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Analysis of the Effects of Work Method Selection and Monitoring of Work Execution on Construction Time and Cost Risks in Highway Projects

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work method; monitoring; time risk; cost risk; SEM-PLS

ABSTRACT
This research aims to analyze the effect of work method selection and work implementation monitoring on time and cost risks in toll road construction projects in Banten Province. Toll road construction projects have a high level of complexity and frequently face various problems, such as project delays, cost overruns, limited resources, and weak project supervision systems. These conditions underscore the importance of implementing appropriate work methods and effective project monitoring to minimize risks during construction activities. This study employed a quantitative approach using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. Data were collected through questionnaires distributed to 54 respondents consisting of contractors, supervisory consultants, and project management personnel involved in toll road projects in Banten Province. Data analysis was conducted using SmartPLS 4 software through outer model and inner model testing. The results show that work methods have a negative and significant effect on both time risk and cost risk. Furthermore, project monitoring also has a negative and significant effect on both time risk and construction cost risk. The findings indicate that the better the implementation of work methods and project monitoring, the lower the risks of project delays and cost overruns. This study is expected to serve as a reference for contractors, consultants, and project owners in improving the effectiveness of toll road construction project management, particularly in controlling project time and costs.

INTRODUCTION

Infrastructure development is one of the primary drivers of national economic growth, especially in developing countries such as Indonesia (Guo et al., 2022; la Torre et al., 2023; Lemanowicz et al., 2026; Pacinella et al., 2022). Toll road infrastructure plays a strategic role in improving connectivity between regions, accelerating logistics distribution, and supporting equitable development (Basri et al., 2024; Bénichou, 2023; Flory & Nyaronga, 2025; Qamar & Khan, 2024). In recent years, the Indonesian government has actively developed infrastructure projects through the National Strategic Project (Proyek Strategis Nasional, PSN) program, as reflected in the construction sector's contribution to Indonesia's Gross Domestic Product (GDP), which reached more than 10% in 2024 (BPS, 2024). The value of national construction continues to increase in line with the growth in infrastructure projects, particularly in the toll road sector, which is a priority for national development (Ministry of PUPR, 2023).

One such strategic project is the construction of the Serang–Panimbang Toll Road in Banten Province, which aims to improve regional accessibility and encourage regional economic growth (Anindito et al., 2025; Buchori et al., 2023; Qamar & Khan, 2024). The project is of high complexity as it involves various technical, social, and environmental aspects. In practice, toll road construction projects frequently encounter obstacles, particularly related to time delays and cost overruns. The phenomenon of construction project delays is a common problem across many countries, including Indonesia (Zali et al., 2025), and can be caused by various factors such as material delays, design changes, weather conditions, and weak coordination among the parties involved (Adhityas et al., 2023).

Delays in construction projects not only affect completion time, but also have direct implications for increased project costs (Issa et al., 2020). In project management, time and cost are two interrelated aspects within the triple constraint framework, alongside project quality (PMI, 2021; Hoque et al., 2024). When delays occur, cost increases inevitably follow due to the need for additional resources, higher operational costs, and potential contract penalties (Al Amri & Marey-Pérez, 2020). Time and cost control are therefore critical aspects of construction project success (Mpofu et al., 2024).

Toll road construction projects are particularly complex, involving factors such as geographical conditions, land acquisition, government regulations, and a large number of stakeholders (Putri et al., 2023; Nufah et al., 2024). This complexity elevates the potential risks that can hinder project implementation (Osei-Kyei et al., 2022). Risk in a construction project refers to uncertainty that can negatively affect the achievement of project goals in terms of both time and cost (Noor et al., 2023), making effective risk management strategies essential to minimizing these negative impacts (Oliveros-Romero & Aibinu, 2023).

The selection of work methods is one of the key factors in determining construction project success, encompassing technical approaches, the use of tools and technology, and the sequence of work execution. Appropriate work methods can increase efficiency, reduce technical errors, and lower the risk of delays and cost overruns, while inappropriate methods can cause inefficiencies and heighten project risks. Monitoring and supervision of work implementation also play a crucial role in ensuring that projects proceed as planned. Continuous monitoring enables early detection of deviations so that corrective action can be taken promptly. The effectiveness of monitoring can be further enhanced through the use of technologies such as Building Information Modeling (BIM), drones, and project management software.

