

## Article

# Investigating the Impact of Communication Factors and Stakeholders Engagement on Renewable Energy Projects in Pakistan

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**Abstract:** This study investigates the relationship between communication factors, stakeholders' engagement, and project success (P.S.) of renewable energy in Pakistan. The aim of this study is to identify the communication factors that impact the success of renewable energy projects. The research investigates multiple dimensions of communication factors such as internal communication, external communication, leadership, relationship, and corporation. Moreover, we also tested the indirect relationship using the stakeholder's engagement (S.E.) as a mediating variable. We used a quantitative approach using the questionnaire survey. The random and snowball sampling technique was used to collect data from the project managers, project engineers, and team leaders associated with renewable projects in Pakistan. We collected data in two phases. In the first phase, between August 2023 and December 2022, we distributed 400 complete research questionnaires. In return, we received 337 questionnaires, 84% of the distributed questionnaires. Similarly, between January 2023 and February 2023, we distributed 350 research questionnaires; in return, we received 255 questionnaires, which is 73% of the distributed questionnaires. However, we collected data from the 592 respondents engaged with renewable energy projects. Further, the structural equation modeling technique (SEM) was performed to analyze the study data through SmartPLS 4.1. The outcomes confirmed that communication factors significantly and positively impact the project's success. The results guaranteed that communication factors have a positive and significant relationship with the stakeholder's engagement. Furthermore, the results demonstrated that stakeholders' engagement mediates communication factors and project success, enhancing the project's success.

**Keywords:** renewable energy; stakeholder's engagement; communication factor; project success



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## 1. Introduction

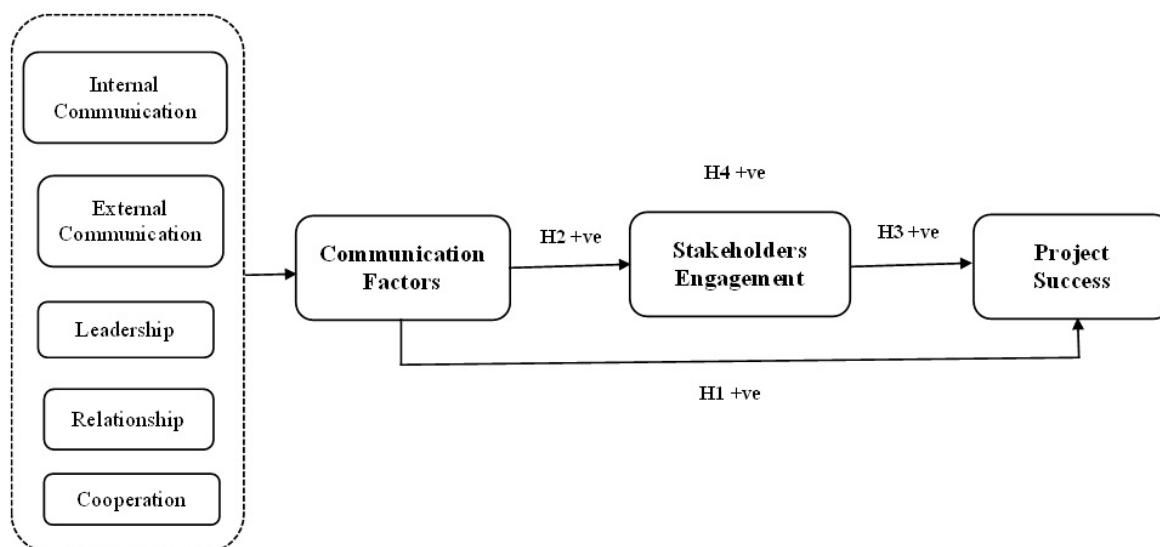
The demand for renewable energy projects has swiftly increased in the last few decades. Renewable energy plays a significant role in a country's economic, social, and industrial growth. Therefore, renewable energy is considered a key aspect of the economic development of a country [1]. As a result, most developed nations employ construction-based renewable energy to adopt environmentally friendly and green energy. However, due to the country's high demand, ongoing projects cannot fulfill the energy needs of Pakistan [2]. Therefore, for the economic development of any country, we cannot ignore the importance of renewable energy. It significantly enhances the nation's economy and decreases poverty [3,4]. By investing in sustainable energy projects, nations may reduce their

dependence on non-renewable resources, which are insufficient and devastate the environment. Adopting green energy technologies can also encourage innovation in the energy production industry and create new job opportunities [5]. Due to the failure of renewable energy projects in Pakistan, it has been crucial for the country to overcome ecological complications and energy crises [1,6], and similarly, to improve energy productivity, which reduces carbon dioxide by adopting advanced technology and economic developments [7]. Many studies addressed that Pakistan is facing environmental issues [8].

