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Examining Project Coordination, Risk Management, and Workforce Competence for Power Transmission Project Success Through Leadership

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ABSTRACT

This study examines the mediating role of transformational leadership in the relationship between project coordination, risk management, workforce competence, and the success of power transmission projects. A quantitative approach was adopted, with data gathered through structured surveys from professionals, including project managers, engineers, and contractors involved in HVDC systems, substations, and transmission lines. The findings indicate that transformational leadership significantly strengthens the impact of project coordination and risk management on project success. By fostering clear communication, motivation, and a shared vision, transformational leaders enhance the effectiveness of project teams, improve decision-making processes, and facilitate collaboration. Additionally, workforce competence was found to be positively influenced by transformational leadership, leading to better technical performance, adherence to safety standards, and timely project delivery. This study highlights the importance of leadership in shaping the outcomes of complex power transmission projects. Transformational leadership helps integrate various project elements, ensuring efficient resource utilization and minimizing risks. The study is beneficial to project managers and contractors, which shows that leadership improvement is crucial for the enhancement of project performance in power transmission projects.

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1.0 Introduction

Power transmission projects are crucial in the today's world as they involve the delivery of electricity from one point to the next. These projects include construction of HVDC systems, substations, and transmission lines, and are critical to the provision of electricity to meet increasing demand, the efficient transfer of electricity, and the support of economic development (Wang et al., 2024). HVDC systems are large capital-intensive projects that involve a number of activities and players and therefore call for proper planning and management of resources. Such projects are usually large and intricate, and are likely to be accompanied by numerous risks on the technical front, financial front, legal and environmental front and many others. Hence, the importance of the success of these projects is crucial in order to enhance the efficiency of the operation, to decrease costs and to fulfil the technical requirements (Sun & Min, 2024).

In power transmission projects, important factors including project integration, project risk management and human resources management are vital. Project coordination means the arrangement of the various activities, resources and time frames of a project in order to achieve the objectives of the project. Good management of resources and coordination of the engineering, contracting, and supply sub systems are critical in avoiding delays and wastages (Nauman et al., 2024). While risk management entails the identification, assessment and control of risks that may hinder the achievement of project objectives. Such risks can be system breakdowns, financial or legal problems, and it is vital to control them to meet project deadlines (Niyafard et al., 2024). The workforce has been defined as another crucial aspect of project success. The engineering workforce, technicians and project managers and other officers who are involved in the project implementation are very crucial in the sense that they are supposed to ensure that the implementation of the project is done effectively in accordance to the set technical specifications, industrial requirements and safety standards that are desirable in the particular project (Sahasrabuddhe, 2024).

However, one of the most crucial factors has not been widely examined in the context of power transmission projects, and this is leadership. The leadership is also important in determining the success of a project since it has an impact on the decision-making process, the communication as well as the motivation of the team to achieve certain goals. Out of all the leadership styles, transformational leadership has emerged as a critical element for achieving positive results in large-scale, high-risk projects (Nauman et al., 2024). Transformational leadership entails the provision of direction, an ability to influence people, create commitment, generate new ideas, and by example. This leadership type is characterized by creation of trust, collaboration, and encouragement of employees for high performance. In the case of power transmission projects, transformational leadership can assist in the harmonization of the work of different teams, the management of project liaison and the issues of risk and human resource management (Aliane & Sadiq, 2023).

Despite the fact that project coordination, risk management, and workforce competency are identified as critical success factors in power transmission projects, leadership, especially transformational leadership has received little attention. Although earlier works have emphasized

the role of leadership in overall project management, little attention has been paid to how leadership can moderate the link between project coordination, risk management, workforce competence, and project success in the power transmission sector. This is an important research gap because the role of leadership may help in determining how best to improve performance and success rates of power transmission projects.

The purpose of this study is to examine the relationship between project coordination, risk management, workforce competence and success of power transmission projects with a view to examining the moderating role of transformational leadership. As a result, this study seeks to establish the relationship between transformational leadership and project coordination, risk management, and workforce competence in high-voltage transmission project delivery. This research aims at adding knowledge to the literature on leadership and the success of power transmission projects through consideration of transformational leadership.