Several studies have examined the factors affecting time and cost risks in construction projects. Zali et al. (2025) found that construction project delays in Indonesia are largely attributable to weak coordination and design changes in the field. Adhityas et al. (2023) identified limited resources and weather conditions as the main causes of delays in toll road projects in Sumatra. In the international context, Ferrada & Serpell (2014) emphasized that the selection of appropriate work methods constitutes critical knowledge capable of reducing technical risks and project delays, while Jaselskis & Russell (1993) highlighted the importance of structured monitoring systems in controlling project costs. However, most previous studies remain partial in scope, focusing on only one aspect of risk or one independent variable without simultaneously examining the relationship between work methods, monitoring, and time and cost risks within a single integrated model. Furthermore, the use of advanced analytical methods such as Structural Equation Modeling–Partial Least Squares (SEM-PLS) in the context of toll road projects in Indonesia remains very limited, despite this method's capacity to analyze complex relationships between variables in greater depth.

Based on this, a research gap exists with respect to the simultaneous analysis of the influence of work methods and monitoring on time and cost risks, particularly in toll road construction projects in Banten Province. The novelty of this study lies in the application of the SEM-PLS approach to test the causal relationships between work methods and monitoring as exogenous variables, and time and cost risks as endogenous variables, within an integrated model, while focusing on toll road projects in Banten, which have their own distinct geographical characteristics and complexities. This study therefore aims to analyze the influence of these two variables using the SEM-PLS approach, based on data obtained from contractors, supervisory consultants, and field implementation teams. This research is expected to make a theoretical contribution to the development of project management science, as well as to offer practical benefits as a reference for determining effective work methods and optimal monitoring systems to minimize the risk of delays and cost overruns in construction projects.

METHOD

Types of Research

This research uses a quantitative approach with descriptive and explanatory methods. The quantitative approach was chosen because this study aims to test the relationship between variables statistically and produce conclusions that are objective and measurable. The descriptive method was used to describe the characteristics of the respondents and the research variables based on the data obtained from the questionnaire, while the explanatory method was used to explain the causal relationship between the variables of the work method and Monitoring on the time and cost risks of the construction project.

This study also uses a survey approach as the main data collection technique. Data was collected through the distribution of questionnaires to respondents who were directly involved in toll road construction projects. This approach allows researchers to obtain primary data that is relevant to field conditions. In addition, this study uses the Structural Equation Modeling (SEM) method based on Partial Least Squares (PLS) to analyze the relationships between variables. The SEM-PLS method was chosen because it is able to test complex models with a relatively limited number of samples and does not require strict normal distribution assumptions. Thus, this method is considered appropriate for research that focuses on the predictive relationships between variables in construction projects.

Research Location and Time

This research was carried out on toll road construction projects in the Banten Province area. The selection of this location is based on the consideration that the toll road project in the area is part of the National Strategic Project which has a high level of complexity, both from technical, managerial, and environmental aspects. This condition makes the research location relevant to examine the influence of work methods and monitoring on project time and cost risks.

The research time is carried out in several stages, starting from the preparation stage, data collection, data processing, to the preparation of research reports. The preparation stage includes literature study and preparation of research instruments. The data collection stage was carried out through the distribution of questionnaires to respondents consisting of contractors, consultants, and project management. Furthermore, the collected data is processed using SmartPLS software for statistical analysis. The final stage is the interpretation of the results and the preparation of the research report. With systematic time allocation, this research is expected to run effectively and produce valid data that can be scientifically accounted for.

Population and Sample

The population in this study is all professionals involved in toll road construction projects in Banten Province, including contractors, supervision consultants, and project management. This population was chosen because they have direct involvement in the implementation of projects, especially related to the selection of work methods, the implementation of monitoring, and the control of time and cost risks. Professionals who have field experience are considered able to provide more objective data and reflect the actual conditions of the project. In addition, toll road projects have a high level of complexity and involve various work disciplines, so respondents who understand the construction process are needed thoroughly. Thus, the population of this study is considered representative to answer the research objectives regarding the influence of work methods and monitoring on the risk of construction projects.