Pakistan has multiple renewable energy projects, and their effective utilization is crucial [9]. As an emerging country, Pakistan mainly relies on fossil fuels for energy, which results in a growing energy crisis. Due to the nearly 145 million people who lack access to appropriate power and the industries' struggles to achieve their objectives, this crisis has a negative influence on day-to-day life and ultimately impacts the economy [10]. The demand for energy in Pakistan is severe, and current energy projects cannot satisfy energy demands. Therefore, Pakistan has tremendous potential to start new renewable energy projects, with the ability to produce nearly 30 GW from hydropower and 50 GW from wind energy [11]. Despite their tremendous potential, the majority of Pakistan's renewable energy projects can only deliver and achieve their primary goals [3,12]. Projects using renewable energy are not merely a way to address the rising demands for transportation, electricity, and purified water, they also provide various advantages that might assist firms in achieving their objectives and meeting the needs of their stakeholders [13]. The success of renewable energy projects depends on stakeholder involvement because retaining their support is essential to realizing long-term success. Projects can provide long-term value to their stakeholders through renewable energy projects by integrating their priorities and values with their business strategies [14]. Maqbool [15] stated that good communication is essential to determining the success of renewable energy projects. However, the current research notably highlights the importance of communication in promoting good outcomes in renewable energy projects. Past studies have identified several critical success variables, including team factors, technical factors, and environmental factors, that have an impact on the realization of renewable energy projects, respectively [2,16,17]. Furthermore, Hussain M [3] conducted research on renewable energy projects in Pakistan and identified different critical success factors, for example, government support, personality traits, and access to finance. Previous studies argue that effective communication improves decision-making power and, as a result, enhances the success of renewable energy projects. Therefore, the success of any project depends on effective communication. Similarly, stakeholders' engagement improves communication and reduces conflicts between workers [18]. As a result, Stakeholder engagement becomes an essential condition to make a project successful. Additionally, every project should develop a good relationship with stakeholders to gain contribution and power to make the project successful. Likewise, stakeholder meetings are dynamic in bringing success into projects and helping them to achieve better decisions [19]. Therefore, to address the challenges of renewable energy projects in Pakistan, these aspects need a comprehensive study on their effects on projects' success. It is essential for policy-makers to understand the problems that must be solved by doing an in-depth analysis of the success factors for renewable energy projects in Pakistan.

The aim of this study is to investigate the relationship between communication factors, stakeholder engagement, and the success of renewable energy projects. Therefore, we tested the direct and indirect relationship between communication factors and project success using stakeholder engagement as the mediating variable. Previously, some researchers investigated the connection between communication factors and organizational performance. Similarly, some studies examined the relationship between communication factors and project sustainability using supportive leadership or organizational support as a mediating variable. Hence, this is the first and novel study in which we investigate communication factors, stakeholders' satisfaction, and the success of renewable energy projects together. Moreover, the mediating effect of stakeholders' satisfaction also adds value to this study. However, based on this idea, we developed a research model, which is shown below in

Figure 1. Moreover, the above-mentioned aims and objective of the study, as well as below mentioned Figure 1, is raising the below-mentioned research questions (RQ).



**Figure 1.** Theoretical framework.

RQ1. Do communication factors enhance the success of renewable energy projects?

RQ2. Does stakeholder engagement mediate communication factors and project success?

The further structure of the paper is as follows: the second part of this study describes the literature review and hypothesis development. The third part of this study explains the research methodology. Similarly, the fourth part of this study presents the complete results and analysis. Finally, a detailed conclusion and recommendations are given in the last section.

