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Effect Of Risk and Project Management on Performance in Minimizing PLTS Project Disputes

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ABSTRACT: The demand for renewable energy, especially Solar Power Plants (PLTS), continues to increase along with the need for suistainable energy sources. However, PLTS projects face various operational risk and challenges in project management effectiveness that can trigger construction disputes. This study aims to analyze the effect of operational risk and project management effectiveness in minimizing construction disputes in PLTS project, with project performance as an intervening variable. Data were collected through a survey of workers in several PLTS project, then analyzed using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The results of the study indicate that operational risk has a significant impact on project performance, which ultimately increases the potential for construction disputes. Project management effectiveness has been shown to play a role in improving project performance and reducing the risk of disputes, with project performance as a mediating variable in the relationship. This research contributes to academics and practitioners in understanding the relationship between risk, project management, and construction disputes. The results are expected to be a guide for project managers in improving efficiency and reducing conflicts in solar power plants projects in the future.

KEYWORDS: Operational risk, Project management, Construction disputes, Project performance, Solar power plant, SEMPLS

INTRODUCTION

The need for renewable energy, especially from Solar Power Plants (PLTS), has experienced a continuous increase because it is considered as one of the strategic solutions to overcome the energy crisis and global environmental challenges (Durrany Zulkifly & Mohd Said, 2022). Indonesia, with its high solar energy potential, is currently aggressively building solar power plant projects as part of its sustainable energy policy. However, these projects often various operational risks, including technical, legal, and financial issues, which have the potential to cause construction disputes (Mignoni et al., 2023).

Disputes that occur in project implementation have the potential to greatly hamper the smoothness and suistainability of the project as a hold. Not only causing delays in work schedules, disputes can also have serious negative impacts, both in terms of finance and reputation for the parties involved. As the number of PLTS projects increases, the potential for disputes is expected to increases. Therefore, an effective and planned mitigation strategy is needed to minimize these risk and ensure that project implementation is in accordance with the targets and directions that have been planned from the start.

The urgency of conducting this research is driven by the increasing intensity and frequency of disputes in the construction sector, as reflected in data from the Indonesian National Arbitration Board (BANI) as seen in the following figure. The following figure shows a consistent upward trend

in the number of dispute cases in the construction sector over a six year period. This reflects that disputes issues are

becoming more frequent and increasingly important challenges to be managed seriously in the construction industry.

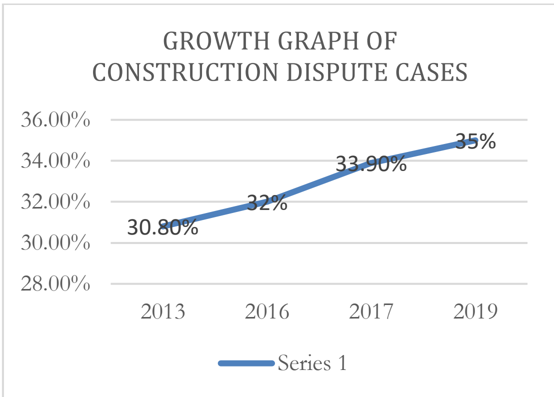

Figure 1 Growth of Dispute Cases

A good project management is a key factor in improving project performance and reducing the likelihood of disputes (Arianie & Puspitasari, 2017). Project performace is one of the key elements that plays an important role in determining the success rate of a solar power project.

Ineffective project management can have a negative impact on project performance, which ultimately increases the risk of construction disputes.

Therefore, it is important to examine how operational risk and project management effectiveness affect construction disputes, with project performance as an intervening variable.

This study aims to evaluate the extent to which operational risk and the level of project management effectiveness contribute to the occurrence of construction disputes in the implementation of solar power projects, with project performance as an intervening variable. Through the Structural Equation Modeling – Partial Least Square (SEM-PLS) approach, this study is expected to provide insight into risk mitigation strategies and improve project management efficiency to support the success and suistainability of solar power projects in Indonesia.

LITERATURE REVIEW

A. SOLAR POWER PLANT PROJECT

Solar Power Plant (PLTS) is an energy generating system that works by utilizing sunlight as the main energy source, then converting it into electrical energy through a mechanism known as the photovoltaic effect (Riko, 2014). Solar cells consists of two layers of semiconductors that have different charges, where the upper layer is negatively charged, while the lower layer is positively charged (Biantoro et al., 2021).

