between task-oriented competencies and project success.

Although the competency of project managers is critical to project success, usually they only have limited authority on personnel allocation, and in the case of numerous projects, even senior management has little latitude in this area (Sicotte & Delerue, 2021). The probability of project success can be higher when the project manager secures the necessary resources and support from senior management (Ahmed & Azmi, 2017), in addition to communicating, encouraging, inspiring, and providing an environment of trust and openness among team members (Ahmed, Philbin, et al., 2021). The lack of resources makes it impossible to discriminate between success and failure, but senior management assistance hampers success by having a direct undesirable influence, although the supportive effect is positive (Sicotte & Delerue, 2021). During project implementation, gaining trust and respect from team members is a key consideration of project managers as well as senior management. Relationship-oriented leaders focus on trust and respect, listen to the needs of followers, and develop action plans based on the inputs of team members (Geoghegan & Dulewicz, 2008). Such leaders often possess diverse leadership competencies or a combination of task and relationship behaviors that can be contingent on the particular situation (Muller, Geraldi, & Turner, 2012). An advanced level of emotional intelligence can also be beneficial for effective relationship building that enables the leaders to empathize with teams and understand the point of view of team members while making effective decisions. Senior management assists in the implementation of proper project structures to fulfill the project objectives, such as ensuring adequate processes, procedures, and systems adoption are in place (Ahmed & Azmi bin Mohamad, 2016), where relationship-oriented leaders encourage teamwork and collaboration through enhanced relationships that exist between team members. Understanding the needs and requirements of each individual is vital for senior management and relationship-oriented competencies facilitate project managers to effectively manage their projects and teams. Therefore, the following hypothesis is proposed:

***Hypothesis 5:***  There is evidence of a significant impact of senior management support on the link between relationship-oriented competencies and project success.

Senior management encourages an inventive climate (Feng & Zhao, 2014), provide strategic vision, guide in planning, and allows the project managers to redirect resources toward the initiatives taken at the start of the project (Ahmed & bin Mohamed, 2017).Senior management is required to develop and communicate a compelling vision to guide the organization and its employees. For this purpose, senior management uses communication as a means for the exchange of information with others in projects (Croucher, 2015, p.24), to deliver project visions to project managers and other stakeholders, which is a vital aspect of project success in organizations (Ruck & Welch, 2012). After communicating the project vision with team members and collecting creative ideas from different people, senior management and project managers shape the end product by harnessing the ideas that have been contributed. Innovation-oriented leaders develop strategies, set directions, and encourage creative thinking, as well as enrich decision-making to manage processes and projects (Yun, Wan, Wang, Bai, & Zhang, 2020). The role of senior management can be viewed as supporting project managers to undertake effective decisions as well as motivating project teams and leveraging new ideas to ensure the innovative outcome of projects (Vlok, 2012). Consequently, senior management involvement through encouraging innovative ideas developed by project managers and team members can enhance the likelihood of project success. Therefore, the following hypothesis is proposed:

***Hypothesis 6:*** There is evidence of a significant impact of senior management support on the link between innovation-oriented competencies and project success.

The proposed research model indicating the research hypotheses is presented in Exhibit 1.

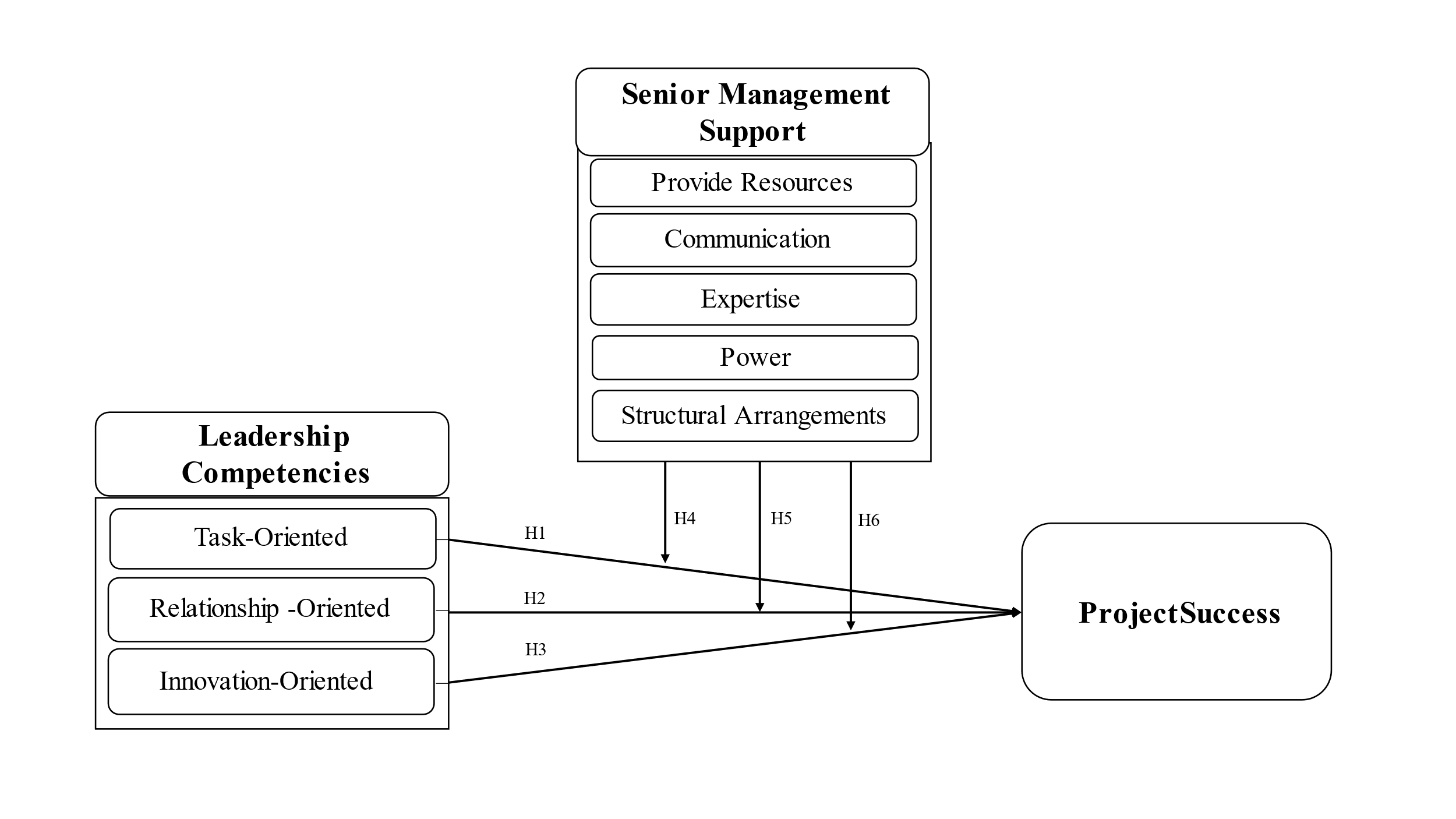


Exhibit 1. Research Model

**Methods**

***Research design***

This study empirically tested the research hypotheses by collecting survey data. A survey instrument was developed by adapting measures from earlier relevant studies and was disseminated among 250 project managers having experience in managing development projects in the public sector of Pakistan. The reliability and validity tests were performed to check the internal and external consistency of the measurement models. After the validation of data, each hypothesis on the measurement model was examined by using hierarchical regression analysis. First, H1 to H3 were tested to investigate the direct link between task-oriented, relationship-oriented, and innovation-oriented competencies and project success, and then H4 to H6 were tested to examine the impact of senior management support on the relationships between task-oriented, relationship-oriented, and innovation-oriented competencies and project success.

***Data collection methods***

The respondents needed to be key informants for the concepts and theory being investigated and have meaningfully been involved in the activities being studied to qualify as a participant (Pesämaa, Zwikael, HairJr, & Huemann, 2021). Therefore, project managers and project directors were selected as respondents, and a survey questionnaire was distributed among 250 project managers and project directors that have experience in managing development projects in the public sector of Pakistan. The public sector consists of government and publicly funded agencies and other entities that deliver programs or services to the public. The developmental projects are funded by the public sector under the Public Sector Development Programme (PSDP) to strengthen the capabilities of institutions and promote sustainable living conditions in the community. The PSDP is an important public sector intervention that is aligned with the long-term objectives of the government to develop human capital and improve the infrastructure for society.