## 2. Literature Review

### 2.1. Communication Factors

Communication means exchanging ideas and thoughts and sharing information between the groups. Prior studies recommend avoiding the use of complicated vocabulary or technical words in your communication, to be clear and concise [17]. The success of a project depends on effective communication, which encourages the sharing of innovative ideas and standpoints and prevents disagreements [20]. Team members should be encouraged to communicate their ideas and opinions honestly and openly, and the problems or concerns should be addressed [21]. Similarly, in project success, effective communication is essential for project sustainability. References [22,23] argue that wise communication brings strategic support to the top management, enhancing team satisfaction and organizational support. Likewise, Wheeler et al. 2022 [24] explain that inspiring communication is a kind of polite comment that inspires team members to put in extra effort and boosts their confidence [25]. In addition, skillful communication identifies project problems that help top management develop effective plans to enhance the success of the construction-based energy project. Furthermore, Ahmad [2] recognizes that the project life cycle requires excellent communication, which is crucial to the success of renewable energy projects. It works like blood in projects, improving team members' confidence and achieving better decision-making results. Communication has different factors, but, in this study, we used five communication factors that extensively affect the success of renewable energy projects. These five communication factors are (i) internal communication, (ii) external communication, (iii) leadership, (iv) relationship, and (v) cooperation.

### 2.1.1. Internal Communication

Internal communication takes place between the project members, empowering organizational culture, organic structure, and participation in decision-making. Therefore, the internal communication symbol emphasizes “credibility, trust, relationship, and feedback” [26]. In addition, wise communication enhances project success and reduces internal conflicts between project members.

### 2.1.2. External Communication

External communication is the exchange of information between two originations or more. External communication policies emphasize involving stakeholders in the project through effective communication. Likewise, a healthy project needs a strong relationship with investors to engage them, influencing the project’s decision-making. The prior study stressed that external communication is essential in bringing stakeholders confidence and developing strategies to know stakeholders’ satisfaction, enhancing the performance of renewable energy projects [14].

### 2.1.3. Leadership

A leader gives directions and guides subordinates to achieve organizational goals. The leader leads the organization and sets some purpose for the organization. Effective leadership involves setting a clear vision for the project, delegating tasks, managing resources, providing guidance and support, and ensuring that team members are accountable for their responsibilities [27]. Likewise, the active leadership approach seeks to increase the active communication of top-level workers to share the responsibility for spatial project success [28].

### 2.1.4. Relationship

A good relationship between employer and employees creates trust between each other and removes doubts. Likewise, a healthy relationship motivates team members and stakeholders to improve trust and confidence [29]. Similarly, Zaman [30] found that a good relationship between the team leaders and team workers reduces the toxicity in the organization and brings project success.

### 2.1.5. Cooperation

Cooperation is the collective effort of team members and project managers to achieve project satisfaction through the workers’ shared willingness and emotional ties [31]. A successful environment develops from better relationships because it involves the workers in the project’s main objectives. Moreover, healthy collaboration among team members and project managers leads to improved project effectiveness and shorter project length.

## 2.2. Stakeholders’ Engagement

Stakeholders are groups of individuals or organizations who have an interest in the project, and who also benefit from the project [32]. Therefore, stakeholder engagement is a process of identifying the interest of stakeholders and engaging them with the project, and dealing with the project to satisfy their requirements [33]. Prior studies presented stakeholders’ engagement with different backgrounds, e.g., maritime spatial planning process [34], innovation and entrepreneurship [35], sustainability development [36], and IT projects, respectively. Therefore, examining the role of stakeholder engagement in renewable energy concerns is worthwhile. A project manager and other authorities should critically identify the demands of stakeholders who may cause any disruption if the stakeholders are not identified [36]. Similarly, project managers can develop some plans to decrease risks and deal with difficulties by comprehending the worries and expectations of stakeholders. This encourages stakeholders to interact practically, strengthening teamwork relationships [37,38]. Likewise, research was conducted by Saad [39]. The project manager is accountable for understanding the stakeholders’ areas of interest so they can perform

better for the project outcomes. Identifying the stakeholders' interests is essential for estimating their involvement in the project [40]. Conversely, engaging stakeholders in the project improves decision-making processes, indicating that stakeholder involvement is important for the project, which enhances the project's success.