The PLTS project is one of the solutions to meet suistainable energy. In its implementation, the PLTS project consists of several stages, namely planning, procurement, mobilization, civil works, installation of electrical systems, to commissioning and project handover.

B. PROJECT RISK

Project risk refers to the potential for events that can disrupt the achievement of project objectives, either in terms of time, cost, or quality (Musostova et al., 2022). Project operational risk refers to the type of risk that arises as a result of failure in internal processes, errors or limitation of human resources, system weakness, or external events that can disrupt the smoothness and suistainability of a project. Each project has a specific potential risk to its project, therefore, project managers must identify risks even before the project begins (Gamage, 2023).

C. PROJECT MANAGEMENT

Project management is the process of planning, organizing, and controlling various available resources, with the aim of completing the project optimally, both in terms of effectiveness and efficiency (Arianie & Puspitasari, 2017). In the context of PLTS, good project management will ensure that each stage is carried out according to plan and specifications, thereby minimizing the risk of conflict between parties. In an effort to ensure the success of construction project implementation, handling and managing construction disputes has now become a crucial aspect in construction project management practices (Suwandari et al., 2020).

D. CONSTRUCTION DISPUTES

Construction disputes are disputes that arise due to discrepancies between project implementation and the agreed contract (Ismanto & Hardjomuljadi, 2018). Construction disputes referred to in this context refer to the type of civil dispute as regulate in Law Number 2 of 2017.

Dispute can arise due to claims that are not processed properly such as late payments, work, differences in understanding of contract documents, and technical or managerial incompetence of the parties involved. Claims are not a dispute but are a method to avoid dispute (Rostiyanti & Hansen, 2017). Claims submitted are not intended as a form of resistance, but rather as a step to ensure that any problems that arise in the field, which have the potential to cause an extension of time or increase costs, can be immediately handled and resolved quickly(Nugroho et al., 2022).

Early risk identification and mitigation can be an effective conflict prevention strategy. This approach allows project parties to recognize sources of risk early on, so that appropriate countermeasures can be designed and implemented before the risk escalates into a more complex conflict.

E. PROJECT PERFORMANCE

Project performance is the work result obtained during the implementation of a job, which is reflected in the final output produced in accordance with the quantity and quality targets that have been set(Trisnawati et al., 2018). Performance can be evaluated through a number of indicators, including cost, quality, implementation time, environmental management, and implementation of occupational safety and health. Achieving project performance in accordance with planning will have a positive impact on increasing the satisfaction of stakeholders involved in project implementation. Poor project performance can increase the chances of conflict arising. In this study, project performance is positioned as a mediating variable that bridges the relationship between risk or project management and construction disputes.

F. STRUCTURAL EQUATION MODELING (SEM-PLS)

Structural Equation Modeling is a statistical technique used to analyze causal relationships between latent variable (Ghozali, 2014). In the PLS method, there are two types of variables, namely construct variables which are abstract variables and cannot be observed directly, and manifest variables or indicators, namely variables that can be observed and measured directly (Juliandi, 2018).

In the application of the Partial Least Square (PLS) method, a number of evaluations are carried out which include two main components, namely evaluations of the structural model (inner model) which focuses on the relationship between latent variables in the model, and evaluation of the measurement model (outer model) which aims to assess the reliability and validy of indicators in presenting the construct or variable being measured (Sukimin et al., 2022).

At the stage of evaluating the measurement model, a number of tests are carried out to assess the quality of the instrument, as well as tests of convergent validity, discriminant validity, composite reliability, and calculation of the Average variance Extracted value. Meanwhile, in the evaluation of the structural model, the assessment is carried out through testing the R-Squared value to see the explanatory power of the model, as well as estimating the path coefficient to determine the relationship between latent variables.

RESEARCH METHODS

This research is a quantitive study that aims to analyze the relationship between variables, namely operational risk, project management effectiveness, and construction disputes in Solar Power Plant (PLTS) projects, with project performance as an intervening variable through statistical data processing. The research model is analyzed using the Structural Equation Modeling method based on Partial Least Square (SEM-PLS), which allows testing the relationship between variables simultaneously in one analytical framework.

