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Analysis of the Influence of Design, Labor, Materials, and Equipment on Control Models, Time Performance, and Costs of Underground Foundation Works in Bridge Construction

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ABSTRACT

In the implementation of construction projects, it has been determined and limited by constraints that are mutually influencing and are commonly referred to as the project constraint triangle, namely the scope of work (scope), time, and cost, these three factors will determine the quality of a project. This study aims to analyze the Design, Labor, Materials, and Equipment Against the Time Performance Control Model and Cost of the Lower Foundation Work (Bore Pile) Bridge Project. The relationship between Design, Labor, and Materials is made a regression analysis with SPSS while the Time Performance Control Model and Cost of the Lower Foundation Work will be made in a path diagram model, and analyzed using SEM-PLS with a sample of 104 respondents. The study's results indicate that design, labor, materials, and equipment significantly influence the control model in bridge construction projects. The control model in bridge construction projects significantly impacts on-time performance and cost performance, design variables, labor, materials, and equipment are the key to improving the control model on-time performance and cost performance. The control model has an effect as a mediation of design, equipment, labor, and materials on cost performance and time performance

Keywords: design; labor; materials; equipment; control model; cost performance; time performance.

INTRODUCTION

Each type of project has different characteristics from other projects, such as civil engineering including buildings, roads, bridges, dams, and other infrastructure. In the implementation of construction projects, it has been determined and limited by constraints that are mutually influencing and are commonly referred to as the project constraint triangle, namely the scope of work (scope), time and cost, these three factors will determine the quality of a project.

In some cases and phenomena in the implementation of the project, there are often delays in the implementation of the work so that it is out of control of the set time schedule. The delay will harm the related parties, both the contractor and the project owner. Project delays cause financial losses for both service providers and project providers. Various things can happen in a construction project that will increase the processing time, so that the completion of the project is late.

Construction project time performance indicators according to Susanto (2009) are: (1) careful planning and proper scheduling of project size, (2) Project time performance function in measuring, managing, and controlling, (3) Careful monitoring, and flexibility in responding to changes, (4) Meeting the predetermined schedule and (5) a place where supervision and reporting on the progress of the construction project are carried out.

Delays in construction projects seem to be something that is normal and must be accepted and tolerated, although these delays clearly have the potential to have a very strong impact on the costs incurred. Construction project costs not only include direct costs associated with the physical construction of infrastructure, but also unexpected costs that do not arise as a result of delays. Delays can have various consequences, such as additional costs for additional labor, extension of equipment rental time, and additional material procurement costs.

In addition, project delays can also result in significant financial losses for all parties involved, including project owners, contractors, and subcontractors. Delays can cause delays in the use of newly constructed assets, which in turn can disrupt expected revenue streams or increase operating costs. The financial impact of project delays is not limited to the additional costs directly related to the delay. The impact can also extend to other aspects, such as lost business opportunities, increased legal risks, and decreased trust from other stakeholders, including the general public and investors. Delays that cause cost overruns are also experienced by other projects such as The Great Belt Link in Denmark which experienced a 54% overrun, The Humber Bridge in the UK experienced a 175% overrun. Information on the progress of a project within a certain period of time and the estimated costs required to complete a project can be provided well by the Earned Value Analysis method (Perdana & Widjajakusuma, 2022). Cost performance indicators according to Mulyadi et al (2019) are: (1) Agreed project budget planning, (2) Coordination of all project development stakeholders, (3) Contractor control in project implementation and (4) Estimated cost budget does not change

The main factors for project delays are contractor experience, low labor consultants, materials and financing (Gunduz & Tehemar, 2020), while according to Harsoyo & Panara (2021) the main factors for project delays are limited materials, quality of labor and limited labor, then according to Lakaoni & Waty (2023) the cause of the delay is due to the many design changes that cause changes to the project contract and according to Hernandi & Tamtana, (2020) factors that affect worker productivity in the implementation of high-rise building construction are factors such as changes in work drawings, limited work areas, changes in weather, lack of space for material availability, working at heights, implementation methods, poor equipment. According to Isramaulana & Yuliana (2017) and Wirabakti et al (2017), project design indicators consist of: (1) Design changes by the owner, (2) Design errors by the planner, (3) Incomplete design drawings, (4) Delays in providing detailed drawings and (5) Design complexity which requires time to be analyzed by stakeholders.