### 2.3. Project Success

Project success means completing any task or objective in terms of allocating resources. Therefore, a successful project efficiently and effectively allocates resources to the project stakeholders [17]. Previously, the concept of project success was ignored by the researchers. Specifically, renewable energy-related project success has not been measured in past studies. However, some recent studies have tried to measure a project's success [14,17,30,41]. A project's success depends on the technical skills of the employees, the process of communication, and organizational support. Therefore, Islam [42] investigated each of the manager's technical skills, communication, and leadership skills that affect the performance of the project. The results of this study indicate that project success is highly dependent on communication factors. Furthermore, [14] confirm that the success of a project is dependent on the successful application of the project process. A project is considered failed if the project time is longer than the decided time. Similarly, if the cost of the project is also more than the forecasting cost, it is also assumed that the project is failing [43]. This study has proven that project success depends on communication factors and employee engagement.

## 3. Hypotheses Development

### 3.1. Communication Factors and Project Success

Prior studies indicate that effective communication plays an important role in the success of any project [2,15,16]. In this study, we also suggest that communication is an important factor that enhances the success of projects. However, communication factors are dominant in improving employee engagement and building a supportive workplace environment that ultimately affects project performance [43]. Effective communication between employees and employer increases trust in each other [43]. Therefore, the project managers, project team, and other stakeholders share their reservations and provide solutions to these reservations. In this way, trust will increase among the project manager, project team, and stakeholders [44]. Therefore, Rasool [45] suggests that communication factors significantly improve project performance. Therefore, based on the above discussion, we suggest the below-mentioned hypothesis.

**H1a:** *Communication factors positively influence project success.*

### 3.2. Communication Factors and Stakeholders Engagement

Past studies demonstrate that communication factors and stakeholder engagement are positively connected with project success [14,46]. Likewise, Shahzad [46] conducted a survey on renewable energy projects in Pakistan. The objective of this study was to investigate the connection between effective communication and strategic goals. The outcomes of this study demonstrate that effective communication enhances trust, workers' job satisfaction, and integrates project stakeholders [2]. Effective communication develops a productive work environment where stakeholders may work together to achieve common objectives. Wise communicators build trust and respect using smart communication [46]. Based on previous literature, we identified that communication factors and stakeholder engagement have a strong relationship. However, this study suggests the following hypotheses.

**H1b:** *Communication factors positively influence stakeholder engagement.*

### 3.3. Stakeholders Engagement and Project Success

Stakeholders play an important role in the success of the projects. Prior researchers suggested that stakeholder engagement has a positive and significant connection with the



success of projects [46,47]. Stakeholder engagement is a process of managing stakeholders to win their support for the project. This process helps organizations proactively consider the expectations of stakeholders and fulfill requirements. Therefore, stakeholders in project management are the people who directly or indirectly influence and are affected by the initiation, execution, and implementation of the project [34]. The absence of interaction with stakeholders or their improper engagement can bring uncertainty to project management. Their needs, statuses, and expectations may change at any moment of project delivery, which will significantly alter the project structure, terms, schedule, and deliverables. This is why a project manager should keep his/her finger on the pulse when dealing with them and be ready for any kind of uncertainty, just in case [48]. Based on the existing literature, we suggest the below-mentioned hypothesis.

**H2a:** *Stakeholders' engagement positively influences project success.*

### 3.4. Mediation Stakeholders Engagement

Previous literature suggests that stakeholder engagement creates the connection between the communication factors and multiple dimensions of project performance, such as construction projects, project sustainability, and environment management [14,34,36,48,49]. The researchers have different approaches to examining the mediation effect of stakeholder engagement. Some studies investigate the connection between community engagement and project performance [50]. Similarly, some studies examine the relationship between participant engagement and project sustainability [51]. According to Rasool [17], effective communication factors, collaborator engagement, and project performance have significant connections with each other [17]. Furthermore, Bahadorestani [32] suggests that stakeholder engagement plays an intervening role in the development of the association between communication factors and project sustainability. An organization learns and progresses its capacity to perform stakeholder engagement while creating relationships with team workers and helping them communicate well [52]. A comfortable environment among the team members will emerge through good stakeholder engagement in the project, which improves performance and project success [35]. According to Teixeira [53], the team members' enthusiasm, trust, and passion affect stakeholder engagement and organizational communication. Thus, it was observed in prior studies that stakeholder engagement was used in previous literature, which positively affects project success. Considering the previous literature, stakeholder engagement mediates the communication factors and the success of the project. The above discussion suggests the hypothesis below.