The SEM-PLS method includes several stages of model evaluation, consisting of evaluation of the structural model and evaluation of the measurement model [15]. Evaluation of the measurement model involves a number of tests such as convergent validity, discriminant validity, composite reliability, and calculation of the Average Variance Extracted (AVE) value. On the other hand, evaluation of the structural model is carried out by testing the R-Square value and analyzing the path coefficient estimates to assess the strength of the relationship between latent variables.

The research subjects consisted of PLTS project implementers, including contractors, project managers, and experts who have experience in managing construction projects and resolving disputes. The research procedure began with a literature study to identify research variables, followed by collecting primary data by distributing questionnaires to PLTS project workers. The questionnaire data obtained were then analyzed using the SEM-PLS method through SmartPLS software. The research instrument was compiled based on predetermined constructs, and measured using a 5-point Likert scale.

In this study, the SEM-PLS data analysis technique was chosen because of its ability to explain the relationship between variables comprehensively in one integrated model. Furthermore, SEM-PLS is able to clearly describe the pattern of relationships between latent constructs and manifest variables or indicators used to measure them. This will help understand the relationships hidden behind the indicators that appear on the surface. The SEM-PLS method is also specifically used in research involving intervening variables, because it is able to test the indirect effects between variables. Thus, the mediation effect that occurs in the relationship between constructs can be analyzed comprehensively.

RESULT AND DISCUSSION

The purpose of this study is to examine the impact of operational risk and project management effectiveness on construction disputes in solar power projects, with project performance as a mediating variable. Based on the SEM-PLS analysis, several important findings were found that answer the research questions, as well as develop existing theories on risk management and construction disputes in renewable energy projects, especially Solar Power Plant (PLTS) projects.

A. LOADING FACTOR

Validity testing at the initial stage aims to ensure that latent variables can be represented appropriately through visible indicators, which are analyzed using the Confirmatory Factor Analysis (CFA) approach or confirmatory factor analysis. In this case, according to (Ghozali, 2014), an indicator can be said to be valid if its factor loading value exceeds 0.7, which indicates that the indicator makes a significant contribution in presenting the intended construct.

B. VALIDITY TEST

In the SEM-PLS validity test, a process is carried out to ensure that the indicators actually measure the intended construct. As a reference, the AVE value should be at least 0.5 or more, which indicates that the construct is able to explain at least 50% or more of the variation of the indicators that measure it (Henseler et al., 2012). The following are the results of the validity test in this study.

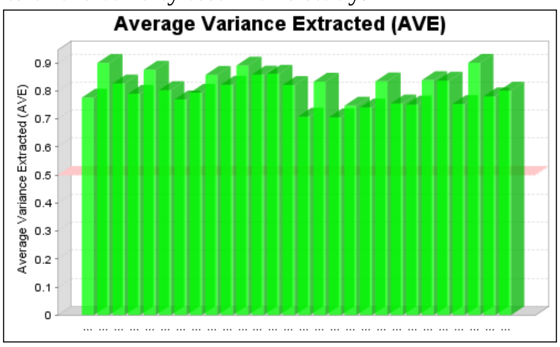

Figure 2 AVE Value Analysis Results

Based on the Figure above, it can be concluded that all variables have an AVE value > 0.5. This indicates that all latent variables meet the convergent validity criteria.

C. RELIABILITY TEST

Reliability testing is carried out to ensure that the indicators of a construct produce consistent and stable measurements. In the SEM-PLS algorithm reliability test, two tools are used, namely composite reliability and Cronbach's alpha. Composite reliability measures the extent to which the indicators have good reliability with values between 0.6 and 0.7, while for Cronbach's alpha, values above 0.6 are expected to indicate satisfactory values (Ghozali, 2014). The following are the results of the reliability test in this study.