The sampling technique uses non-probability sampling with the purposive sampling method, which is the selection of respondents based on certain criteria that suit the needs of the research. These criteria include having at least two years of experience in toll road projects, being directly involved in project implementation, understanding work methods and monitoring systems, and coming from elements of contractors, supervision consultants, or project management. The number of samples used was 50 respondents, who had met the minimum requirements in the SEM-PLS analysis, which was five to ten times the number of research indicators. With 10 main indicators, the minimum number of samples is 50 respondents, so this study is considered to have met the analysis requirements. The use of this method is expected to be able to produce relevant, accurate data, as well as valid and reliable research models in explaining the relationship between work methods, monitoring, and time and cost risks in toll road construction projects in Banten Province.

Data Collection Techniques

Data collection techniques are an important stage in research to obtain valid, objective, and relevant data in accordance with the research objectives. In this study, data collection was carried out through several methods, namely literature review, interviews, and questionnaire distribution, so that the data obtained was more comprehensive and able to describe the actual condition of the toll road construction project in Banten Province. The literature review is carried out by collecting various references such as journals, scientific books, regulations, and previous research to obtain a strong theoretical basis related to project management, work methods, monitoring, and risk management. In addition, interviews were conducted with parties involved in the project, such as contractors, supervision consultants, and project management, to obtain preliminary information about field conditions, obstacles faced, and the application of real work and monitoring methods.

Furthermore, the main technique of data collection was carried out through the distribution of questionnaires using Google Form to respondents involved in toll road projects in Banten Province. The questionnaire was prepared in the form of closed-ended questions based on the indicators of research variables and used a Likert scale with five levels of answers, ranging from strongly disagree to strongly agree, to measure respondents' perceptions of work methods, monitoring, time risk, and cost risk. The higher the score given, the higher the respondent's level of approval of the statement submitted. The data obtained was then processed using SmartPLS 4 software to test the validity, reliability, and relationships between variables through the SEM-PLS method. With this systematic and structured data collection technique, it is hoped that the research will be able to produce accurate data and can comprehensively explain the influence of work methods and monitoring on construction project risks.

Data Analysis Techniques

The data analysis technique in this study uses the Structural Equation Modeling (SEM) method based on Partial Least Squares (PLS) which was chosen because it is able to analyze the relationship between latent variables simultaneously, either directly or indirectly, and can still be used on relatively small sample numbers and data that are not normally distributed. This method is also suitable for predictive and exploratory research, especially in the context of construction project management involving many indicators. The analysis process is carried out with the help of SmartPLS 4 software so that model testing can be carried out systematically and accurately. The initial stage of analysis began with descriptive statistics to describe the characteristics of respondents' responses to variables of work methods, monitoring, time risk, and cost risk. Questionnaire data is processed using a scale range calculation to group respondents' assessments into certain categories, making it easier to interpret the results of the study.

Furthermore, measurement model testing (outer model) was carried out to ensure the validity and reliability of indicators on each latent variable through convergent validity tests (loading factor > 0.70 and AVE > 0.50) and reliability tests (Composite Reliability and Cronbach Alpha > 0.70). After that, structural model testing (inner model) was carried out to analyze the relationship between variables by looking at the R-Square (R^2) value, path coefficient, and hypothesis test through the bootstrapping technique. The R-Square value is used to assess the model's ability to explain dependent variables, while the path coefficient indicates the direction and strength of the relationships between variables. The hypothesis is stated to be accepted if the t-values > 1.96 and p-values < 0.05 at a significance level of 5%. Through this stage, the research is expected to produce a valid, reliable, and able model to comprehensively explain the influence of work methods and monitoring on time and cost risks in toll road construction projects in Banten Province.

RESULT AND DISCUSSION

SEM-PLS Analysis

1. Outer Loading

Outer Loading analysis was performed to test the convergent validity of each indicator against the latent construct measured in this study. Outer Loading shows the extent to which the indicator is able to represent the latent variable being measured, so this value is one of the main parameters in the evaluation of the measurement model (outer model). In the SEM-PLS method, an indicator is declared valid if it has a loading factor value above 0.70, although in some conditions a value above 0.60 is still acceptable (Hair et al., 2021). Therefore, the Outer Loading test is an important first step to ensure that all indicators used in this study have an adequate level of validity. The variables of the working method in this study were measured using several indicators designed to represent important aspects in the implementation of construction projects. Thus, the results of the Outer Loading test will provide an overview of the quality of the indicator in measuring the construction of the working method accurately and consistently.