**H3a:** *Stakeholders' engagement positively mediates communication factors and project success.*

## 4. Research Methodology

### 4.1. Research Strategy

A quantitative approach was used for the collection and analysis of data. We collected data through the questionnaire survey method. There are two main reasons to choose the questionnaire survey approach. First, collecting data through a questionnaire survey is easy, and we can collect the maximum amount of data in a minimum amount of time [3]. Second, this approach is related to the experimental method that leads to quantitative measures, which presents positivism in a logical way to employ hypothesis generalization of the research outcome. In general, social attitudes and social behaviors are only partially measurable in a quantitative way. Still, the testable method of hypothesis analysis, the method of quantitative analysis, offers a roadmap to treat the research problems somehow in a quantitative way [17].

### 4.2. Questionnaire Development

The aim of this study is to investigate the connection between communication factors and the success of renewable energy projects. This study also explores the mediating effect

of stakeholder satisfaction on the relationship between communication factors and project success. The research questionnaire we used in the current study consisted of 30 items. We adopted these items from Rasool 2021, Rasool 2022 [3], and [17]. Moreover, we measured the items using a 5-point Likert scale (i.e., strongly disagree (1) to strongly agree (5)). Before data collection, the authors pre-tested the research questionnaire through a pilot study. In the pilot study, we distributed the questionnaire among 10 project managers associated with renewable energy projects and 10 academic professors with research backgrounds in project management. However, the pilot study respondents suggest some modifications to the questionnaire. As per their suggestions, we modified the questionnaire. After revision of the questionnaire, we distributed the survey questionnaire among the target population and collected data.

#### 4.3. Sampling and Data Collocation

This research applies a questionnaire survey to obtain first-hand empirical data. The demand for renewable projects is rapidly expanding in Pakistan. Therefore, we collected data in the vicinity of Islamabad, Lahore, and Karachi, Pakistan. Random and snowball sampling techniques were used to collect data from the project managers, project engineers, and team leaders associated with renewable projects located in Pakistan. We collected data in two phases. In the first phase, between August 2023 and December 2022, we distributed 400 complete research questionnaires, in return, we received 337 questionnaires, which was 84% of the distributed questionnaires. Similarly, between January 2023 and February 2023, we distributed 350 research questionnaires, in return, we received 255 questionnaires, which was 73% of the distributed questionnaires. However, we collected data from the 592 respondents engaged with renewable energy projects.

#### 4.4. Variables Measurements

This study consists of three variables: communication factors, stakeholders' engagement, and project success. In this part, we measured each variable on a 5-point Likert scale, which adopted modified items from Hussain [3]. We used 5 items of communication factors adopted from Maqbool and Rasool [23,54]. The sample items of communication factors are as follows: "The project manager gives great motivation to the worker to work hard at the project site" and "Our project team have an effective communication channel". The acceptable and standard value of Cronbach's alpha is 0.70 higher than the validity criteria. The alpha value (0.74) of communication factors indicates that all the items we used in this study are valid and reliable.

The items of stakeholder engagement were adopted from Molwus and Tan [55,56]. A total of 4 items were used (stakeholder's engagement provides full support to make our project successful). The Cronbach alpha achieved for stakeholders' engagement is (0.863), more than the standard alpha value (0.7); therefore, this study confirms that it is valid and reliable.

The items of project success were adopted from Zamman and Rasool [2,17]. The sample was "We completed our projects within the budget allocation" and "Our organization is always satisfied with our team members and overall project performance". This study shows that Cronbach's alpha value is 0.793, which fulfills the requirements, being greater than the standard value that confirms the items' reliability and validity. Therefore, the above value indicates the instrument items were valid and reliable.

#### 4.5. Demographics

Table 1, mentioned below, presents the demographic information about the respondents. The total number of participants is 592 and the ratio of male participants is more than female participants. Similarly, we classified participants' work experience, distributed into three portions: below 5 years, 5–10 years, and 10–15 years. For respondents' educational qualifications, we divided them into three parts: postgraduate, undergraduate, and other. The demographic table of the respondents is given in below mentioned table.