In response to the survey distributed among 250 respondents, 197 responses were received from project managers and project directors of development projects, which is an overall response rate of 79%. This response rate is consistent with earlier research in the domain of leadership competencies (Ahmed & Anantatmula, 2017; Ahmed & Lodhi, 2021; Yang, Wu, & Huang, 2013) and senior management support (Ahmed & Azmi bin Mohamad, 2016; Ahmed & bin Mohamed, 2017; Ahmed, Hussain, et al., 2021). Respondents were asked to provide information about a recently completed project in the public sector. A summary of the demographic data is presented in Exhibit 2.

Exhibit 2. Summary of demographic data

|  | ***Demographic*** | ***Characteristics*** | ***N*** | ***%*** |
| --- | --- | --- | --- | --- |
|  | Gender | Male | 148 | 75.1 |
|  |  | Female | 49 | 24.9 |
|  | Qualification | Bachelor degree | 40 | 20.3 |
|  |  | Master degree | 122 | 62.9 |
|  |  | PhD degree | 35 | 17.8 |
|  | Experience | < 3 Years | 33 | 16.8 |
|  |  | 3 to 5 Years | 35 | 17.8 |
|  |  | 5 to 10 Years | 62 | 31.4 |
|  |  | 10 to 15 Years | 33 | 16.8 |
|  |  | > 15 Years | 34 | 17.2 |
|  | Project cost (Rs) | Small projects (≤ 60 M) | 57 | 28.9 |
|  |  | Medium projects (>60M & ≤ 1000M) | 73 | 37.1 |
|  |  | Large projects (>1000 M) | 67 | 34.0 |
|  | Project team size | Small (≤ 20 members) | 114 | 57.9 |
|  |  | Medium (>20 & ≤ 50 members) | 58 | 29.4 |
|  |  | Large (>50 members) | 25 | 12.7 |
|  | Project duration | ≤ 1 year | 4 | 2.0 |
|  |  | ≤ 3 year | 47 | 23.9 |
|  |  | ≤ 5 year | 94 | 47.7 |
|  |  | ≤ 7 year | 44 | 22.3 |
|  |  | > 7 year | 8 | 4.1 |
|  |  |  |  |  |
|  | Project type | Capacity building | 93 | 47.2 |
|  |  | Construction & infrastructure | 72 | 36.5 |
|  |  | Engineering & technology | 32 | 16.2 |

***Measurement of variables***

To measure the constructs of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented competencies), neither an instrument was developed by (Ahmed, Philbin, et al., 2021) who identified these three clusters of competencies nor any single instrument available in prior research. The clusters of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented competencies) conceptualized by Ahmed, Philbin, et al. (2021) are adopted for this study, which is a combination of various competencies, for instance: a) task-oriented competencies (include sub-competencies of resource management, defining roles, developing and empowering, teamwork, etc.); b) relationship-oriented competencies (include sub-competencies of motivation, interpersonal skills, communication, etc.); and c) innovation-oriented competencies (include sub-competencies of innovation, critical analysis, decision-making, strategic insight, vision, and imagination, etc.). Hair Jr, Hult, Ringle, and Sarstedt (2021) suggested that measurement scales established more than five years ago need to be adapted from relevant studies. Accordingly, an instrument for this study was adapted from well-established scales of earlier relevant studies; where 15 items for task-oriented competencies, 17 items for relationship-oriented competencies, and 15 items for innovation-oriented competencies were adapted from Dulewicz and Higgs (2005), PMI (2007) and Clarke (2010). Similarly, 22 items were adapted from Ahmed and Azmi bin Mohmad (2016) to measure multi-dimensions of senior management support, and 25 items were adapted from Shenhar and Dvir (2007) and Ahmed and Azmi bin Mohamad (2016), for the measures of project success (see Appendix-I).

To capture the opinions of respondents, measurement items were anchored on a 5-point Likert rating scale from ‘strongly disagree’ to ‘strongly agree’ for leadership competencies and project success and on a 5-point Likert rating scale for senior management support from ‘not at all’ to ‘frequently (if not always)’. To ensure the face validity of measurement items of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented) and eliminate the chances of overlapping in measures, two university professors and one industry expert were involved in finalizing the instrument before its distribution among the participants through the survey. The same approach was used for the measures of senior management support and project success. However, a few context-specific modifications were made to the measurement items based on the feedback of the experts. Also, validity was confirmed statistically by using exploratory factor analysis as well as confirmatory analysis due to the adaption of measurement items from various studies. Moreover, the common method bias was also analyzed to ensure that there is no biases reported in sample data collected from the respondents.

***Common method bias***

The common method bias (CMB) is common particularly in research when data is collected from the same participants using the same measurement items with identical characteristics in the same measurement context (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The CMB happens when the variations in responses are generated by an instrument rather than the real biases of the respondents that an instrument is attempting to reveal (Fuller, Simmering, Atinc, Atinc, & Babin, 2016). To avoid CMB, this study devised a procedure in which the predictor and criteria variables were gathered from the same respondents who were the key informants of the study. Pesämaa et al. (2021) recommended that only key informants of the context be chosen as respondents for a quantitative study. Moreover, there were very limited chances of biases as only a single construct of leadership competencies was related to the self-reported behaviors of the project managers and/or team members.

Following the guidelines of Y. Yang, Kuria, and Gu (2020), certain techniques were used to reduce the possible chances of CMB occurring. Initially, the unclear and unfamiliar terms were removed/rephrased from the questions, and items were written in simple language and phrases. Furthermore, Harman's single-factor technique is used to statistically check the common method bias in the case of self-reported data (Podsakoff, MacKenzie, & Podsakoff, 2012). Accordingly, Harman's single factor test was employed to verify whether common method covariance exists among single (self-reported) or all variables of the study. For this purpose, all of the items were combined into a single factor. The common method biases do not affect the data when the total variance of a single factor is between 20% and 40% (Fuller et al., 2016). The results of one factor obtained from Harman’s test through SPSS software revealed that only 27.16 percent of the overall variance is explained for one factor, indicating that there is no issue of common method bias in the sample data of this study.

**Findings**

***Reliability and validity***

Reliability and validity are used to check the consistency and accuracy of the measurement models (Mirabella, 2008). Accordingly, the reliability was examined by calculating Cronbach’s alpha, which was well above the threshold of 0.70 for all variables of leadership competencies (0.86 to 0.91), project success (0.74 to 0.89), and senior management support (0.75 to 0.92). The Kaiser-Meyer-Olkin (KMO) and Bartlett’s test of Sphericity were used to determine how sample data is suited for factor analysis and to check if there is a certain redundancy between the variables, respectively. The KMO test measures sampling adequacy for each variable of the model and revealed a value of 0.898 for leadership competencies, 0.894 for senior management support, and 0.866 for project success, which is well above the cut-off value of 0.60. Similarly, Bartlett’s test also yielded significant results discarding the redundancy issue among the variables (Tabachnick & Fidell, 2007), as evident from the results of leadership competencies [χ2 (1081, n=197)=5268.305, p<.001]; senior management support [χ2 (231, n=197)=2434.837, p<.001]; and project success [χ2 (300, n=197)=2728.428, p<.001].

To further check the validity of the measurement items of all variables, the guidelines of Hair, Black, Babin, Anderson, and Tatham (2010) were followed, due to the non-availability of any single instrument that can be used to measure all three constructs of leadership competencies, i.e. task-oriented, relationship-oriented and innovation-oriented, as well as senior management support and project success. Therefore, principal component analysis (PCA) as an extraction technique was used to perform exploratory factor analysis (EFA) through SPSS software, to ensure that factor loadings of measurement items on the corresponding variables are within the suggested range. Subsequently, the loadings of all measurement items ranges were as follows: 0.41 to 0.72 (leadership competencies); 0.58 to 0.76 (senior management support); and 0.43 to 0.71 (project success), which are all well above the cut-off value of 0.40 (Hair et al., 2010). Furthermore, the PCA analysis yielded a total variance of 32.28% explained by the measurement items of leadership competencies; 39.28% variance was explained by the measurement items of senior management support, and a variance of 32.19% was explained by the measurement items of project success. In addition, confirmatory factor analysis (CFA) was also performed through AMOS software to check the construct validity and confirm the validity of measurement items, where CFA results supported the validity. The summary of reliability and validity analyses along EFA and CFA loadings is presented in Exhibit 3.