This study aims at finding the answer to the following questions. First, it will investigate the impact of project coordination, risk management and workforce competence on the success of power transmission projects independently. Second, it will test the hypothesis that transformational leadership moderates the relationship between these factors and project success. In specifics, this research will examine the following: how and in what ways transformational leadership can enhance the effects of project coordination, risk management, and workforce skills by focusing on teamwork, innovation, and shared goal setting. Thirdly, the study will also seek to find out whether leadership is more effective at certain phases of the project, be it the planning, the execution or delivery phases and how leadership can be integrated into each of the phases of the project to improve the outcome of the project.

The importance of this study is in its possibility to contribute to the identification of the possibilities of leadership practices application for the enhancement of power transmission project success through the management practices. This research could also assist project managers, engineers, and contractors to realize that leadership plays a significant role in determining the performance of a project through the identification of the mediating role of transformational leadership. The results of the study can be useful for the development of recommendations for improving leadership practices during the implementation of power transmission projects, with a focus on the creation of a highly productive, team-oriented, and innovative team. Additionally, the study's findings may have implications for leadership training and development, guiding project managers in the development of the competencies that are required to steer large, critical projects to successful completion.

The foremost contribution of this research is its ability to identify the relationship between leadership, project management, risk management, and workforce competency in power transmission projects. Through the use of transformational leadership, the study presents a theoretical contribution to the existing literature on leadership in project management. Moreover, the theoretical contribution of the study could be useful for the energy industry and project management experts to implement possible solutions for the enhancement of project execution, minimizing the risks, and increasing the overall performance of projects. This is even more so

since there is a growing complexity and size of power transmission projects, and the need for a strong management to manage through the difficulties that come with such projects:

2.0 Literature Review

The implementation of power transmission projects particularly those that involve high voltage is greatly determined by project management. Prior literature has established the importance of factors such as project integration, project risk management and human resource management to the success of complex projects such as power transmission projects (Niyafard et al., 2024). They are interrelated because efficient planning, control and coordination of activities, and resources guarantee that the project is implemented within the scheduled time and cost, while proper identification, assessment, and management of risks will help avoid or at least minimize possible negative impacts on project performance. In addition, workforce competence guarantees that the right technical skills are used in the project, to avoid operational mishaps and to meet safety standards (Utomwen, 2024). However, there is a slowly emerging understanding that leadership is a key driver of these factors and success of projects in general. Transformational leadership has recently emerged as an important moderator in the improvement of team performance, collaboration, and problem solving within project teams (Hartono & Wiguna, 2023).

Transformational leadership theory, which was developed by Bass (1999), is built on the idea of changing the expectations of followers through the power of the leader inspiring, motivating and challenging them. Transformational leaders do this by articulating a vision, challenging the status quo and fostering trust and cooperation. In power transmission projects for instance, whereby interdependence of the various parties involved in the project is crucial, a transformational leader can ensure that engineers, contractors and project managers work coherently to ensure that resources are well utilized and that all the risks are well managed. Transformational leadership has been associated with positive results such as increased job satisfaction, high productivity and enhanced team co-ordination and cooperation (Ahmad et al., 2022), all of which are critical for developing power transmission projects. These leaders help in the management of the challenges that arise in these projects through encouraging environments that enable workers, build their confidence and make them feel that they own the project output.

Other research also show that leadership is an important factor that affect the success of large-scale projects. Zaman (2020) were able to reveal that transformational leadership had a positive relation with the project performance through the enhancement of team coordination and the efficiency of the decision-making process. This finding is in agreement with the work done by Kala Kamdjoug (2024) who stated that leadership was among the critical factors that defined the success of project in high technology industries including power transmission. This work showed that when leaders adopted transformational leadership, they were able to create better project teams to handle the challenges that are common in energy industry projects. Therefore, Mandagi et al. (2023) aimed at highlighting the role of transformational leadership in project coordination and risk management, particularly in large engineering projects, where the management of multiteam and multi-stakeholder systems is critical.

In the power transmission where several teams are involved in installation and maintenance

of power infrastructure, leadership is very important in ensuring that the teams are working in harmony to achieve one goal. Cleveland (2022) established that leadership in power sector projects influenced both technical efficiency and schedule compliance through encouraging communication between project teams. This paper emphasized the need to tap into the leader's capacity to mobilize people and create meaning, especially when leading big teams that need people with different competencies. The risk management skills of transformational leaders in identifying risks and directing the workforce towards the achievement of project objectives is particularly relevant in the power transmission projects.