Tabel 1. Outer Loading

Indicator	Loading
MK1	0.82
MK2	0.85
MK3	0.81

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that all indicators have an Outer Loading value above 0.70, which shows that these indicators are valid in representing the construct of the working method. The highest loading value was found in the MK2 indicator of 0.85, which shows that this indicator has the greatest contribution in shaping the working method variable. Meanwhile, the MK1 and MK3 indicators also have high loading values, namely 0.82 and 0.81, respectively. This shows that all indicators have a strong correlation level with the latent variable being measured. Thus, it can be concluded that the work method variables in this study have met the criteria for convergent validity. This result is in line with the opinion of Hair (2021) who states that indicators with high loading indicate good ability to represent latent constructs. Therefore, all indicators in this study can be used for further analysis.

2. Average Variance Extracted (AVE)

Average Variance Extracted (AVE) testing is performed to measure the validity of convergences at the latent construct level. AVE shows the proportion of indicator variance that can be explained by latent variables, so that the higher the AVE value, the better the construct's ability to explain the indicators. In the SEM-PLS analysis, a construct is declared to have good convergent validity if the AVE value is greater than 0.50 (Fornell & Larcker, 1981). Therefore, AVE testing is important to ensure that the variables used in this study have an adequate level of validity. The variables in this study consist of work methods, monitoring, and risks, each of which is measured using several indicators. Thus, the results of the AVE test will provide an overview of the ability of each variable to explain its indicators.

Table 2. AVE

Variabel	AVE
Working Method	0.68
Monitoring	0.71
Risk	0.69

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that all variables have an AVE value above 0.50, which indicates that the construct in this study has met the criteria for convergent validity. The Monitoring variable has the highest AVE value of 0.71, which indicates that it has the best ability to explain its indicators. Meanwhile, the variables of work method and risk also have high AVE values, namely 0.68 and 0.69, respectively. This shows that the three variables in this study have a good level of validity. This result is in line with the opinion of Fornell and Larcker (1981) who stated that an AVE value above 0.50 indicates that the construct is able to explain more than 50% of the variance of the indicator. Thus, all variables in this study are suitable for further analysis.

3. Composite Reliability

Composite Reliability (CR) is used to measure the level of internal reliability of a construct in the SEM-PLS model. In contrast to Cronbach Alpha, CR is considered more accurate because it does not assume that all indicators have an equal contribution to latent constructs. A good CR value is above 0.70, which indicates that the construct has a high internal consistency (Hair et al., 2021). Therefore, CR testing is essential to ensure that the research instrument has an adequate level of reliability. In this study, the variables of work methods, monitoring, and risk were tested for reliability using the Composite Reliability value to ensure that the indicators used were able to measure the construct consistently.

Tabel 3. Composite Reliability

Variabel	CR
Working Method	0.88
Monitoring	0.90
Risk	0.87

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that all variables have a Composite Reliability value above 0.70, which shows that the constructs in this study have a high level of reliability. The Monitoring variable has the highest CR value of 0.90, which indicates that it has excellent internal consistency. Meanwhile, the variables of work methods and risks also had high CR values, namely 0.88 and 0.87, respectively. This shows that the indicators used in this study are able to measure constructs consistently. This result is in line with the opinion of Hair (2021) who stated that a CR value above 0.70 indicates good reliability. Thus, all variables in this study can be declared reliable and suitable for use in further analysis.

4. Cronbach Alpha

Cronbach Alpha is used to measure the internal consistency of indicators in a construct, i.e. the extent to which they are able to provide consistent results in measuring the same latent variable. A good Cronbach Alpha value is above 0.70, which indicates that the indicators in the construct have a high level of reliability and are trustworthy (Sekaran, 2017). This test is carried out as a complement to Composite Reliability, as both methods are used to test reliability, but with different approaches. In the context of SEM-PLS, Cronbach Alpha is still used as an initial indicator to see the internal consistency of the construct before further analysis is carried out. Therefore, the Cronbach Alpha test in this study aims to ensure that all variables, namely work methods, monitoring, and risk, have an adequate level of consistency. Thus, the results of this test will provide a solid basis that the research instrument used has met the reliability criteria and is feasible for use in subsequent structural model analysis (Hair et al., 2021).