Exhibit 3. Summary of reliability and validity analysis (including EFA & CFA)

| ***Item*** | ***Variable*** | ***KMO*** | ***Bartlett’s Test*** | ***df*** | ***Cronbach (α)*** | | ***EFA*** | ***CFA*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Leadership Competencies | | 0.898 | 5268.305 | 1081 | 0.95 | | - | - |
| Task-Oriented Competencies | |  |  |  | 0.91 | | - | - |
| TO1 |  | | | | |  | 0.689 | 0.67 |
| TO2 |  | | | | |  | 0.592 | 0.57 |
| TO3 |  | | | | |  | 0.613 | 0.59 |
| TO4 |  | | | | |  | 0.564 | 0.53 |
| TO5 |  | | | | |  | 0.565 | 0.54 |
| TO6 |  | | | | |  | 0.493 | 0.64 |
| TO7 |  | | | | |  | 0.619 | 0.61 |
| TO8 |  | | | | |  | 0.616 | 0.54 |
| TO9 |  | | | | |  | 0.637 | 0.40 |
| TO10 |  | | | | |  | 0.631 | 0.51 |
| TO11 |  | | | | |  | 0.666 | 0.37 |
| TO12 |  | | | | |  | 0.698 | 0.45 |
| TO13 |  | | | | |  | 0.646 | 0.59 |
| TO14 |  | | | | |  | 0.644 | 0.59 |
| TO15 |  | | | | |  | 0.608 | 0.61 |
| Relationship-Oriented Competencies | |  |  |  | 0.86 | | - | - |
| RO1 |  | | | | |  | 0.676 | 0.65 |
| RO2 |  | | | | |  | 0.633 | 0.59 |
| RO3 |  | | | | |  | 0.662 | 0.63 |
| RO4 |  | | | | |  | 0.726 | 0.71 |
| RO5 |  | | | | |  | 0.678 | 0.66 |
| RO6 |  | | | | |  | 0.664 | 0.63 |
| RO7 |  | | | | |  | 0.633 | 0.59 |
| RO8 |  | | | | |  | 0.569 | 0.50 |
| RO9 |  | | | | |  | 0.645 | 0.58 |
| RO10 |  | | | | |  | 0.685 | 0.61 |
| RO11 |  | | | | |  | 0.569 | 0.50 |
| RO12 |  | | | | |  | 0.663 | 0.61 |
| RO13 |  | | | | |  | 0.646 | 0.66 |
| RO14 |  | | | | |  | 0.574 | 0.69 |
| RO15 |  | | | | |  | 0.455 | 0.63 |
| RO16 |  | | | | |  | 0.557 | 0.62 |
| RO17 |  | | | | |  | 0.407 | 0.58 |
| Innovation-Oriented Competencies | |  |  |  | 0.90 | | - | - |
| IO1 |  | | | | |  | 0.602 | 0.56 |
| IO2 |  | | | | |  | 0.665 | 0.63 |
| IO3 |  | | | | |  | 0.620 | 0.58 |
| IO4 |  | | | | |  | 0.656 | 0.62 |
| IO5 |  | | | | |  | 0.606 | 0.56 |
| IO6 |  | | | | |  | 0.577 | 0.54 |
| IO7 |  | | | | |  | 0.628 | 0.59 |
| IO8 |  | | | | |  | 0.672 | 0.64 |
| IO9 |  | | | | |  | 0.613 | 0.58 |
| IO10 |  | | | | |  | 0.720 | 0.69 |
| IO11 |  | | | | |  | 0.657 | 0.63 |
| IO12 |  | | | | |  | 0.669 | 0.64 |
| IO13 |  | | | | |  | 0.651 | 0.63 |
| IO14 |  | | | | |  | 0.678 | 0.65 |
| IO15 |  | | | | |  | 0.652 | 0.62 |
| Senior Management Support | | 0.894 | 2434.837 | 231 | 0.92 | | - | - |
| Provide Resource | |  |  |  | 0.75 | | - | - |
| POR1 |  | | | | |  | 0.612 | 0.30 |
| POR2 |  | | | | |  | 0.672 | 0.25 |
| POR3 |  | | | | |  | 0.626 | 0.23 |
| POR4 |  | | | | |  | 0.763 | 0.17 |
| Communication | |  |  |  | 0.81 | | - | - |
| COM1 |  | | | | |  | 0.642 | 0.28 |
| COM2 |  | | | | |  | 0.630 | 0.62 |
| COM3 |  | | | | |  | 0.719 | 0.71 |
| COM4 |  | | | | |  | 0.716 | 0.71 |
| COM5 |  | | | | |  | 0.745 | 0.73 |
| Expertise (EXP): | |  |  |  | 0.79 | | - | - |
| EXP1 |  | | | | |  | 0.654 | 0.63 |
| EXP2 |  | | | | |  | 0.602 | 0.45 |
| EXP3 |  | | | | |  | 0.695 | 0.67 |
| EXP4 |  | | | | |  | 0.768 | 0.75 |
| Power | |  |  |  | 0.85 | | - | - |
| PWR1 |  | | | | |  | 0.723 | 0.69 |
| PWR2 |  | | | | |  | 0.644 | 0.61 |
| PWR3 |  | | | | |  | 0.776 | 0.76 |
| PWR4 |  | | | | |  | 0.745 | 0.73 |
| PWR5 |  | | | | |  | 0.670 | 0.65 |
| Structural Arrangements | |  |  |  | 0.82 | | - | - |
| STA1 |  | | | | |  | 0.687 | 0.67 |
| STA2 |  | | | | |  | 0.723 | 0.71 |
| STA3 |  | | | | |  | 0.691 | 0.68 |
| STA4 |  | | | | |  | 0.691 | 0.67 |
| Project Success | | 0.866 | 2728.428 | 300 | 0.90 | | - | - |
| Project Efficiency | |  |  |  | 0.89 | | - | - |
| PE1 |  | | | | |  | 0.640 | 0.79 |
| PE2 |  | | | | |  | 0.639 | 0.80 |
| PE3 |  | | | | |  | 0.692 | 0.81 |
| PE4 |  | | | | |  | 0.661 | 0.84 |
| PE5 |  | | | | |  | 0.640 | 0.75 |
| Impact on Customer | |  |  |  | 0.74 | | - | - |
| IU1 |  | | | | |  | 0.627 | 0.49 |
| IU2 |  | | | | |  | 0.621 | 0.45 |
| IU3 |  | | | | |  | 0.432 | 0.30 |
| IU4 |  | | | | |  | 0.649 | 0.82 |
| IU5 |  | | | | |  | 0.641 | 0.79 |
| Impact on Team | |  |  |  | 0.88 | |  |  |
| IT1 |  | | | | |  | 0.564 | 0.60 |
| IT2 |  | | | | |  | 0.705 | 0.73 |
| IT3 |  | | | | |  | 0.715 | 0.75 |
| IT4 |  | | | | |  | 0.662 | 0.69 |
| IT5 |  | | | | |  | 0.596 | 0.62 |
| Organization/Business Success | |  |  | 0.63 | 0.57 | | - | - |
| BS1 |  | | | | |  | 0.627 | 0.57 |
| BS2 |  | | | | |  | 0.607 | 0.56 |
| BS3 |  | | | | |  | 0.665 | 0.61 |
| BS4 |  | | | | |  | 0.465 | 0.40 |
| BS5 |  | | | | |  | 0.548 | 0.49 |
| Preparing for the Future | |  |  |  | 0.83 | | - | - |
| PF1 |  | | | | |  | 0.533 | 0.52 |
| PF2 |  | | | | |  | 0.705 | 0.70 |
| PF3 |  | | | | |  | 0.565 | 0.57 |
| PF4 |  | | | | |  | 0.629 | 0.62 |
| PF5 |  | | | | |  | 0.564 | 0.55 |

***Hypotheses testing***

To test the research hypotheses of the study, correlation and regression analyses were performed. The Pearson correlation analysis was performed to check the strength of association among variables of the study, which indicated a significant positive correlation between task-oriented, relationship-oriented, and innovation-oriented competencies and project success as well as among the dimensions of senior management support and project success. The significance of the results of correlation analysis further reveals that project managers possess task-oriented, relationship-oriented, and innovation-oriented competencies and senior management provide sufficient support to ensure the likelihood of project success. A summary of the correlation analysis is provided in Exhibit 4.