Although the leadership and project success have been investigated in many settings, the moderating role of transformational leadership between project coordination, risk management, workforce competence, and project success has not been adequately investigated. Although the management of project and human capital is evidently essential for achievement of the project goals, leadership is the only way through which these elements can be organization and coordinated in the right manner. In their current study, Sundeep and Ghapanchi (2024) identified leadership as the mediator between team competencies and project performance in large scale infrastructure projects. This can only mean that leadership could be the missing factor that is required to enhance the benefits of project coordination and workforce competence in the success of power transmission projects.

However, literature on risk management in large projects does not capture the leadership aspect in managing risks. Hussain et al. (2024) conducted a study to examine the effects of project managers' leadership style on the risk management practices within construction projects and showed that transformational leadership enhances positive risk management practices. Transformational leaders are always able to create an environment that encourages free flow of information and hence the team is able to identify risks that may be likely to occur and counter them. This capacity to reduce risks early can greatly enhance the achievement of power transmission projects that are prone to various risks that can prove costly and even dangerous.

This paper aims to examine the relationships between project coordination, risk management, workforce competence, and the leadership in the energy sector as the sector shifts to projects of larger size and complexity. Therefore, the study argues that leadership can be used as a tool to enhance the outcomes of power transmission projects. This paper has therefore posited that through the improvement of team work, communication and the motivation of the teams, transformational leadership can positively influence the effects of the key project management variables and therefore lead to better project outcomes. The purpose of this paper is to build on this understanding of the leadership and power transmission projects in order to determine how leadership can influence these factors for project success.

Namely, although the research that has been conducted and which has determined that project coordination, risk management, and workforce competence as the key success factors of power transmission projects, leadership, particularly transformational leadership, affects these factors. The past research evidence suggests that transformational leadership is beneficial for project performance in terms of cooperation, risk management and team knowledge. However, the

role that transformational leadership has in power transmission projects is not well understood. This research aims at filling this gap by examining the impact of transformational leadership on the relationship between project coordination, risk management, workforce competence and project success in the power transmission industry with a view of deepening the knowledge of the factors that define success in project management.

3.0 Methodology

This study aims to find out the extent of the effect of project coordination, risk management, workforce competency and leadership on power transmission projects success in Pakistan. To achieve this, the research design that was adopted for this study was a quantitative research design and data collected using a structured survey questionnaire. The questionnaire was devised in order to collect feedback from those professionals who are in power transmission line industry in Pakistan and are involved either directly or indirectly into the power transmission line such as HV and EHV transmission systems.

The population of interest in this research is the professionals who are working on power transmission projects in Pakistan with emphasis on people who are involved in planning, implementation and management of transmission projects. These are the engineers and project managers from the public and private sectors, contractors and other stakeholders in the energy industry. The power transmission industry in Pakistan is huge and interconnected with many states owned and private entities handling transmission lines, substations and HVDC systems throughout the country. The participants for this study were chosen in such a way that they include all the key players in the sectors as the success of these projects depend with the collaboration of many people. The sampling method used in this study was purposive sampling since the people to be sampled are well known and have the required experience in power transmission projects. This approach was adopted to ensure that the information gathered would come from professionals in the field who have responsibility in the overseeing of such projects. The study aimed at having 250 participants, and the final respondents were both from public sector utilities of NTDC and the private sector contractors working on power transmission projects. This study used the adequate sample size to ensure that the professionals working in power transmission projects with different ranks provided the data.

The research instrument used in the study was a self-structured questionnaire which was derived from a review of the literature and consultation with experts. The questionnaire was divided into several sections, each corresponding to one of the key variables of the study: The variables that are project coordination, risk management, workforce competence, transformational leadership, and project success. The questions were designed to find out the extent to which these variables were included in the projects of the participants and the impact of these variables on the projects. In order to determine participants' attitude on each of the factors of the study, the questionnaire employed the use of the Likert scale with responses made on a scale of strongly agree, agree, neutral, disagree, and strongly disagree.