Tabel 4. Cronbach Alpha

Variable	Alpha
Working Method	0.84

Monitoring	0.87
Risk	0.85

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that all variables have a Cronbach Alpha value above 0.70, which shows that the constructs in this study have good internal consistency. The Monitoring variable has the highest value of 0.87, which shows that the indicators in this variable have a very high level of consistency in measuring the construct in question. Meanwhile, the variables of work method and risk also had high Cronbach Alpha values, which were 0.84 and 0.85, respectively. This shows that all indicators in this study are able to provide consistent results. This result is in line with the opinion of Sekaran (2017) who stated that the Cronbach Alpha value above 0.70 indicates good reliability. In addition, Hair (2021) also stated that high reliability indicates good instrument quality. Thus, all constructs in this study can be declared reliable and feasible to be used in future analysis.

5. R-Square

R-Square (R^2) is a measure used to determine how much the model is able to explain dependent variables that are influenced by independent variables. The R-Square value indicates the proportion of variation in the dependent variable that can be explained by the independent variable in the model. In the SEM-PLS analysis, the R-Square value was divided into several categories, namely weak (0.19), moderate (0.33), and strong (0.67) (Hair et al., 2021). Therefore, the R-Square test in this study aims to find out the extent to which the variables of working methods and monitoring are able to explain the variation in time risk and cost risk in construction projects. The higher the R-Square value, the better the model's ability to explain dependent variables. Thus, the results of this test will provide an overview of the strength of the research model used.

Table 5. R-Square

Variabel	R^2
Time Risk	0.62
Cost Risk	0.65

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that the R-Square value for time risk is 0.62 and cost risk is 0.65. This value shows that the variables of work methods and monitoring are able to explain 62% of the variation in time risk and 65% of the variation in cost risk. This shows that the research model has a fairly strong ability to explain dependent variables. Although this value has not reached the very strong category, it is included in the moderate to close to strong category. This result is in line with the opinion of Hair (2021) who states that an R-Square value above 0.50 indicates good modelability. Thus, it can be concluded that this research model has an adequate level of ability to explain the relationship between work method variables, monitoring, and construction project risks.

6. Path Coefficient

Path coefficients are used to measure the strength and direction of the relationship between independent variables and dependent variables in a structural model. The value of the path coefficient can be of positive or negative value, which indicates the direction of the relationship between variables. In addition, the greater the absolute value of the coefficient, the stronger the influence of the variable on other variables. In this study, the path coefficient is used to determine the influence of work methods and monitoring on time risk and cost risk. This analysis is very important because it provides an empirical picture of the relationships between the variables tested in the research model. The path coefficient results are also used as a basis for testing hypotheses that have been formulated previously. Therefore, this analysis is an important part of the evaluation of structural models in SEM-PLS (Hair et al., 2021).

Tabel 6. Path Coefficient

Hubungan	**Coeficin**
MK → RW	-0.45
MK → RB	-0.40
M → PC	-0.42
M → RB	-0.47

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that the entire relationship between variables has a negative coefficient value, which shows that the working method and monitoring have a negative influence on time and cost risks. This means that the better the work methods and monitoring that are implemented, the project risk will decrease. The largest coefficient value was found in the relationship of Monitoring to cost risk of -0.47, which showed that Monitoring had the strongest influence in controlling project costs. This result is in line with the opinion of Kerzner (2017) who stated that project control is greatly influenced by an effective monitoring system. Thus, the results of this analysis show that work methods and monitoring have an important role in reducing the risk of construction projects.

7. Uji Hypothesis

Hypothesis testing in this study was carried out to find out whether the relationship between the variables tested in the research model has statistical significance. This test is carried out based on the results of bootstrapping by looking at t-statistical and p-value values. A hypothesis is declared acceptable if the t-value is greater than 1.96 and the p-value is less than 0.05 (Hair et al., 2021). Therefore, hypothesis testing is an important stage in this study to prove whether the relationship assumed in the research model actually occurs empirically. The results of the hypothesis test will provide a final conclusion regarding the influence of work method and monitoring variables on time and cost risks in construction projects.