Exhibit 4. Summary of correlation among variables

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sr | Var | | Mean |  | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | IOR | | 3.96 |  | 0.544 | 1 |  |  |  |  |  |  |  |  |
| 2 | TOR | | 4.02 |  | 0.498 | 0.650\*\* | 1 |  |  |  |  |  |  |  |
| 3 | ROR | | 3.90 |  | 0.568 | 0.744\*\* | 0.760\*\* | 1 |  |  |  |  |  |  |
| 4 | POR | | 3.90 |  | 0.626 | 0.591\*\* | 0.526\*\* | 0.780\*\* | 1 |  |  |  |  |  |
| 5 | COM | | 3.79 |  | 0.670 | 0.398\*\* | 0.357\*\* | 0.364\*\* | 0.272\*\* | 1 |  |  |  |  |
| 6 | EXP | | 3.50 |  | 0.785 | 0.336\*\* | 0.190\*\* | 0.252\*\* | 0.184\*\* | 0.587\*\* | 1 |  |  |  |
| 7 | PWR | | 3.62 |  | 0.736 | 0.473\*\* | 0.389\*\* | 0.478\*\* | 0.378\*\* | 0.645\*\* | 0.657\*\* | 1 |  |  |
| 8 | STA | | 3.69 |  | 0.708 | 0.356\*\* | 0.259\*\* | 0.300\*\* | 0.177\* | 0.644\*\* | 0.636\*\* | 0.710\*\* | 1 |  |
| 9 | PS | | 3.50 |  | 0.465 | 0.349\*\* | 0.229\*\* | 0.330\*\* | 0.287\*\* | 0.499\*\* | 0.419\*\* | 0.536\*\* | 0.473\*\* | 1 |
|  | | \*\*. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | | | | | |

Results of the regression analysis revealed that task-oriented competencies (TOC) explained a significant variance of only 4.8% in project success (ΔF=10.808, p<0.001). The standardized Beta value of task-oriented leadership competencies was significant and positive (β=.392, t=3.287, p<0.001). The findings, therefore, support H1, which hypothesizes that task-oriented leadership competencies displayed by project managers are positively and significantly related to project success. The results indicated that relationship-oriented competencies (ROC) significantly explained a 10.4% variance in project success (ΔF=23.848, p<0.001). The coefficient value of relationship-oriented leadership competencies was positive and significant (β=0.300, t=4.883, p<0.001). Therefore, the results supported H2, which hypothesizes that relationship-oriented competencies of project managers are significantly and positively related to project success. Furthermore, the findings revealed that innovation-oriented competencies (IOC) explained a significant variance of 11.7% in project success (ΔF=27.092, p<0.001). The standardized Beta coefficient value of innovation-oriented leadership competencies was significant and positive (β=0.349, t=5.205, p<0.001). The results provide support for H3, which hypothesizes that relationship-oriented competencies of project managers are significantly and positively related to project success. A summary of the regression analysis for the direct relationships between leadership competencies and project success is provided in Exhibit 5.

Exhibit 5. Results of regression analysis for direct hypothesis

|  | Project Success | | | |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | Hypothesis 1 | | Hypothesis 2 | | Hypothesis 3 | |
| Model 1 (TOC) | | Model 2 (ROC) | | Model 3 (IOC) | |
| Task-Oriented | | Relationship-Oriented | | Innovation-Oriented | |
| β | t | β | t | β | t |
|  | 0.229\*\*\*\* | 3.287 | 0.300\*\*\*\* | 4.883 | 0.349\*\*\*\* | 5.205 |
|  |  |  |  |  |  | |
| R2 | 0.053 | | 0.109 | | 0.122 | |
| Adjusted R2 | 0.048 | | 0.104 | | 0.117 | |
| ΔR2 | 0.053 | | 0.109 | | 0.122 | |
| ΔF | 10.808\*\*\*\* | | 23.848\*\*\*\* | | 27.092\*\*\*\* | |
| \* p ≤0.05, \*\* p ≤0.01, \*\*\* p ≤0.005, \*\*\*\* p ≤0.001 | | | | |  |  |

Task-oriented competencies (TOC) explained 4.8% of the variance in project success for all factors of senior management support (ΔF=10.808, p<0.001). Provision of resources (POR) explained an 8.1% variance in project success, with a significant value of ΔF=8.130, (p<0.001), and the interaction term (TOCxPOR) does not explain any significant variance in project success (ΔF=0.008, p>0.05). The findings reveal little improvement in the value of R2 in Model 1 (R2=0.053) and Model 2 (R2=0.091), but insignificant improvement in Model 3 (R2=0.091, P>.05), which indicates that providing resources is not a moderator on the relationship. Communication (COM) explained a 24.5% variance in project success, with a significant value of ΔF=51.862 (p<0.001), and the interaction term (TOCxCOM) explained a 24.2% variance in project success (ΔF=0.412, p>0.05). The result shows significant improvement in the value of R2 in Model 1 (R2=0.053), Model 2 (R2=0.252), and Model 3 (R2=0.254), which validates communication as a moderator; means that communication strengthens the relationship between task-oriented competences and project success.

The result indicates that expertise (EXP) explained 19.1% variance in project success, with a significant value of ΔF=35.444 (p<0.001), and the interaction term (TOCxEXP) explained 18.6% variance in project success (ΔF=0.017, p>0.05). The findings show continuous improvement in the value of R2 in Model 1 (R2=0.053) and Model 2 (R2=0.199) but no improvement in Model 3 (R2=0.191), which indicates that expertise is not a moderator. The power (PWR) factor explained 28% variance in project success, with a significant value of ΔF=64.083 (p<0.001), and the interaction term (TOCxPWR) explained 27.7% variance in project success (ΔF=0.110, p>0.05). The results show continuous improvement in the value of R2 in Model 1 (R2=0.053) and Model 2 (R2=0.288) but no improvement in Model 3 (R2=0.288), which indicate that power is not a moderator. Structural arrangements (STA) explained 22.8% variance in project success, with a significant value of ΔF= 46.498 (p<0.001) and the interaction term (TOCxSTA) explained 22.5% variance in project success (ΔF= 0.240, p<0.01). the finding indicates a significant improvement in the value of R2 in Model 1 (R2=0.053), Model 2 (R2=0.236), and Model 3 (R2=0.237), which validates structural arrangements as a moderator that strengthen the relationship between task-oriented competences and project success. A summary of the moderation analysis for the fourth hypothesis (TOCxSMS) is provided in Exhibit 6.