For data analysis the study employed Structural Equation Modeling (SEM) to test the relationships between the variables. Specifically, the hypotheses were examined and the mediating

effect of transformational leadership on the linkages between project coordination, risk management, workforce competence, and project success were examined with Smart PLS SEM. Due to this, Smart PLS is chosen since it performs optimally in situations where there are many variables and relationships and this study involves such a model. Smart PLS can estimate both the measurement model and the structural model so as to find out the coefficients of the relationships between variables. To present the demographic characteristics of the participants and the variables of interest, descriptive statistics was employed. The researchers also made sure that they considered the following in the course of the study. All the participants were informed of their rights to confidentiality and, therefore, permission was sought from them to gather data. The participants were assured that the information that they would provide would be used for academic purpose and that the anonymity of the participants would be maintained.

4.0 Findings and Results

4.1 Measurement Model

Smart PLS was used in the measurement model assessment in order to examine the reliability and validity of the constructs within the research framework. The internal reliability of the measurement model was evaluated by Cronbach's alpha, composite reliability (CR), rho_A, and Average Variance Extracted (AVE). These metrics give some indication of the validity of the measures, as well as the degree to which the constructs are measuring the same phenomenon. The measurement model assessment is presented in Table 4.1 below. The Cronbach alpha of all the constructs was above 0.7, the minimum accepted level of reliability, thus showing that the measures were internally consistent. Similarly, the composite reliability for all the constructs was greater than the recommended level of 0.7, which test for the reliability of the constructs. All the Rho_A values also supported the goodness of the measurement model and the AVE for all the constructs was above 0.50 which indicates acceptable convergent validity.

Table 4.1: Reliability Analysis

Construct	Cronbach's Alpha	Composite Reliability (CR)	Rho_A	AVE
Project Coordination	0.84	0.91	0.90	0.58
Risk Management	0.85	0.92	0.91	0.60
Workforce Competence	0.87	0.93	0.92	0.62
Transformational Leadership	0.89	0.94	0.93	0.65
Project Success	0.86	0.92	0.91	0.59

4.2 Validity Analysis

We also assessed the discriminant validity of the constructs by computing the Heterotrait-Monotrait (HTMT) ratio of correlations. A value of HTMT that is greater than 0.90 is considered to have discriminant validity problem. As presented in Table 4.2, the HTMT analysis results are as follows. All the HTMT ratios are less than the cutoff point of 0.90 which is an indication of good discriminant validity. This proves that the constructs are distinct and that, therefore, the multicollinearity does not pose a threat to the measures.

Table 4.2: Validity Analysis (HTMT)

Construct	Project Coordination	Risk Management	Workforce Competence	Transformational Leadership	Project Success
Project Coordination					
Risk Management	0.727				
Workforce Competence	0.611	0.694			
Transformational Leadership	0.704	0.745	0.738		
Project Success	0.685	0.751	0.720	0.771	

4.3 Model Fitness

Fit indices are very important in determining the general quality of the structural equation model. The output of the model fitness analysis is presented in the Table 4.3. The Fit Indices which were used in this study to check the model fitness included the Standardized Root Mean Square Residual (SRMR), the Normed Fit Index (NFI) and the Comparative Fit Index (CFI). The SRMR value is 0.04 which is less than 0.08, which means that the proposed model is in correct fit with the data. The NFI and CFI values are all above the recommended minimum of 0.90, indicating that the model fits the data reasonably well.

Table 4.3: Model Fitness

Fit Index	Value	Threshold Value
SRMR	0.04	≤ 0.08
NFI	0.91	≥ 0.90
CFI	0.93	≥ 0.90

4.4 PLS SEM Results (Direct Effects)

The direct impacts of the independent variables on the project success were assessed by using path coefficients. Table 4.4 below summarizes the findings of the analysis. The path analysis findings showed that all the independent variables had positive impacts on the success of the project. The direct effect of risk management was the highest for this study with a coefficient of 0.34 and p value of less than 0.01, followed by workforce competence with a coefficient of 0.33 and p value less than 0.01, and project coordination with a coefficient of 0.29 and p value of less than 0.01. The direct positive relationship between transformational leadership and project success was also established ($\beta = 0.27$, $p < 0.01$).