**Table 1.** Respondents Summary.

| Characteristics | Category          | Frequency | Percentage |
|-----------------|-------------------|-----------|------------|
| Sex             | Men               | 376       | 63.51%     |
|                 | Women             | 216       | 36.48%     |
| Work experience | 5–10 years        | 292       | 49.32%     |
|                 | 10–15 years       | 189       | 31.92%     |
|                 | Above 15 years    | 111       | 18.75%     |
| Positions       | Project directors | 64        | 10.81%     |
|                 | Project managers  | 153       | 25.84%     |
|                 | Working managers  | 224       | 37.82%     |
|                 | Group leaders     | 110       | 17.06%     |
| Education       | Section managers  | 41        | 6.92%      |
|                 | Post-graduation   | 95        | 16.04%     |
|                 | Undergraduate     | 373       | 63.00%     |
|                 | Other             | 124       | 20.94%     |

## 5. Results and Analysis

The authors used SmartPLS software to analyze the data. Data collection, screening, descriptive analysis, and demographic analysis were all steps in the data analysis process. The use of factor analysis, direct path analysis, and particular indirect path analysis was performed as part of structural equation modeling (SEM). In this study, we used a two-step process to evaluate the measurement and inner models. According to prior researchers [57], partial least squares modeling is a special method for multivariate analysis that can help with theory development and the analysis of difficult data.

### 5.1. Reliability and Validity Testing

In this part, validity and reliability are two fundamental, universally recognized steps for data analysis. Before using an instrument, psychometric testing is strongly recommended [58]. To assess the overall measurement model fitness, we evaluated each component's reliability, convergent validity, and discriminant validity. The model's fitness level was up to the specified threshold conditions. Multiple attempts were made to reach the desired level, and the objects with low standard values were eliminated. Therefore, Heeringa [59] suggested that the minimum Cronbach's alpha is 0.907, higher than 0.7, considering the correct reliability. The findings of this study indicate that the results are valid, as their values are above 0.70. The findings also confirm that the AVE value is greater than 0.60 for more significant factor loadings for each value. Each construct was measured using the referred criteria values. The reliability is shown in Table 1, together with the results of the extracted average variance, standard loading (SA), composite reliability (CR), and Cronbach's alpha tests.

Through using the HTMT (heterotrait–monotrait) approach, the discriminant validity of each reflective construct was analyzed. Therefore, Voorhees [60] suggests that HTMT is better for analyzing discriminant validity than Fornell and Larcker. Similarly, HTMT is another methodology used to check correlation accuracy [61]. Table 2 shows the outcomes of each item. Therefore, the HTMT value of each item is less than 0.90. Thus, all our discriminant values are valid and reliable.

In Table 3, the R-squared value is a measure that describes the change of the variance in the dependent variable that can be explained by the independent variables. The R-squared value of 0.641 for the variable "Project Support" explains that 64.1% of the variability in the outcome can be explained. The R-squared value of 0.522 for the variable "Stakeholders Engagements" describes that approximately 52.2% of the variability in the outcome can be attributed to changes in this variable alone. Moreover, the R Square and adjusted R s values are given in Table 4.



**Table 2.** Reliability and convergent validity.

| Variables   | F. L  | C.A   | CR    | rho   | AVE   |
|---|-------|-------|-------|-------|-------|
| <b>Communication Factors</b>  |       |       |       |       |       |
| CF1: our project has a factual communication channel.   | 0.897 |       |       |       |       |
| CF2: our project manager delivers motivation to work hard on an energy project.   | 0.830 |       |       |       |       |
| CF3: our project objectives are designed visibly so that every team worker recognizes their duty.                         | 0.794 | 0.844 | 0.902 | 0.914 | 0.682 |
| CF4: our project team workers hold capability and proficiency.  | 0.750 |       |       |       |       |
| CF5: external communication helps to obtain better decision-making stakeholder engagement                                 | 0.850 |       |       |       |       |
| <b>Stakeholders' Engagement</b>   |       |       |       |       |       |
| SHE1: stakeholder engagement effectively solves the firm's environmental problems.  | 0.840 |       |       |       |       |
| SHE2: stakeholder engagement generated innovative concepts which enhance management and ecological duties.                | 0.725 |       |       |       |       |
| SHE3: stakeholders contributed while initiating ecological presentation corporation standards that should be reported on. | 0.779 | 0.863 | 0.870 | 0.907 | 0.710 |
| SHE4: stakeholders contributed to recognizing organization agendas, policies, and goals.                                  | 0.780 |       |       |       |       |
| <b>Project Success</b>  |       |       |       |       |       |
| PS1: we completed our projects under a reasonable budget.   | 0.868 |       |       |       |       |
| PS2: our project has a priority to fulfill the needs of our stakeholders.   | 0.876 |       |       |       |       |
| PS3: we always complete the project within a fixed time.  | 0.866 | 0.793 | 0.813 | 0.863 | 0.611 |
| PS4: our project feels satisfied with team workers and overall achievements.  | 0.755 |       |       |       |       |