Table 7. Hypothesis Test

Hypothesis	**Results**
H1	Accepted
H2	Accepted
H3	Accepted
H4	Accepted

Source: Data processing results using SmartPLS 4 (2025)

Based on the table above, it can be seen that all hypotheses in this study are accepted. This shows that all the relationships between the variables tested have a significant influence. Thus, it can be concluded that the working method and monitoring have a real influence on the time and cost risk of the construction project. These results are in line with the opinion of Hair (2021) who stated that the results of the hypothesis test are significant and show that the research model has good validity. Therefore, the model used in this study can be said to be able to explain the relationship between variables empirically and can be used as a basis for managerial decision-making.

Model Analysis

1. Model SEM

The analysis of the structural model (inner model) in SEM-PLS aims to test the causal relationship between latent variables that have been formulated in the research model. This model illustrates how independent variables, namely work methods and monitoring, affect dependent variables, namely time risk and cost risk in construction projects. The evaluation of the structural model was carried out by looking at the value of the path coefficient, the direction of the relationship, and the strength of influence between variables.

Figure 1. SEM Model Flow

Source: Author's own work based on data processing using SmartPLS 4 (2025)

Figure 1 illustrates that in the SEM-PLS approach, structural models are considered good if they are able to show significant relationships and are in accordance with the hypotheses that have been formulated previously (Hair et al., 2021). In addition, the model must also have adequate predictive capabilities, which is indicated by the R-Square value on the dependent variable. The work method variable in this study is assumed to have a negative influence on risk, which means that the better the work method applied, the smaller the risk that occurs. Similarly, the Monitoring variable is expected to be able to reduce the level of risk through effective supervision. This is in line with project management theory which states that planning and control are the two main factors in the success of a project (Kerzner, 2017). Therefore, SEM model analysis is important to prove the relationship empirically.

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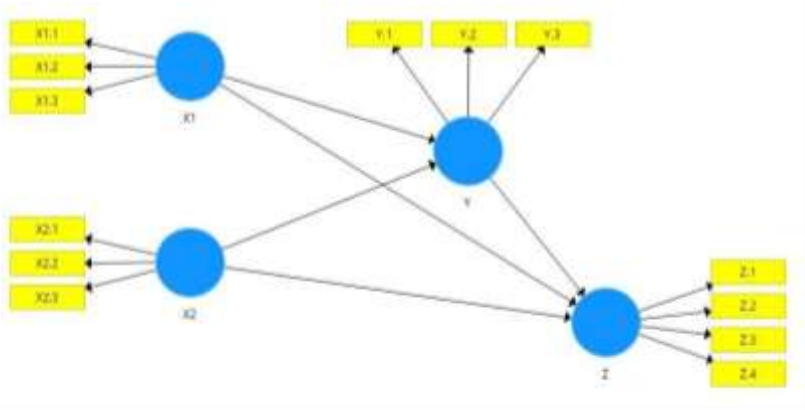

Figure 2. SEM Model

Source: Author's own work based on data processing using SmartPLS 4 (2025)

Based on Figure 2 of the SEM model above, it can be seen that there is a direct relationship between the variables of work method and Monitoring to time and cost risks. The arrow direction that shows the relationship between variables illustrates the influence that occurs, where all relationships have a negative direction, which means that improving the quality of work methods and monitoring will lower the level of project risk. In addition, the thickness of the line in the model usually describes the strength of the relationship between variables, where the stronger relationship is indicated by the thicker line. In the context of this study, the relationship between monitoring and cost risk appears to have a stronger influence than other relationships. This shows that Monitoring has a very important role in controlling project costs. This result is in line with the opinion of PMI (2021) which states that effective supervision is the key to controlling project costs and time. Thus, the SEM model produced in this study can be said to be able to explain the relationship between variables clearly and in accordance with existing theories.

2. Bootstrapping

Bootstrapping is one of the techniques in SEM-PLS that is used to test the significance of relationships between variables in structural models. This technique is carried out by repeatedly resampling data to obtain an empirical distribution of the estimated parameters. The bootstrapping results are used to calculate the t-statistical and p-values, which are then compared to the critical values to determine whether or not a relationship is significant. In this study, the t-statistical value used as a reference was 1.96 for a significance level of 5%, so that a relationship is declared significant if the t-statistical value is greater than 1.96 and the p-value is less than 0.05 (Hair et al., 2021). The use of bootstrapping in this study aims to ensure that the results of the analysis obtained are not only descriptive, but also have a strong statistical basis. In addition, this technique also allows researchers to test the stability of the model as well as identify the most influential relationships in the research model. Thus, bootstrapping becomes an important stage in the SEM-PLS analysis to test the validity of the proposed hypothesis.