According to Wahyuningtyas & Waskito (2021), the workforce indicators are: (1) Lack of workforce skills, making work less than optimal, (2) Lack of workforce discipline, (3) Lack of worker motivation, (4) Lack of workforce attendance which results in daily progress not being achieved, (5) Lack of workforce availability, (6) Replacement of new workers and (7) Poor communication between workers. According to Choudhry et al (2014) and Wirabakti et al (2017) material indicators are (1) Delay in delivery of materials to the project location, (2) Limited availability of materials on the market, (3) Poor quality materials impact the quality of work, (4) Scarcity of required materials, (5) Changes in materials by the owner, and (6) Damage to materials in storage

According to Putri et al, (2019) construction project equipment indicators are: (1) maximum ability of the tool to perform certain tasks within a specified time, (2) high-quality physical condition and functionality of the equipment, (3) Easy maintenance can reduce downtime and increase productivity and (4) equipment is easy to operate by the operator.

In Indonesia, project control is carried out using various approaches and methods that have been adapted to the local context. Project control in Indonesia continues to evolve along with changes in technology, regulations, and industry practices. Continuous efforts to improve project efficiency, quality, and sustainability are an integral part of project control in Indonesia

A construction project control model is needed to cover various methods and techniques used to ensure that the project runs according to the established plan, including time, cost, and quality control. Project control is a process that involves monitoring, evaluating, and regulating various aspects of a project to ensure that the project runs according to the established plan. The project control model includes the framework or methods used to carry out such control.

The construction project control model focuses on the need to organize and optimize all activities in the project so that they function optimally, achieve project objectives efficiently, and ensure that time, cost, and quality are in accordance with the established plan. This control model is important because construction projects involve many variables and resources that must be managed properly to avoid waste and ensure project success.

Construction project control includes various aspects such as supervision, inspection, and corrective actions taken during the implementation process to minimize deviations from the initial plan. This

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includes the use of methods such as the Critical Path Method (CPM) and the Project Evaluation and Review Technique (PERT) for project schedule and duration analysis, as well as other techniques such as Earned Value Management (EVM) for the integration of cost, time, and project scope measurements.

According to Terry & Rue (2020), the control model has the following indicators: (1) Conducting massive and routine supervision of the stocking of material usage at the location, (2) Providing various relevant options and making it easy for the Client to make decisions, (3) Requiring daily monitoring program reporting for each work item at the location, (4) Preparing a checklist and controlling the stages of the inspection procedure along with the feasibility test for each work item completed by the supervisor, (5) controlling every opportunity for a series of interdependent activities, has an effect on increasing the performance of the project implementation time and (6) controlling to minimize the occurrence of errors in the application of the work method conveyed by the supervisor to the foreman and workers

This research will be carried out on a bridge project, especially the lower foundation work (bore pile), to find the Analysis of the Influence of Design, Labor, Materials and Equipment on the Control Model, Time Performance and Cost Performance

RESEARCH METHODS
Materials

Research Methods are procedures or stages carried out sequentially, starting from the problem identification process, data collection, analysis process to problem solving, which is depicted in the research design flow diagram which can be seen in Figure 1 below.