**Note:** FL = factor loading, SA = standard loading, CA = Cronbach's alpha, CR = composite reliability, AVE = average variance extracted.

**Table 3.** HTMT.

|   | Factors                | Communication Factors | Stakeholders' Engagements | Project Success |
|---|------------------------|-----------------------|---------------------------|-----------------|
| 1 | Communication factors  |                       |                           |                 |
| 2 | Project success        | 0.807                 |                           |                 |
| 3 | Stakeholder engagement | 0.783                 | 0.886                     |                 |

**Note:** Criteria is that maximum values should be less than 0.85.

**Table 4.** R Square and Adjusted R s Values.

| Research Variables       | R Square | R-Square Adjusted |
|--------------------------|----------|-------------------|
| Project support          | 0.641    | 0.633             |
| Stakeholders' engagement | 0.522    | 0.516             |

## 5.2. Hypothesis Testing

### Direct and Mediated Effects

Hypothesis 1a describes that CF has a direct and positive influence on PS, with a direct influence (B) of 0.418. The *t*-value of 13.155 indicates that this relationship is significant. Therefore, H1a is accepted. The effect size ( $F^2$ ) of 0.233 indicates a moderate effect, which means that CF describes 23.3% of the variance in PS.

Hypothesis 1b describes that CF has a direct and positive influence on SE. The results reveal a direct effect (B) of 0.722. The *t*-value of 10.549 indicates the effect is significant. Therefore, H1b is accepted. The effect size ( $F^2$ ) of 1.091 reflects a large effect, meaning that CF explains 109.1% of the variance in SE.

Hypothesis 2a describes that SE has a direct and positive effect on PS, with a direct effect (B) of 0.445. The *t*-value of 4.548 reflects statistical significance. Therefore, H2a is accepted. The effect size ( $F^2$ ) of 0.264 indicates a moderate effect, meaning that SE explains 26.4% of the variance in PS. The results of direct relationships are given in below mentioned Table 5.

**Table 5.** Direct Effect.

| Hypothesis Name | Path    | Direct Effect | T-Value | Results  | Effect Size F <sup>2</sup> |
|-----------------|---------|---------------|---------|----------|----------------------------|
| H1a             | CF → PS | 0.418         | 13.155  | Accepted | 0.233                      |
| H1b             | CF → SE | 0.722         | 10.549  | Accepted | 1.091                      |
| H2a             | SE → PS | 0.445         | 4.548   | Accepted | 0.264                      |

The mediating paths in this analysis describe that CF has an indirect effect on PS through SE. The total effect (TE) is described as 0.739, which represents the overall effect of CF on PS, considering both the direct and indirect pathways. The *t*-value associated with the total effect is reported as 4.130, indicating that it is statistically significant. Below mentioned Table 6 presents the indirect relationship.

**Table 6.** Indirect Effect.

| Hypothesis | Paths        | Specific Effect | Total Effect | t-Value | Results  |
|------------|--------------|-----------------|--------------|---------|----------|
| H3a        | CF → SE → PS | 0.321 ***       | 0.739        | 4.130   | Accepted |

**Note:** \*\*\* shows the *p* values, significant for this relationship. Remark 1 accepted is based on VAF (variance accounted for). VAF = specific indirect effect/total effect {0.321/0.739 × 100 = 23.7219}.