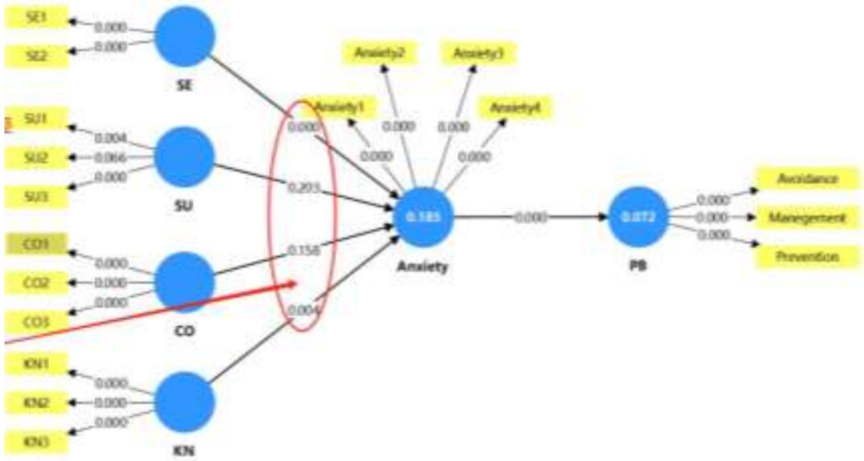

Figure 3. Bootstrapping Results

Source: Author's own work based on bootstrapping analysis using SmartPLS 4 (2025)

Based on the image of the bootstrapping results above, it can be seen that all relationships between variables have a t-statistical value greater than 1.96 and a p-value smaller than 0.05, so it can be concluded that all relationships in this research model are significant. This shows that the variables of work methods and monitoring have a real influence on the time and cost risks in construction projects. In addition, the bootstrapping results also showed that the relationship between monitoring and cost risk had the highest t-statistical value, indicating that this variable had the strongest influence in the research model. These results are in line with the opinion of Hair (2021) who states that high t-statistical values indicate a high level of trust in the relationship being tested. Thus, the results of bootstrapping in this study provide strong empirical evidence that the model used is valid and can be used to explain the relationship between variables in this study.

The Effect of Work Methods on Time Risk

The results of the study show that the work method has a negative and significant influence on time risk in construction projects. This indicates that the better the work method applied, the less likely there will be delays in the implementation of the project. The right work method allows the work process to run systematically and efficiently, so that each stage of work can be completed according to the planned schedule. In the context of construction projects, good work methods include planning the sequence of work, selecting the right technology, and optimal resource management. If the work method is not well designed, the potential for technical errors and delays will be greater. The results of this study are in line with project management theory which states that work method planning is an important factor in project time control (Kerzner, 2017). In addition, this research is also supported by the opinion of Soeharto (2019) who stated that effective work methods can increase productivity and reduce the risk of delays. Thus, it can be concluded that the working method has a very important role in controlling the time risk of a construction project.

The Influence of Work Methods on Cost Risk

The results show that the work method has a negative influence on cost risk, which means that the better the work method applied, the less likely it is to overrun project costs.

Effective working methods allow for efficient use of resources, thereby reducing wasted materials, labor, and heavy equipment. In practice, errors in the selection of work methods often lead to repetitive work, which ultimately increases project costs significantly. Therefore, planning the right working methods is very important in controlling project costs. The results of this study are in line with the theory put forward by PMI (2021) which states that efficiency in project implementation is greatly influenced by the work methods used. In addition, this research is also supported by the opinion (Kerzner, 2017) which states that good work methods can reduce uncertainty in projects, so that costs can be better controlled. Thus, the working method has a significant contribution in reducing the cost risk of construction projects.