Exhibit 6. Summary of regression analysis for moderation (TOC x SMS)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable (s) | Project Success | | | | | | | | | |
| TOC x POR | | TOC x COM | | TOC x EXP | | TOC x PWR | | TOC x STA | |
| β | t | β | t | β | t | β | t | β | t |
| Step 1: IV (TOC) |  |  |  |  |  |  |  |  |  |  |
| Model 1 | 0.229\*\*\*\* | 3.287 | 0.229\*\*\*\* | 3.287 | 0.229\*\*\*\* | 3.287 | 0.229\*\*\*\* | 3.287 | 0.229\*\*\*\* | 3.287 |
| Model 2 | 0.109 | 1.394 | 0.058 | 0.877 | 0.155\* | 2.370 | 0.024 | 5.365 | 0.114 | 1.759 |
| Model 3 | 0.104 | 0.395 | -0.140 | -0.433 | 0.118 | 0.409 | -0.057 | -0.225 | -0.027 | -0.091 |
| Step II: MV (SMS) |  |  |  |  |  |  |  |  |  |  |
| Model 2 | 0.229\*\*\* | 2.851 | 0.479\*\*\* | 7.202 | 0.390\*\*\*\* | 5.953 | 0.527\*\*\*\* | 8.005 | 0.443\*\*\*\* | 6.819 |
| Model 3 | 0.273 | 0.568 | 0.165\*\*\*\* | 4.334 | 0.320\*\*\*\* | 0.603 | 0.383 | 0.872 | 0.209 | 0.433 |
| Step III: Interaction |  |  |  |  |  |  |  |  |  |  |
| Model 3 | -0.066 | -0.091 | 0.429 | 0.642 | 0.085 | 0.132 | 0.192 | 0.332 | 0.305 | 0.490 |
| Value of R2: |  | |  | |  | |  | |  | |
| Model 1 | 0.053 | | 0.053 | | 0.053 | | 0.053 | | 0.053 | |
| Model 2 | 0.091 | | 0.252 | | 0.199 | | 0.288 | | 0.236 | |
| Model 3 | 0.091 | | 0.254 | | 0.199 | | 0.288 | | 0.237 | |
| Value of Adj R2: |  | |  | |  | |  | |  | |
| Model 1 | 0.048 | | 0.048 | | 0.048 | | 0.048 | | 0.048 | |
| Model 2 | 0.081 | | 0.245 | | 0.191 | | 0.280 | | 0.228 | |
| Model 3 | 0.077 | | 0.242 | | 0.186 | | 0.277 | | 0.225 | |
| Value of ΔR2: |  | |  | |  | |  | |  | |
| Model 1 | 0.053 | | 0.053 | | 0.053 | | 0.053 | | 0.053 | |
| Model 2 | 0.038 | | 0.200 | | 0.146 | | 0.235 | | 0.183 | |
| Model 3 | 0.000 | | 0.002 | | 0.000 | | 0.000 | | 0.001 | |
| Value of F: |  | |  | |  | |  | |  | |
| Model 1 | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | |
| Model 2 | 9.666\*\*\*\* | | 32.744\*\*\*\* | | 24.080\*\*\*\* | | 39.194\*\*\*\* | | 29.913\*\*\*\* | |
| Model 3 | 6.414\*\*\*\* | | 21.901\*\*\*\* | | 15.978\*\*\*\* | | 26.046\*\*\*\* | | 19.944\*\*\*\* | |
| Value of ΔF: |  | |  | |  | |  | |  | |
| Model 1 | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | | 10.808\*\*\*\* | |
| Model 2 | 8.130\*\*\* | | 51.862\*\*\*\* | | 35.444\*\*\*\* | | 64.083\*\*\*\* | | 46.498\*\*\*\* | |
| Model 3 | 0.008 | | 0.412 | | 0.017 | | 0.110 | | 0.240\*\* | |
| \* p ≤0.05, \*\* p ≤0.01, \*\*\* p ≤0.005, \*\*\*\* p ≤0.001 | | | | | | | | | | |

Relationship-oriented competencies (ROC) explained 10.4% of the variance in project success for all factors of senior management support (ΔF=23.848, p<0.001). The provision of resources explained a 10.4% variance in project success (ΔF=0.934, p>0.05), and the interaction term (ROCxPOR) does not explain any variance in project success. The findings show significant improvement in the value of R2 in Model 1 (R2=0.109) and Model 2 (R2=0.113) but no value appears for Model 3, which indicates that providing resources is not a moderator (no effect on the relationship). The communication explained a 26.7% variance in project success, with a significant value of ΔF=44.327 (p<0.001), and the interaction term (ROCxCOM) explained a 26.3% variance in project success (ΔF=0.006, p>0.05). The results show a significant improvement in the value of R2 in Model 1 (R2=0.104) and Model 2 (R2=0.275) but no significant improvement in Model 3 (R2=0.275), which indicates that communication is not a moderator.

The results indicate that expertise explained a significant variance of 21.2% in project success (ΔF=30.326, p<0.001), whereas the interaction term (ROCxEXP) explained a 22.1% variance in project success (ΔF=0.934, p>0.05). The findings show continuous improvement in the value of R2 in Model 1 (R2=0.109), Model 2 (R2=0.229), and Model 3 (R2=0.233), which validates expertise as a moderator and strengthens the relationship between relationship-oriented competencies and project success. The power factor explained 28.7% variance in project success, with a significant value of ΔF=50.937 (p<0.001), and the interaction term (ROCxPWR) explained 28.5% variance in project success (ΔF=0.296, p>0.05). The results show continuous improvement in the value of R2 in Model 1 (R2=0.109), Model 2 (R2=0.294), and Model 3 (R2=0.295), which indicate power as a moderator and strengthen the link between relationship-oriented competencies and project success. Structural arrangements explained 25.5% variance in project success, with a significant value of ΔF= 40.362 (p<0.001) and the interaction term (ROCxSTA) explained 25.2% variance in project success (ΔF=0.188, p<0.01). The finding indicates a significant improvement in the value of R2 in Model 1 (R2=0.109), Model 2 (R2=0.262), and Model 3 (R2=0.263), which validates structural arrangements as a moderator and strengthens the association between relationship-oriented competences and project success. A summary of the moderation analysis for the fifth hypothesis (ROCxSMS) is provided in Exhibit 7.

Exhibit 7. Summary of regression analysis for moderation (ROC x SMS)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable (s) | Project Success | | | | | | | | | |
| ROC x POR | | ROC x COM | | ROC x EXP | | ROC x PWR | | ROC x STA | |
| β | t | β | t | β | t | β | t | β | t |
| Step 1: IV (ROC) |  |  |  |  |  |  |  |  |  |  |
| Model 1 | 0.330\*\*\*\* | 4.833 | 0.330\*\*\*\* | 4.883 | 0.330\*\*\*\* | 4.833 | 0.330\*\*\*\* | 4.883 | 0.330\*\*\*\* | 4.883 |
| Model 2 | 0.157 | 0.824 | 0.171\* | 2.601 | 0.240\*\*\*\* | 3.687 | 0.096 | 1.396 | 0.207\*\*\* | 3.199 |
| Model 3 | - | - | 0.195 | 0.588 | 0.504 | 1.792 | -0.040 | -0.155 | 0.327 | 1.151 |
| Step II: MV (SMS) |  |  |  |  |  |  |  |  |  |  |
| Model 2 | 0.020 | 0.185 | 0.437\*\*\*\* | 6.658 | 0.359\*\*\*\* | 5.507 | 0.490\*\*\*\* | 7.140 | 0.443\*\*\*\* | 6.353 |
| Model 3 |  |  | 0.468 | 1.137 | 0.773\*\*\*\* | 1.783 | 0.292 | 0.785 | 0.573 | 1.511 |
| Step III: Interaction |  |  |  |  |  |  |  |  |  |  |
| Model 3 | - | - | -0.046 | -0.076 | -0.548 | -0.966 | 0.291 | 0.544 | -0.230 | -0.434 |
| Value of R2: |  | |  | |  | |  | |  | |
| Model 1 | 0.109 | | 0.109 | | 0.109 | | 0.109 | | 0.109 | |
| Model 2 | 0.113 | | 0.275 | | 0.229 | | 0.294 | | 0.262 | |
| Model 3 | - | | 0.275 | | 0.233 | | 0.295 | | 0.263 | |
| Value of Adj R2: |  | |  | |  | |  | |  | |
| Model 1 | 0.104 | | 0.104 | | 0.104 | | 0.104 | | 0.104 | |
| Model 2 | 0.104 | | 0.267 | | 0.212 | | 0.287 | | 0.255 | |
| Model 3 | - | | 0.263 | | 0.221 | | 0.285 | | 0.252 | |
| Value of ΔR2: |  | |  | |  | |  | |  | |
| Model 1 | 0.109 | | 0.109 | | 0.109 | | 0.109 | | 0.109 | |
| Model 2 | 0.004 | | 0.166 | | 0.120 | | 0.185 | | 0.153 | |
| Model 3 | - | | 0.000 | | 0.004 | | 0.001 | | 0.001 | |
| Value of F: |  | |  | |  | |  | |  | |
| Model 1 | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | |
| Model 2 | 12.387\*\*\*\* | | 36.737\*\*\*\* | | 28.800\*\*\*\* | | 40.467\*\*\*\* | | 34.512\*\*\*\* | |
| Model 3 | - | | 24.368\*\*\*\* | | 15.558\*\*\*\* | | 26.979\*\*\*\* | | 22.975\*\*\*\* | |
| Value of ΔF: |  | |  | |  | |  | |  | |
| Model 1 | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | | 23.848\*\*\*\* | |
| Model 2 | 0.934 | | 44.327\*\*\*\* | | 30.326\*\*\*\* | | 50.937\*\*\*\* | | 40.362\*\*\*\* | |
| Model 3 | - | | 0.006 | | 0.934 | | 0.296 | | 0.188 | |
| \* p ≤ 0.05, \*\* p ≤0.01, \*\*\* p ≤0.005, \*\*\*\* p ≤0.001 | | | | | | | | | | |