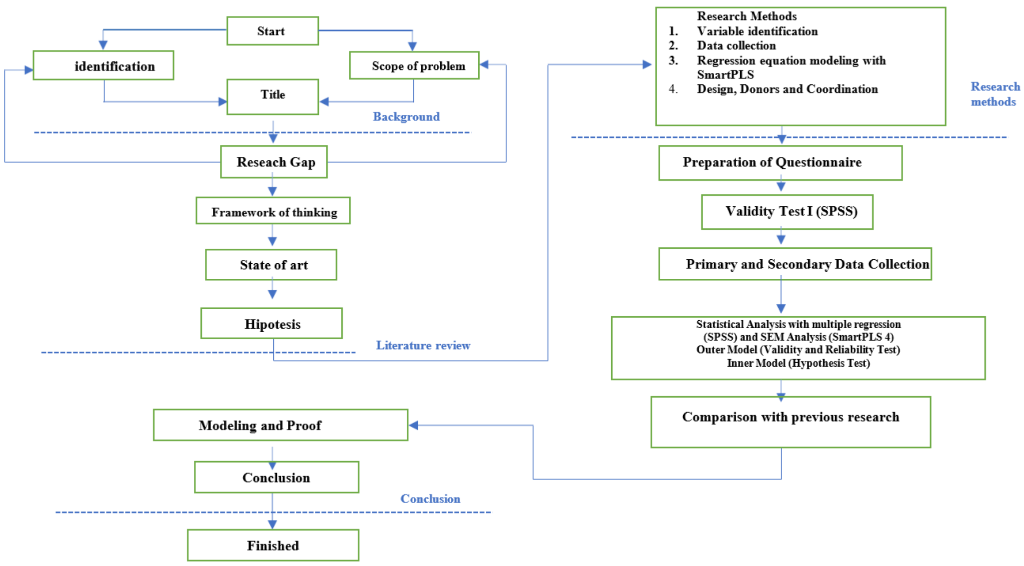

Figure 1. Flow chart

Methods

The research was conducted from May to July 2024 which was conducted on a bridge project in the Gorontalo and Southeast Sulawesi Provinces based on the bridge project being the field of work with the largest construction value in this province which has been completed among other fields as many as 5 projects. The research sample consisted of 104 respondents consisting of 5 Project Manager respondents, 12 Site Manager respondents, 11 Drafter/Logistics respondents, 33 Implementers, 8 Team Leaders, 25 Quality/Quantity Control respondents and 10 HSE/K3 Experts respondents.

Data Analysis

questionnaire trial with validity and reliability test with SPSS 21 research data analysis using path analysis with SemPLS 4.

RESULT AND DISCUSSION

Validation test was conducted on 30 respondents, the results of the design variable validity test from 5 items were all valid because the calculated r value was greater than the r table (0.361), on the workforce variable from 8 items were all valid, the Material Instrument Validity Test from 6 items was all valid, the Equipment Instrument Validity Test from 4 items was all valid, the Control Model Instrument Validity Test from 6 items was all valid, the Time Performance Instrument Validity Test Results from 6 items were all valid and the Cost Performance Instrument Validity Test Results from 4 items were all valid. The reliability of the questionnaire was tested using the Cronbach's alpha formula with a value between 0.743-0.857, the reliability figure was stated as Reliable.

The outer model test with smart PLS, namely the Validity Test and Reliability Test of the Measurement Model, is obtained as follows:

Table 1 Construct Reliability and Validity Results

Constructs	Indicators	Factor Loading	CA	CR	AVE
Design (X1)	X1.1	0.797	0.889	0.892	0.694
	X1.2	0.853			
	X1.3	0.759			
	X1.4	0.886			
	X1.5	0.862			
Labor (X2)	X2.1	0.722	0.877	0.885	0.550
	X2.2	0.731			
	X2.3	0.74			
	X2.4	0.722			
	X2.5	0.768			
	X2.6	0.756			
	X2.7	0.728			
	X2.8	0.764			
Material (X3)	X3.1	0.859	0.830	0.848	0.627
	X3.2	0.789			
	X3.3	0.749			
	X3.4	0.852			
	X3.5	0.77			
	X3.6	0.724			
Equipment (X4)	X4.1	0.726	0.884	0.895	0.543
	X4.2	0.729			
	X4.3	0.762			
	X4.4	0.731			
Control Model (Y1)	Y1.1	0.806	0.872	0.873	0.610
	Y1.2	0.797			
	Y1.3	0.73			
	Y1.4	0.819			
	Y1.5	0.777			
	Y1.6	0.755			
Time Performance (Y2)	Y2.1	0.714	0.735	0.737	0.585
	Y2.2	0.726			
	Y2.3	0.807			
	Y2.4	0.775			
	Y2.5	0.798			
Cost Performance (Y3)	Y3.1	0.891	0.885	0.891	0.732
	Y3.2	0.907			
	Y3.3	0.765			

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	Y3.4	0.852

Based on table 1 below, it appears that the overall loading factor shows that the model has met the convergent validity requirements because the loading factor value is more than 0.7. In the design variable, all indicators are stated as valid, then in the labor variable all indicators are stated as valid, then in the material variable all indicators are stated as valid, in the equipment variable all indicators are valid, the control model variable is entirely valid, the time performance variable all indicators are more valid and in the cost performance variable all indicators are stated as valid. Based on table 1 above, it can be seen that all variables have an AVE value > 0.5, this shows that all latent variables in the estimated model meet the convergent validity (valid) criteria. The results of the construct reliability test as presented in table 1 show the Composite Reliability and Cronbach's Alpha values of all latent variables > 0.70. So that all manifest variables in measuring latent variables in the estimated model are declared reliable.