The Effect of Monitoring on Time Risk

Monitoring the implementation of work has a negative and significant influence on time risk in construction projects. This shows that the more effective the monitoring system implemented, the less likely it is that there will be project delays. Monitoring allows management to monitor the progress of work in real-time and compare it with the plan that has been set. With good monitoring, any deviation from the schedule can be immediately detected and followed up with corrective actions. In practice, effective monitoring focuses not only on reporting, but also on performance evaluation and rapid decision-making. The results of this study are in line with project management theory which states that supervision is one of the main functions in project control (Kerzner, 2017). In addition, the opinion of Soeharto (2019) also states that good monitoring can increase the timeliness of project implementation. Thus, Monitoring has a very important role in reducing the risk of project delays.

The Effect of Monitoring on Cost Risk

The results of the study show that Monitoring has a negative influence on the cost risk of construction projects. This indicates that the better the monitoring system is implemented, the less likely it is to cause cost overruns. Effective monitoring allows for more structured control of the use of resources, thereby avoiding waste and ensuring that the budget is used according to the plan. In addition, Monitoring also allows for early detection of cost irregularities, so that corrective action can be taken immediately before costs increase. In practice, good monitoring includes supervision of the use of project materials, labor, and equipment. The results of this study are in line with the opinion of PMI (2021) which states that cost control is one of the important aspects in project management. In addition, this research is also supported by a theory (Kerzner, 2017) that states that effective monitoring can reduce uncertainty in projects, so that costs can be better controlled. Thus, Monitoring has a significant contribution in reducing the cost risk of construction projects.

The Simultaneous Effect of Work Methods and Monitoring on Risk

The results of the study show that the work method and monitoring simultaneously have a significant influence on the time and cost risk of construction projects. This shows that the two variables complement each other in project management, where the work method functions as planning, while Monitoring functions as control. The combination of good work methods and effective monitoring will result in a more structured and controlled project implementation. In the context of project management, the integration between planning and control is the key to achieving project success. The results of this study are in line with the theory put forward by Kerzner (2017) which states that the success of a project is greatly influenced by the balance between planning and control. In addition, PMI's (2021) opinion also states that effective project management requires integration between various management functions. Thus, it can be concluded that work methods and monitoring together have a very important role in controlling the risk of construction projects.

Managerial Implications

The results of this study provide important managerial implications for construction industry players, especially in the management of toll road projects. Based on the results of the analysis, work methods and monitoring are proven to have a significant influence on project risk, so these two aspects need to be the main concern in project management. The contractor is advised to improve the quality of work method planning by considering various factors such as field conditions, availability of resources, and the technology used. In addition, the project implementation monitoring system also needs to be improved by utilizing digital technology, such as software-based project management systems. This is in line with the opinion of PMI (2021) which states that the use of technology in monitoring can increase the effectiveness of project control. Thus, the results of this research can be used as a basis for managerial decision-making to improve the performance of construction projects.

Research Limitations

This study has several limitations that need to be considered in interpreting the research results. One of the main limitations is the use of data based on respondents' perceptions obtained through questionnaires, so there is a possibility of subjectivity bias in the answers given. In addition, this study only focuses on two independent variables, namely work methods and monitoring, so there are still other factors that can affect project risks that have not been researched. Another limitation is that the scope of research is limited to toll road construction projects, so the results of this study may not be generalized to other types of construction projects. This is in line with the opinion of Sekaran (2017) who states that research limitations are natural in scientific research. Therefore, further research is expected to develop a research model by adding other variables and expanding the research object so that the results obtained are more comprehensive.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that work methods and monitoring have a significant influence on time and cost risks in toll road construction projects. Work methods have a negative effect on time and cost risks, which shows that the implementation of the right work methods can improve implementation efficiency, minimize technical errors, and reduce potential delays and budget overruns. On the other hand, monitoring the implementation of work also negatively affects the risk of time and cost, which means that effective supervision can keep the implementation of the project on schedule. Simultaneously, the two variables complement each other in project management and become key factors in reducing risk, in line with project management theory that emphasizes the importance of planning and control. Therefore, it is recommended that contractors and project

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management improve the quality of planning work methods through the analysis of field conditions and resources, as well as optimize monitoring systems by utilizing digital technologies such as project management software and real-time reporting. In addition, further research is expected to add other variables such as risk management, labor competence, and external factors, as well as expand the research object so that the results obtained are more comprehensive in supporting the development of construction management science.

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