Innovation-oriented competencies (IOC) explained 11.7% of the variance in project success for all factors of senior management support (ΔF= 27.092, p<0.001). The provision of resources explained an 11.9% variance in project success (ΔF= 0.1.428, p<0.001), and the interaction term (IOCxPOR) does not explain any variance in project success. The finding shows significant improvement in the value of R2 in Model 1 (R2=0.122) and Model 2 (R2=0.128) but the SPSS software does not generate values for Model 3, which indicate that providing resources does not act as a moderator in this study. The communication explained a 26.9% variance in project success, with a significant value of ΔF= 41.374 (p<0.001) and the interaction term (IOCxCOM) explained a 27.4% variance in project success (ΔF= 2.406, p>0.05). The results show significant improvement in values of R2 in Model 1 (R2=0.122), Model 2 (R2=0.276), and Model 3 (R2=0.285), which indicates that communication is a moderator and strengthen the relationship between innovation-oriented competencies and project success. The result indicates that expertise explained 21.7% variance in project success, with a significant value of ΔF= 25.678 (p<0.001) and the interaction term (IOCxEXP) explained 21.7% variance in project success (ΔF= 0.1.097, p>0.05). The finding show continuous improvement in the value of R2 in Model 1 (R2=0.122), Model 2 (R2=0.225), and Model 3 (R2=0.229), which validates expertise as a moderator and strengthen the link between innovation-oriented competencies and project success.

The power dimension explained 29.2% variance in project success, with a significant value of ΔF= 49026 (p<0.001) and the interaction term (IOCxPWR) explained 29.1% variance in project success (ΔF= 0.885, p>0.05). The results show continuous improvement in the value of R2 in Model 1 (R2=0.122), Model 2 (R2=0.299), and Model 3 (R2=0.302), which indicate power as a moderator and strengthen the association between innovation-oriented competencies and project success. Structural arrangements explained a 25.3% variance in project success, with a significant value of ΔF= 36.480 (p<0.001) and the interaction term (IOCxSTA) explained a 25.6% variance in project success (ΔF= 0.1.639, p<0.01). The findings indicate significant improvement in the value of R2 in Model 1 (R2=0.117), Model 2 (R2=0.253), and Model 3 (R2=0.256), which validates structural arrangements as a significant moderator and strengthens the relationship between innovation-oriented competences and project success. A summary of the moderation analysis for the sixth hypothesis (IOCxSMS) is provided in Exhibit 8.

Exhibit 8. Summary of regression analysis for moderation (IOC x SMS)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable (s) | Project Success | | | | | | | | | | |
| IOC x POR | | IOC x COM | | IOC x EXP | | IOC x PWR | | | IOC x STA | |
| β | t | β | t | β | t | β | t | β | | t |
| Step 1: IV (IOC) |  |  |  |  |  |  |  |  |  | |  |
| Model 1 | 0.349\*\*\*\* | 5.205 | 0.349\*\*\*\* | 5.205 | 0.349\*\*\*\* | 5.205 | 0.349\*\*\*\* | 5.205 | 0.349\*\*\*\* | | 5.205 |
| Model 2 | 0.214 | 1.621 | 0.179\*\*\*\* | 2.686 | 0.235\*\*\*\* | 4.250 | 0.123 | 1.809 | 0.207\*\*\* | | 3.135 |
| Model 3 | - | - | 0.720\* | 2.027 | 0.510 | 2.708 | 0.337 | 1.421 | 0.593\*\* | | 1.921 |
| Step II: MV (SMS) |  |  |  |  |  |  |  |  |  | |  |
| Model 2 | 0.158 | 1.195 | 0.428\*\*\* | 6.432 | 0.340\*\*\* | 5.067 | 0.478\*\*\* | 7.002 | 0.399\*\*\*\* | | 6.040 |
| Model 3 | - | - | 0.769\*\*\*\* | 2.501 | 0.796 | 1.807 | 0.810\* | 2.252 | 0.962\* | | 2.163 |
| Step III: Interaction |  |  |  |  |  |  |  |  |  | |  |
| Model 3 | - | - | -0.120 | -1.551 | -0.611 | -1.047 | -0.476 | -0.940 | -0.792\*\* | | -1.280 |
| Value of R2: |  | |  | |  | |  | | |  | |
| Model 1 | 0.122 | | 0.122 | | 0.122 | | 0.122 | | | 0.122 | |
| Model 2 | 0.128 | | 0.276 | | 0.225 | | 0.299 | | | 0.261 | |
| Model 3 | - | | 0.285 | | 0.229 | | 0.302 | | | 0.267 | |
| Value of Adjusted R2: |  | |  | |  | |  | | |  | |
| Model 1 | 0.117 | | 0.117 | | 0.117 | | 0.117 | | | 0.117 | |
| Model 2 | 0.119 | | 0.269 | | 0.217 | | 0.292 | | | 0.253 | |
| Model 3 | - | | 0.274 | | 0.217 | | 0.291 | | | 0.256 | |
| Value of ΔR2: |  | |  | |  | |  | | |  | |
| Model 1 | 0.122 | | 0.122 | | 0.122 | | 0.122 | | | 0.122 | |
| Model 2 | 0.006 | | 0.154 | | 0.103 | | 0.177 | | | 0.139 | |
| Model 3 | - | | 0.009 | | 0.004 | | 0.003 | | | 0.006 | |
| Value of F: |  | |  | |  | |  | | |  | |
| Model 1 | 27.092\*\*\*\* | | 27.092\*\*\*\* | | 27.092\*\*\*\* | | 27.092\*\*\*\* | | | 27.092\*\*\*\* | |
| Model 2 | 14.290\*\*\*\* | | 37.038\*\*\*\* | | 28.099\*\*\*\* | | 41.395\*\*\*\* | | | 34.251\*\*\*\* | |
| Model 3 | - | | 25.673\*\*\*\* | | 19.108\*\*\*\* | | 27.875\*\*\*\* | | | 23.455\*\*\*\* | |
| Value of ΔF: |  | |  | |  | |  | | |  | |
| Model 1 | 27.092\*\*\*\* | | 27.092\*\*\*\* | | 27.092\*\*\*\* | | 27.092\*\*\*\* | | | 27.092\*\*\*\* | |
| Model 2 | 1.428\*\*\*\* | | 41.374\*\*\*\* | | 25.678\*\*\*\* | | 49.026\*\*\*\* | | | 36.480\*\*\*\* | |
| Model 3 | - | | 2.406 | | 1.097 | | 0.885 | | | 1.639 | |
| \* p<0.05, \*\* p<0.01, \*\*\* p<0.005, \*\*\*\* p<0.001 | | | | | | | | | | | |

**Discussion**

The findings of this study show a significant and positive link between task-oriented, relationship-oriented, and innovation-oriented competencies and the success of development projects. The results indicate a significant impact of senior management’s communication, expertise, power, and structural arrangements (except for the provision of resources) on the link between task-oriented, relationship-oriented, and innovation-oriented competencies and project success. Further, the results of correlation analysis show that task-oriented, relationship-oriented, and innovation-oriented competencies as well as all dimensions of senior management support have a significant and positive relationship with project success. Moreover, the significant and positive values of coefficient and correlation show that there are more chances of success of development projects when project managers employ task-oriented, relationship-oriented, and innovation-oriented competencies, and senior management also ensures timely provision of resources, effective communication with the project team, exhibit project related expertise, exercise the authority, and show commitment in structural planning, in addition to meeting the cost, schedule, scope and quality parameters. Thus, the research questions have been addressed and the research objectives have been met along with the research hypotheses being substantiated by the findings.