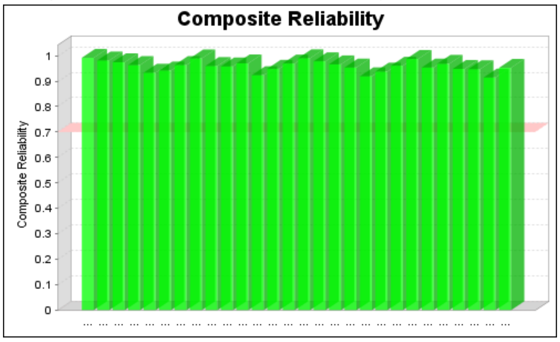

Figure 3 Results of Composite Reliability Value Analysis (Reliability Test)

From the image above, it is evident that each construct shows a composite reliability value above 0.7, this indicates that the established criteria have been met.

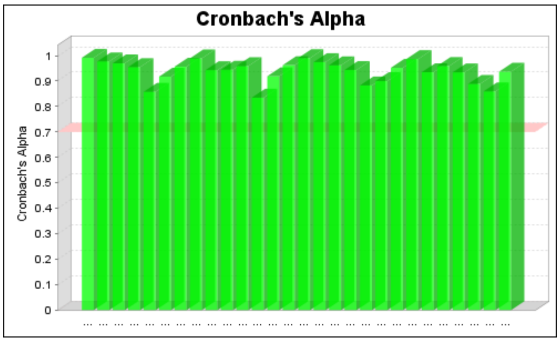

Figure 4 Cronbach's Alpha Value Analysis

Based on the image above, it is clear that each construct shows a Cronbach alpha coefficient above 0.7. As a result, it can be interpreted that all of these constructs have met the reliability criteria.

In testing the R-Square algorithm on the PLS method, the coefficient of determination values were obtained at 0.67; 0.33; and 0.19, respectively, which indicate that the strength of the relationship in the model is classified as strong, moderate, and weak respectively (Henseler et al., 2009) so that it can be used to measure the variation of changes in exogenous constructs against endogenous constructs.

Table 1 R Square Value

Main Factor	R Square	R Square Adjusted
Performance (Z1)	0.98	0.979
Dispute Construction (Y1)	0.978	0.977

Based on the results of testing the structural model, the coefficient of determination (R2) value for the latent variable Project Performance (Z1) was obtained at 0.98. This value indicates that the construct has a very high level of explanation because it is above the threshold of 0.67, which is classified as a strong category. In other words, 98% of the variations that occur in project performance can be explained by two independent constructs, namely project operational risk and project management.

Furthermore, for the latent variable Construction Dispute (Y1), the R2 value obtained was 0.978, which is also above the value of 0.67 and is included in the high category. This result indicates that 97.8% of the variability of construction disputes can be explained by the influence of project operational risk and project management.

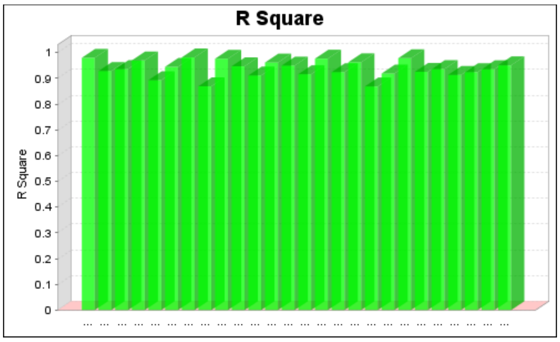

Figure 5 R Square Value

D. HYPOTHESIS TEST

Hypothesis testing in SEM-PLS is conducted to determine whether the relationship between constructs is statistically significant or not. In the bootstrapping direct effect test, the following results were obtained:

Table 2 Direct Effect Bootstrapping Value

	T-Statistics	P Values
Project Risk (X1) -> Performance (Z1)	10.862	0
Performance (Z1) -> Dispute Construction (Y1)	4.704	0
Project Management (X2) -> Performance (Z1)	10.752	0
Project Managemenet (X2) -> Dispute Construction (Y1)	4.579	0
Project Risk (X1) -> Dispute Construction (Y1)	9.621	0

The results of the research and model analysis show that:

1. Operational risk (X1) has a significant effect on project performance (Z1) with a T-statistic value of 10.862 and a P-value of 0.000, which means that the higher the operational risk, the lower the project performance, so H1 is accepted. The most dominant operational risk is at the project risk stage in civil construction work (X1.3) with the highest loading factor value.
2. Effective project management (X2) has a significant effect on project performance (Z1) with a T-statistic

value of 10.752 and a P-value of 0.000, which means that the better the project management, the higher the project performance, so H2 is accepted. The most dominant management indicators include project management at the civil construction work stage (X2.3), which has a direct impact on reducing the potential for technical errors and increasing compliance with technical specifications.