Before hypothesis testing is carried out, a structural model equation can be created based on the statistical test results presented in Figure 2:

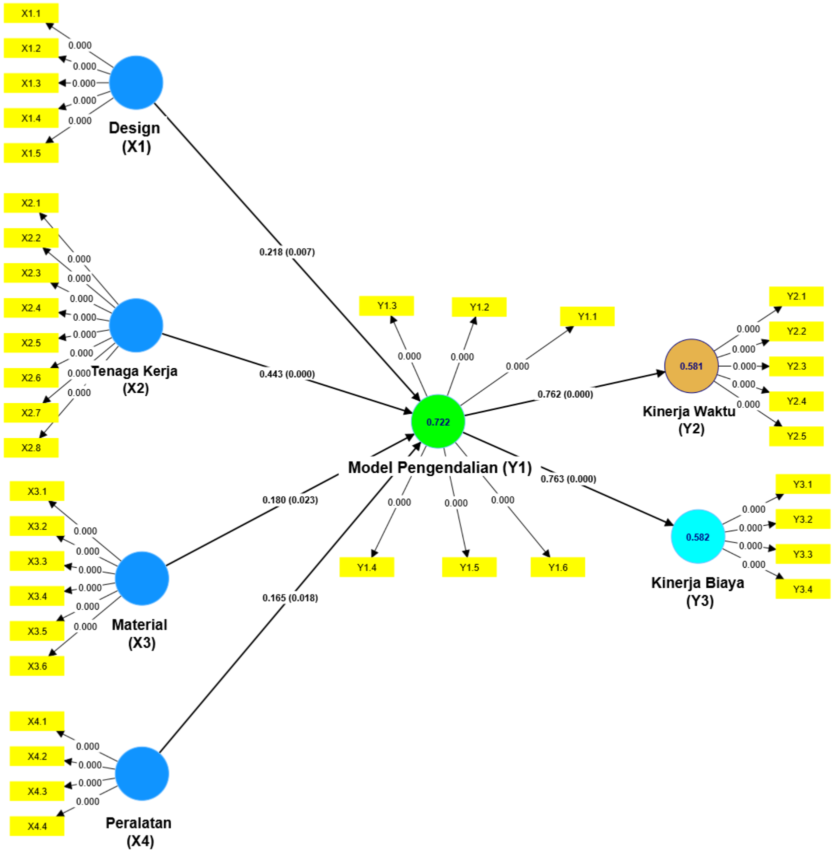

Figure 2 Path Coefficient Value Path Diagram (Bootstrapping)

The results of the model testing show that the design variables (X1), labor (X2), materials (X4) and equipment (X5) have a significant positive effect on the control model (Y1) to obtain a path equation **Model** : $Y_1 = 0{,}218X_1 + 0{,}443X_2 + 0{,}180X_3 + 0{,}165X_4 + \zeta 1$.