Our findings suggest that project managers displaying task-oriented competencies mainly focus on the management of resources to achieve project goals. Also, project managers follow a task-oriented approach in defining project priorities and schedules to achieve project objectives within a specified budget and schedule. Indeed, the leadership competencies required to manage tasks are considered important in achieving project success (Moradi, Kähkönen, & Aaltonen, 2020). The adoption of a task-oriented approach helps in achieving the overall project vision by communicating clear objectives and processes, issuing deadlines, offering guidance, and implementing appropriate reward systems. On this matter, time-oriented project managers play a key role in the successful completion to achieve the desired project goals which are supported through earlier research (Blanchard, 2018). Furthermore, a significant and positive link between relationship-oriented competencies and project success entails that project managers exhibiting relationship-oriented competencies recognize and appreciate the contribution of team members in projects, which often drives the project forward for successful completion. Also, innovation-oriented leaders appreciate innovative ideas and encourage the adoption of creative practices that have a positive influence on the success of projects. Similarly, innovation-oriented leaders provide vision and critical thinking to help team members that can lead towards successful completion of projects and achievement of the desired results. In line with the work of Irfan et al. (2021) and Ahmed and Lodhi (2021), a set of leadership competencies displayed by project managers not only aids in the achievement of the project's goals but can also help to secure the long-term utilization of resources with the backing of senior management in public sector organizations.

Although the provision of resources indicated a significant and direct effect on project success but no impact on the links between task-oriented, relationship-oriented, and innovation-oriented competencies and project success, due to insignificant results of the moderating effect. These insignificant results for the provision of resources in the context of public sector development projects are not consistent with an earlier study conducted on construction projects in the non-public sector (Ahmed, Hussain, et al., 2021). As such, one of the possible reasons for the insignificant results can be the non-availability of adequate and timely resources in the public sector’s development projects because several organizational channels and hierarchies are followed in the approval process of resources in the public sector projects. Furthermore, the findings reveal a significant association and positive influence of task-oriented, relationship-oriented, and innovation-oriented competencies on the success of development projects in the presence of support from senior management in terms of communication, expertise, power, and structural arrangements. Indeed, engineering and project managers must be fully aware that if adequate support is not provided, this does not imply that the project should be construed as either an unsuccessful project or failed project (Bashir, Ojiako, & Mota, 2020). Nevertheless, the findings suggest the significant and positive moderating effect of structural arrangements which strengthen the link between innovation-oriented competencies and the success of public sector projects.

This study advances the argument based on recent work by Salman et al. (2020) and Ahmed, Philbin, et al. (2021) that project outcomes are often not successful due to a deficiency of leadership competencies exhibited by project managers in the implementation of public sector projects. The same limitation applies to engineering organizations within the public sector as well as other sectors. In projects, the competencies of engineering and project managers are considered important and critical success factors (Janjić, Todorović, & Jovanović, 2020). Focusing on the appropriate competencies can help engineering and project managers to improve their performance and lead to successful project completion as well as instantaneous career progression. Nevertheless, engineering and project managers should adopt task-oriented, relationship-oriented, and innovation-oriented competencies, in addition to having the awareness of other critical success factors and challenges to identify the areas for improvement relating to essential leadership competencies as well as the type of support required to ensure successful completion of projects. Therefore, the study's findings suggest that if the public sector wants to enhance the likelihood of project success, a focused strategy is required based on the development of task-oriented, relationship-oriented, and innovation-oriented competencies of project managers, in addition to the support of senior management is in place in terms of expertise, communication, power, resource provision, and structural arrangements.

***Implications for engineering managers and project managers***

This study contributes to the body of knowledge investigating how task-oriented, relationship-oriented and innovation-oriented competencies impact the success of projects, which is highly relevant to public sector and engineering organizations that tend to be project-based. In this context, the insights highlighted by the empirical evidence are relevant to both engineering managers and project managers, since both professions are generally engaged in the delivery of complex and innovative projects. Compared with prior studies that only focus on the identification of leadership clusters (Ahmed, Philbin, et al., 2021), or the effect of emotional competencies on projects (Ahmed & Lodhi, 2021), the empirical results of this study further extend the prior literature. This extension of the literature identifies that project success is influenced by various leadership competencies possessed by both engineering managers and project managers (i.e. task-oriented, relationship-oriented and innovation-oriented) in the presence of senior management support, in terms of communication, expertise, power, and structural arrangements. Although, all the types of support from senior management exhibit significant positive effects on each leadership competency of project managers (p<0.01), which is evident from the values of R2 and/or Adjusted R2. However, the beta coefficient values of the interaction terms were mostly insignificant. Indeed, there is still limited evidence about developing and prioritizing competencies for engineering managers and project managers in the context of public sector development projects. Thus, future research should develop appropriate clusters and priorities for the competencies of engineering and project managers and further develop appropriate strategies to ensure various levels of support from senior management in engineering organizations.

An engineering manager can use the findings of this study to understand which leadership competencies are needed to move from simple to innovative or complex developmental projects, or from the public sector to other sectors, or vice versa. Indeed, due to the significant and positive effect of leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented) on project success, these competencies enable engineering managers and project managers to overcome less-than-ideal levels of support from senior management in development projects. Therefore, both engineering managers and project managers need to prioritize and exhibit task-oriented, relationship-oriented, and innovation-oriented competencies in different phases of projects as well as according to the requirement and nature of developmental projects. For instance, innovation-oriented and relationship-oriented leadership competencies can be more suitable for engineering managers and project managers during the initiation and planning phases of manufacturing or new product development projects. On the other hand, task-oriented and relationship-oriented leadership competencies facilitate the execution or controlling phases of development projects in the public sector. Moreover, given that various aspects of senior management support can weaken the effects of the different leadership competencies in projects, engineering managers can benefit from understanding that the best way to gain support from senior management is through the provision of resources, frequent communication, expertise in managing projects, delegation of power and structural arrangements. Also, engineering and project managers can further identify, prioritize and develop a mapping between the different levels of support required from senior management and the sets of leadership competencies based on the nature and complexity of projects, to mitigate the chances of project failure and enhance the probability of project success in the public sector.

Besides practitioners, the findings are also helpful for the senior-level management who provide support both for public and private sector projects. Indeed, senior management should have an awareness of leadership competencies possessed by engineering and project managers who gain the necessary support from senior management in engineering organizations. To maximize the likelihood of project success, senior management should provide the required resources that can be used efficiently by engineering managers and project managers to ensure the completion of projects within schedule, budgetary and specification requirements. Nevertheless, task-oriented, relationship-oriented, and innovation-oriented competencies should be sought when selecting engineering and project managers in organizations, in addition to prioritizing leadership competencies according to the requirement of the projects that can enhance the likelihood of project success. Furthermore, matching the leadership competencies is necessary when filling leadership positions, where engineering organizations focus on making more informed decisions in hiring, developing, and promoting engineering managers. Since the majority of development projects and programs are organized and funded by the public sector, this study also has several societal implications. Such as organizations and departments working under the umbrella of the public sector can advance recruitment and training policies to develop project managers’ right set of leadership competencies who can ensure that support from senior management would be made available to the right people at the right time in development projects.

**Conclusions**

This research study investigated the impact of multi-dimensional senior management support on the relationship between leadership competencies (i.e. task-oriented, relationship-oriented, and innovation-oriented) and project success. The findings of the study revealed that task-oriented, relationship-oriented, and innovation-oriented competencies significantly and positively contribute to the success of development projects in the public sector of Pakistan. The study implies that the success of engineering projects relies on task-oriented, relationship-oriented, and innovation-oriented competencies that are possessed by engineering managers and project managers. A further contribution of this study is that the success of public sector projects can be further enhanced if consistent and multi-faceted support is made available from senior management. Furthermore, a higher level of support from senior management would be more helpful in the successful completion of complex development projects where engineering and project managers should also exhibit task-oriented, relationship-oriented, and innovation-oriented competencies.

***Limitations and future directions***

This study has the following limitations. Firstly, although the sample data of projects used for investigation in this study was collected from multiple projects and organizations in the public sector, however, it was limited to one specific country i.e. Pakistan. For further generalization of findings, an international study may be more prolific in the future as respondents from different countries could have different perceptions about leadership competencies and the necessity of support required from senior management. Thus, the model of this study can be adopted in various cultural, regional, and project contexts to further validate the findings in the future. Secondly, the study focused on investigating the impact of senior management support on task-oriented, relationship-oriented, and innovation-oriented leadership competencies in the context of public sector projects. Future studies in the context of various types of engineering projects, organizations, industries, sectors, and cross-culture comparisons may be interesting areas to investigate. Thirdly, the level of support provided by senior management varies from project to project and leadership competencies possessed by project managers also vary from person to person, therefore, future studies should investigate the variation in diverse levels of support provided by senior management and the nature or proportion of leadership competencies required during the various phases of different types of engineering projects.