3. Project performance (Z1) has a significant effect on construction disputes (Y1) with a T-statistic value of 4.704 and a P-value of 0.000, which means that low project performance will increase the potential for disputes, so H3 is accepted. The most dispute-prone stage of the PLTS project is performance at the planning and procurement stage (Z1.1), with the highest t-statistics value in the test.

Then, the indirect effect test is intended to determine the influence of performance as a mediating variable in this study. In testing the indirect effects of bootstrapping, the following results were obtained:

Table 3 Indirect Effect Value

	T-Statistics	P Values
Project Management (X2) -> Performance (Z1) -> Dispute Construction (Y1)	4.521	0
Risk Project (X1) -> Performance (Z1) -> Dispute Construction (Y1)	4.073	0

The results of the research and model analysis show that:

1. Operational risk (X1) affects construction disputes (Y1) through project performance (Z1) as a mediating variable, with a T-statistic value of 4.073 and a P value of 0.000, this indicates that project performance only partially explains the relationship, so H4 is accepted.
2. Project management (X2) affects construction disputes (Y1) through project performance (Z1), with a T-statistic value = 4.521 and a P value = 0.000, this also shows partial mediation, so H5 is accepted.

Based on the results of the hypothesis testing that has been carried out, it can be concluded that the occurrence of construction disputes in Solar Power Plant projects is not solely caused by operational risk factors alone, but is also greatly influenced by the extent to which project management is carried out effectively.

These findings indicate that good project management plays an important role in controlling potential disputes. In addition, project performance is proven to function as a significant intermediary variable (mediator), because it strengthens and bridges the relationship between operational risk, project management effectiveness, and the emergence of construction disputes. Thus, the role of project performance in this context is not only as an output, but also as a key element that influences the dynamics of the relationship between the main variables in the study.

The results of this study are in line with existing theories, which state that the implementation of effective risk management can contribute positively to improving project performance and reducing construction disputes (Gamage, 2023).

In addition, this study is also in line with research (Maharani et al., 2022), which shows that project management effectiveness plays an important role in maintaining project sustainability and preventing conflicts between stakeholders. However, this study provides additional insights by emphasizing that the role of project performance as a mediating variable is very important in determining the impact of operational risk and project management effectiveness on construction disputes. This strengthens the idea that improving project performance can be a key strategy in reducing disputes, especially in renewable energy infrastructure projects such as solar power plants.

CONCLUSIONS

Based on the results of the study, it was found that operational risk and project management effectiveness have a significant effect on construction disputes in solar power projects, with project performance as an intervening variable. This study found that operational risk has a significant effect on project quality performance, a result that is in line with previous studies, but this study enriches previous studies by identifying that the civil construction work stage is the most critical stage in influencing project performance.

Similarly, project management has been shown to have a positive impact on project quality performance, supporting previous studies. However, the uniqueness of this study lies in the mapping of six stages of project management, with the emphasis that management at the civil construction stage has the strongest influence in reducing technical errors and increasing compliance with specifications.

In addition, this study also shows that project quality performance plays an important role in suppressing construction disputes, in line with the results of previous studies. However, the new contribution of this study lies in the discovery that the planning and procurement stage is the most vulnerable point to disputes, a dimension that has not been widely revealed in previous studies.

Furthermore, this study confirms the mediating role of project performance in the relationship between operational risk and construction disputes. This study provides added value by identifying that the mediation is partial, where both direct and indirect relationships show significance.

Finally, this study provides an important new contribution through the specific context of solar power projects, which is still rarely discussed in the literature. The focus on the dominant stages of risk and project management and the use of performance variables as mediators make this study relevant not only theoretically, but also applicatively in efforts to minimize construction disputes in renewable energy projects.

For further research, it is recommended to expand the scope of the research area, consider external factors such as government regulations and renewable energy policies, and use a mixed method approach to gain a more comprehensive understanding of the factors that influence construction disputes in solar power projects.

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