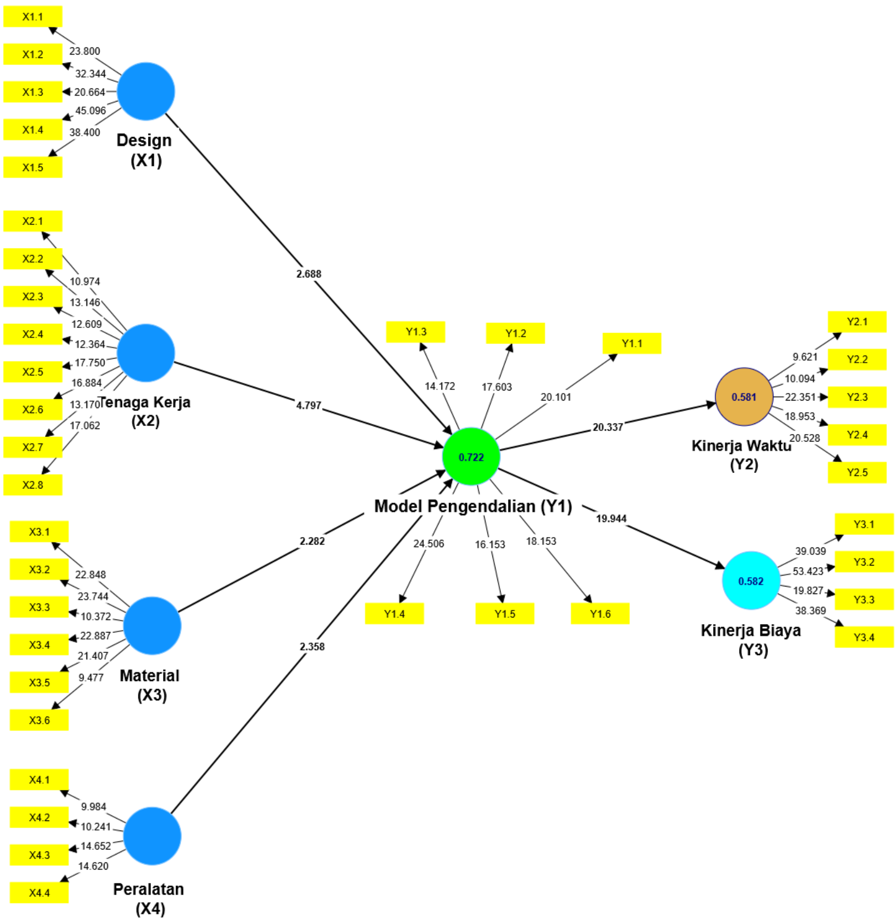

Figure 3 Path Diagram of T-Statistic Values

The image above shows the bootstrapping results of the research hypothesis test calculations, the numbers in the image are the values of the t-test between variables and variables with indicators, for more details it is shown in the table below:

Table 2. Hypothesis Test Result

Effect Between Variables	Original sample	T statistics	P values	Information
	Direct Effect			
Design _(X1) -> Control Model (Y1)	0.218	2.688	0.007	Supported
Labor _(X2) -> Control Model (Y1)	0.443	4.797	0	Supported
Material _(X3) -> Control Model (Y1)	0.18	2.282	0.023	Supported
Equipment _(X4) -> Control Model (Y1)	0.165	2.358	0.018	Supported
Control Model (Y1) -> Time Performance _(Y2)	0.762	20.337	0	Supported
Control Model (Y1) -> Cost Performance_ (Y3)	0.763	19.944	0	Supported

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Effect Between Variables	Original sample	T statistics	P values	Information
	Indirect Effect			
Design _(X1) -> Control Model (Y1) -> Cost Performance_(Y3)	0.166	2.61	0.009	Supported
Design _(X1) -> Control Model (Y1) -> Time Performance _(Y2)	0.166	2.633	0.008	Supported
Equipment _(X4) -> Control Model (Y1) -> Time Performance _(Y2)	0.126	2.292	0.022	Supported
Equipment_(X4) -> Control Model (Y1) -> Cost Performance_(Y3)	0.126	2.339	0.019	Supported
Labor _(X2) -> Control Model (Y1) -> Time Performance _(Y2)	0.338	4.817	0.000	Supported
Labor _(X2) -> Control Model (Y1) -> Cost Performance_(Y3)	0.338	5.009	0.000	Supported
Material _(X3) -> Control Model (Y1) -> Cost Performance_(Y3)	0.137	2.166	0.03	Supported
Material _(X3) -> Control Model (Y1) -> Time Performance _(Y2)	0.137	2.225	0.026	Supported

The test criteria state that if the t-statistic value> t-table (1.96) or the p-value <significant alpha 5% or 0.05, then it is stated that there is a significant influence of exogenous variables on endogenous variables, (Hair Jr et al., 2021). The test results displayed in table 2 show that the P value of the design, labor, material and equipment variables is less than 0.05 and the t-statistic value is greater than the t table (1.96), so it can be concluded that all hypotheses, both direct and indirect influences, have an effect or the hypothesis is accepted.

The calculation results show that design, labor, materials and equipment have a significant influence on the bridge construction project control model with an indication of a p value of less than 0.05 and a calculated t greater than t table (1.96). Thus, hypothesis one (H1) which states that there is an influence between design, labor, materials and equipment on the control model is accepted.