Table 4.4: PLS SEM Results (Direct Effects)

Path	Path Coefficient	t-value	p-value
Project Coordination → Project Success	0.29	3.50	0.000
Risk Management → Project Success	0.34	4.10	0.000
Workforce Competence → Project Success	0.33	3.90	0.000
Transformational Leadership → Project Success	0.27	3.30	0.001

4.6 Mediating Effect

The mediating role of transformational leadership was examined using the bootstrapping procedure to determine the indirect relationships between project coordination, risk management, workforce competence and project success. Table 4.5 shows the results of mediating effect analysis that follows. The findings also reveal that transformational leadership fully moderates the relationship between all the independent variables (project coordination, risk management, and workforce competence) and project success. In more detail, the indirect effect of transformational leadership was 0.15, 0.18, and 0.16 for the relationships between project coordination, risk management and workforce competence and project success. The results of this study support the proposition that transformational leadership is instrumental to the beneficial outcomes of power transmission projects.

Table 4.5: Mediating Effect

Path	Indirect Effect	t-value	p-value
Project Coordination → Transformational Leadership → Project Success	0.15	2.80	0.005
Risk Management → Transformational Leadership → Project Success	0.18	3.10	0.002
Workforce Competence → Transformational Leadership → Project Success	0.16	2.90	0.004

5.0 Discussion and Conclusion

This research has implications for understanding the importance of project coordination, risk management, workforce competence, and transformational leadership in the success of the power transmission projects in Pakistan. When analysing the data it was observed that each of the key variables is different and has a significant influence on the project success. Importantly, the study identified that project coordination has a highly significant positive impact on the project success. Co-operation between the project manager, engineer and contractor means that everything is done in time, within the project's budget and according to the technical requirements. These findings are in accordance with the findings of other scholars, who have stressed that integration and proper coordination of all the project stakeholders are vital in tackling various challenges and in the achievement of successful implementation of large-scale infrastructural projects (Mandagi et al., 2023; Nauman et al., 2024)

In addition, risk management was another factor found to affect the success of project significantly. Risk management ensures that identification, assessment and management of risks occur at all phases of a project thus hammering the chances of getting the desired results. Precautions and contingency measures in risk management can be used to avoid adverse incidents from happening or to be ready for any such occurrence. This finding is in congruence with the general literature on risk management where it has been highlighted time and again that the strategic management of risk is a critical factor that determines the success or failure of an infrastructure project (Adu Gyamfi et al., 2024).

The analysis also indicated that workforce competence was another factor that influenced the success of a project. The following was also observed in the projects; projects that used a professional and informed workforce were well positioned to achieve their goals, sustain quality and achieve safety. Skills in managing technical work and flexibility in meeting project challenges were essential in achieving positive project results. This finding corroborates previous research which has established that workforce competency is highly correlated with positive project performance and low risk of project delay or quality problems (Mandagi et al., 2023; Niyafard et al., 2024).

The mediating role of transformational leadership in the relationship between other independent variables and project success was also supported. The present study identified transformational leadership, defined as the capacity to motivate and involve the team, encourage creativity, and set goals, as positively affecting the success of power transmission projects. The leaders who presented transformational activities ensured that there was integration and proper management of risks as well as the workforce productivity and thus ensured that there was enhanced positive work culture that led to high success rates in the projects. This can be in concurrence with the literature work done by Bass (1999) who states that leaders especially the transformational kind have a big responsibility of making sure that teams go through the right process of tackling challenges and ensuring that projects are completed.

By applying the theoretical framework of the study to power transmission projects in Pakistan, this work concludes that the following are critical in ensuring project success: effective

project coordination, efficient risk management, a competent workforce, and transformational leadership. All of these factors can play a role in affecting the performance of projects and when added together can work to producing better results in terms of the cost, time and quality of projects. Therefore, this paper shows that there are many factors that need to be taken into account when assessing the effectiveness of power transmission projects. From the results presented in this paper, it can be useful for policy makers, project managers, and other interested parties in the power transmission industry. In order to improve the prospects of project success it is important for organizations to focus on leadership, employee training, and sound risk management. Also, there is potential for enhancing cooperation and coordination among various players involved in transmission projects. These findings can be useful in future power transmission projects in Pakistan as the sector remains to grow and the practices that may be effective can be adopted. The study also provides possibilities for further research to investigate the interconnections between leadership styles and other elements of project success in large scale infrastructure projects in developing countries.

Muhammad Naeem Anjum: Problem Identification and Theoretical Framework

Muhammad Touseef Yazdani: Data Analysis, Supervision and Drafting

Babar Shahzad Khan: Methodology and Revision

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