Finally, the scope of this study was limited to being investigative, therefore generalizations must be considered with caution, especially considering the nature of competencies and support required in the implementation of public sector projects. Consequently, further research may be needed to determine the importance of each competency in different phases of projects as well as the level of competency development required and/or is present in each kind of project or phase, and what degree of support would be required from senior management in each phase of the project. Researchers may also examine whether these contextualized leadership competencies can be sustained over time and lead to excellent performance in terms of achieving success in other types of projects (i.e. in addition to public sector development projects). This could pave the way forward for engineering and project managers of public sector projects as well as those in other engineering organizations to realize project success and achieve enhanced project outcomes.

**Conflict of interest**

There is no conflict of interest among the authors.

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**Appendix-I. Measurement items of variables**

| ***Variable measurement item(s)*** | |  |  |  | ***Average score*** |
| --- | --- | --- | --- | --- | --- |
| Task-Oriented Competencies: | |  |  |  |  |
|  | made ahead planning to manage project resources in an efficient manner | | | | 4.0051 |
|  | perceived project goals and objectives very clearly | | | | 4.127 |
|  | regularly monitored staff work to manage project outcome | | | | 4.1523 |
|  | evaluate team’s work by giving honest feedback | | | | 4.0914 |
|  | transformed project long-term goals into action plans | | | | 3.9340 |
|  | autonomy given to project team for successful completion of the project | | | | 3.7766 |
|  | encouraged the team to take challenging and demanding project tasks | | | | 3.9848 |
|  | empowered team members to enhance efficiency, trust, and vision of the team | | | | 4.1117 |
|  | supported the team to solve problems and develop innovative ideas and proposals | | | | 3.9949 |
|  | encouraged the team to cope with the challenges of existing practices and policies | | | | 3.9188 |
|  | shared knowledge and expertise with project team | | | | 4.1878 |
|  | encouraged teamwork for successful accomplishment of project objectives | | | | 4.1827 |
|  | maintained dynamic working environment for completion of project tasks | | | | 4.2893 |
|  | developed confidence and trust of the team while performing project activities | | | | 4.1675 |
|  | collaborated with project stakeholder to manage scope, task and specifications | | | | 3.9492 |
| Relationship-Oriented Competencies: | |  |  |  |  |
|  | energize and stimulated the team to achieve project objectives | | | | 3.8680 |
|  | motivated the team to focus on short-term and long-term project goals | | | | 3.9188 |
|  | encouraged the team to pursue demanding goals in an achievable manner | | | | 3.8071 |
|  | inspired the team to feel pride for being associated with the project | | | | 4.0254 |
|  | shared own strengths and weaknesses | | | | 3.7411 |
|  | encourage and demonstrated a thirst for positive criticism | | | | 4.0102 |
|  | awareness about the impact of emotions on the project work environment | | | | 3.7462 |
|  | awareness of self-belief with capability to manage own emotions | | | | 3.9898 |
|  | focused to achieve project results through challenges and constructive criticism | | | | 4.0558 |
|  | performed consistently under pressure and adapted appropriate behaviors | | | | 3.9695 |
|  | maintained balance association between the situation, task and team members | | | | 3.8832 |
|  | communicated the vision and instructions to the project team | | | | 4.0711 |
|  | engaged team members through lively and enthusiastic communication | | | | 3.9848 |
|  | maintained formal communication channels during the project work | | | | 4.1117 |
|  | employed communication for coaching and mentoring the project team | | | | 3.6904 |
|  | tailored communication according to the interest of project stakeholders | | | | 3.8071 |
|  | established informal communication channels with project stakeholders | | | | 3.7665 |
| Innovation-Oriented Competencies: | |  |  |  |  |
|  | explored a wide range of inventions for achieving project objectives | | | | 4.0355 |
|  | judged issues and implications of the project in a broader perspective | | | | 4.0152 |
|  | explored project stakeholder’s needs and expectations | | | | 4.0863 |
|  | explored strategies to maximize opportunities and minimize the project threats | | | | 4.0863 |
|  | maintained balance in project’s short-term and long-term considerations | | | | 4.1980 |
|  | conscious about implications and impact of external factors on project outcomes | | | | 3.7970 |
|  | employed critical ability to identify and probe the facts regarding project outcome | | | | 3.9746 |
|  | analyzed the advantages and disadvantages of the project in a critical manner | | | | 4.0254 |
|  | observed shortcomings of ideas and proposals concerning the project | | | | 3.9492 |
|  | made sound judgments and decisions for successful accomplishment of project | | | | 3.9188 |
|  | anticipated the impact of assumptions on project objectives | | | | 4.0000 |
|  | established sound priorities for project’s futuristic work | | | | 3.8325 |
|  | imaginative and innovative in all aspects of project work | | | | 3.8426 |
|  | had clear vision for project’s future directions to meet organizational needs | | | | 3.7360 |
|  | anticipated the impact of changes on project’s vision due to implementation issues | | | | 4.0355 |
| Senior Management Support: | |  |  |  |  |
|  | provided adequate resources for successful implementation of the project | | | | 3.8376 |
|  | provided sufficient resources for system implementation and organizational change | | | | 3.8782 |
|  | provided adequate resources to facilitate system adaptations in the organization | | | | 3.9949 |
|  | provided resources to support stakeholder environment and project completion | | | | 3.9086 |
|  | frequent communication with project team for successful project implementation | | | | 3.9848 |
|  | often communicated to sell the project to the rest of the organizations | | | | 3.7868 |
|  | communicated organizational implications and changes related to project | | | | 3.6701 |
|  | discussed potential system changes related to organizational effectiveness | | | | 3.7005 |
|  | continuously communicated implications of the project with various stakeholders | | | | 3.7970 |
|  | possesses relevant expertise and experience in project management | | | | 3.7411 |
|  | often recognized the changes and implications associated with project | | | | 3.2690 |
|  | awareness of necessary system adaptations in the organization | | | | 3.5838 |
|  | recognized the power and interest of all stakeholders around the project | | | | 3.4264 |
|  | used power to support the project and protect the project team members | | | | 3.5381 |
|  | used power to facilitate system implementation and organizational change | | | | 3.5279 |
|  | used authority to facilitate and enforce essential system changes | | | | 3.5888 |
|  | used authority to determine the needs, roles, and positions of project stakeholders | | | | 3.6548 |
|  | exercised authority to develop better project management capabilities | | | | 3.7766 |
|  | enforced adequate project structures for successful implementation of the project | | | | 3.7817 |
|  | instituted processes and procedures to implement organizational change | | | | 3.6954 |
|  | developed structures to adapt system and improve organizational efficacy | | | | 3.6853 |
|  | strengthen the stakeholder’s support for successful completion of the project | | | | 3.5939 |
| Project Success (PS) | |  |  |  |  |
|  | the project was completed on time | | | | 3.6193 |
|  | the project was completed within budget | | | | 3.6345 |
|  | the project had only minor changes in scope | | | | 3.5330 |
|  | the project achieved overall efficiency measures | | | | 3.5533 |
|  | the project met predefined quality parameters | | | | 3.7360 |
|  | the product improved the customer’s performance | | | | 3.1320 |
|  | the customer was satisfied with deliverables | | | | 3.1066 |
|  | the product met the customer’s functional and technical requirements | | | | 3.0254 |
|  | the product improved the customer image and value | | | | 3.4721 |
|  | the product improved the customer loyalty and trust | | | | 3.4721 |
|  | the project team was satisfied and motivated | | | | 3.6447 |
|  | the team was loyal to the project | | | | 3.5787 |
|  | the project team had high morale and energy | | | | 3.6142 |
|  | the team felt that working on project was an opportunity | | | | 3.7107 |
|  | the team members experienced personal growth | | | | 3.6751 |
|  | the project was an economic and business success | | | | 3.4416 |
|  | the project increased the organization’s productivity | | | | 3.5787 |
|  | the project enhanced the organization’s market value | | | | 3.4315 |
|  | the project directly contributed to the organization’s performance | | | | 3.2437 |
|  | the project improved the efficiency of organization | | | | 3.4518 |
|  | the project outcome will contribute to future projects | | | | 3.5838 |
|  | the project will help to create new markets | | | | 3.6142 |
|  | the project created new technologies for future use | | | | 3.7107 |
|  | the project contributed to new business processes | | | | 3.6041 |
|  | the project supported in developing better managerial capabilities | | | | 3.4772 |