## 6. Discussion

In this study, we investigated the communication factors and project success related to construction-based renewable energy projects in Pakistan. Furthermore, we examined the role of stakeholders' engagement as a mediating variable between communication factors and project success. Firstly, we investigated the connection between communication factors and project success. We found a strong combination between communication factors and project success, and the outcomes show a direct and positive relationship with project success, which supports our H1a. Prior studies indicated and found a strong association between renewable energy projects and communication factors [2,14]. Clarifying the project's goals indicates that communication factors play an important role in project success. Moreover, ref. [62] also examined the relationship between communication factors and the role of authentic leaders and project success, their findings indicate that the use of clear and effective communication from leaders effectively enhances project success; their study also supports hypothesis H1a. Similarly, the findings of Doloi and Tan [63,64] suggested that poor communication capabilities and unclear goals reduce the strength of project success.

Second, in the current study, we also tested the relationship between SE and PS. Our results confirmed that SE positively impacts project success, which supports H2a. Prior studies also supported our results. Shaukat et al. [46] demonstrated that stakeholder engagement achieves better decision-making, which supports hypothesis H2a. Likewise, our findings confirm that stakeholder engagement positively affects PS, which helps to develop the best project decision [46]. Thirdly, we identified the mediating effect of SE and analyzed the indirect impact of CF on project success. Our results confirmed that SE mediated the relationship between CF and project success (H3a). Firstly, SE significantly impacts the PS and supports H2a (conditional for the mediation analysis). Our results demonstrate that SE enhances project success. Previous literature also supports our outcomes [14,39]. These studies investigated the success of renewable energy projects in Pakistan based on a number of factors, including stakeholder satisfaction and effective communication. Adequate planning and preparedness to meet environmental factors are also essential for a project's success. Hence, stakeholder engagement contributes to the sustainability of renewable energy projects globally, which is a novel contribution; as a result, The results of our mediation will benefit the decision-makers in enhancing the success of the project.

## 7. Conclusions

This study broadens the scope of renewable energy initiatives for developing countries by examining the relationship between communication factors and project success of renewable energy projects. The outcomes of this study highlight that communication factors positively impact renewable energy projects in Pakistan. Moreover, this study identified the five dimensions of communication factors (internal, external, leadership, coordination, and relationship) that make communication wise and effective in renewable project projects. The results of this study demonstrated that communication factors significantly impact project success. Furthermore, this study investigates the mediating effect of stakeholder engagement on the connection between communication factors and project success. However, the outcomes of this study suggest that effective communication and stakeholder engagement networking enhance the success of renewable energy projects.

### 7.1. Managerial Implications

This study offers some insightful recommendations for research scholars, practitioners, and government policymakers, mainly in developing countries such as Pakistan, because construction-based renewable energy projects are still at the primary stage. Some practical strategies that enhance the project's success and bring sustainability are mentioned. Firstly, this study will help project-oriented organizations and top project managers to develop effective communication in renewable projects that establishes a good connection with stakeholders (internal and external). This study suggests that project managers should develop strategic and effective communication with their stakeholders to achieve maximum satisfaction from stakeholders, which makes a project successful. Secondly, renewable energy projects should inspire project managers by using effective communication, considering its core factors (internal, external, leadership, coordination, and relationship), with their stakeholders to motivate them to participate in projects. Third, to establish cooperation and coordination between the team members and project managers with our proposed communication factors, which will create harmony and improve confidence among the workers. Fourth, studies identified that stakeholders' engagement makes a good indirect and direct connection between communication factors and project success. Therefore, the authors suggest that stakeholder engagement in renewable energy projects will assist in better decision-making in Pakistan's poor economy and renewable energy projects. In addition, it contributes most to project success through their engagement. Moreover, the government of Pakistan should introduce new schemes for renewable energy projects which will help to reduce carbon emissions in Pakistan. Policymakers should focus on developing a strategic relationship with other investors to enhance green energy in Pakistan.

### 7.2. Limitations

This study has some possible limitations. Firstly, this study focused on construction-based projects in Pakistan, which is a developing nation. In the future, such kinds of studies can be explored in developed or underdeveloped countries to generalize the results. Secondly, limited data were collected in this study. In the future, researchers can collect more data and generalize the results. Thirdly, project managers did not respond frequently, and their laziness may have been due to negligence while responding to our questions. Therefore, scholars can examine renewable energy projects in another country by investigating other critical success factors such as organizational efficiency and green finance.

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