The results of this study are in line with Vigneshwar & Shanmugapriya (2023) who stated that management factors such as resource availability, individual learning, decision making, job design, and resource allocation have a controlling influence on construction project performance. Then the results of the study by Pahlawati et al (2019) stated that design, labor, materials, and equipment are important factors in the construction management control model for the Cinapel Bridge project on the Cisundawu toll road, analyzed using qualitative methods

Project design has a significant influence on the control model in bridge projects. Project control covers various aspects such as time, cost, and quality, all of which are influenced by the initial design of the project. A mature and efficient design is an important initial step in project control. Good planning involves proper site selection, feasibility studies, and analysis of environmental and geological conditions. This helps in minimizing the risk of design changes and additional costs in the future.

Quality and cost control are integral parts of the project control model. Regular inspection and checking of the work carried out ensures that all activities are in accordance with the design specifications and the established budget. Overall, good and efficient project design plays a vital role in the bridge project control model. A well-thought-out design allows for more accurate risk identification, use of appropriate materials and technology, and effective planning and control, so that the project can be completed on time, within budget, and with the expected quality.

Labor is one of the key factors that greatly influences the control model in bridge projects. Project control includes aspects of time, cost, and quality, all of which are greatly influenced by labor productivity and management. Labor productivity is one of the determining factors for the success of a construction project. High productivity levels can accelerate project completion and reduce costs. Conversely, low productivity can cause delays and increased costs. Research shows that labor productivity is influenced by various factors such as physical conditions of the site, planning and coordination, and worker experience. Effective management of labor productivity, time, cost, and quality is essential to ensure project success. By using various control methods such as CPM, EVM, and work sampling.

The materials used in bridge projects have a significant influence on the project control model. Project control includes aspects of time, cost, and quality, all of which are greatly influenced by the selection, management, and availability of materials. The selection of the right material is essential to ensure the strength, durability, and efficiency of the bridge. The main materials often used in bridge construction include concrete, steel, stone, wood, and cast iron. In addition, innovative materials such as fiber composites and pre-stressed concrete are also gaining popularity due to their strength, light weight, corrosion resistance, and design flexibility. Selecting the right material can reduce the risk of structural failure and ensure that the project is on track. Good material management is key to avoiding delays and waste. An effective material management system includes planning the ordering schedule and use of materials, as well as an organizational structure that handles material management. Delays in material supply can disrupt project schedules and increase costs, so good material planning and control are essential to keep the project running smoothly.

Material-related control models such as the JIT Method can be used to reduce storage costs and ensure that materials are available exactly when they are needed. By reducing storage time and minimizing material scrap, this method can improve project efficiency and reduce costs, then BIM methods can also be used to plan and manage materials more effectively. By using BIM, project managers can visualize material requirements more accurately, identify potential problems before they occur, and better plan material deliveries.

Equipment plays a crucial role in the control model of a bridge project. Project control encompasses aspects of time, cost, and quality, all of which are greatly influenced by the efficiency and management of the equipment used. The right equipment in good condition can improve the efficiency and productivity of the project. The use of modern equipment and advanced technology, such as concrete pumps and finishing tools, can speed up the construction process and reduce the time required to complete the work. Equipment efficiency also helps in reducing labor and material costs. Effective equipment management is essential to avoid delays and waste. A good equipment management system includes maintenance planning, scheduling of use, and tracking the location and condition of equipment. By using technology such as equipment management software, companies can ensure that equipment is always in optimal condition and available when needed.

The results of the study found that the control model had a significant effect on cost performance based on the calculation of the path coefficient value of the control model on time performance of 0.763, then the t-statistic value> t-table (19.944> 1.96) and at p-value <significance level (0.000 <0.05)

The results of this study are in line with the research of Fazil et al (2022) which states that the control model has an impact on cost estimation performance in construction projects, with project complexity moderating this relationship. Choosing the right control mechanism is critical to project success. Then Rehman & Ishak (2022) stated that government regulatory control procedures positively affect construction project performance by reducing political hazards, improving risk management, and minimizing damage from political interests and conflicts. The project control model has a significant effect on time performance on bridge projects. Effective project control can help ensure that projects are completed on time, on budget, and with the expected quality. project control models such as CPM, PERT, BIM 4D, and EVM have a major influence on time performance on bridge projects. By using these methods, project managers can identify and manage critical work, reduce uncertainty, and ensure that the project is completed on time.

Project control models have a significant impact on cost performance on bridge projects. Effective cost control can help ensure that projects stay on budget and avoid unwanted cost overruns. Control models such as EVM, BIM, risk management, and Lean Construction have a significant impact on cost performance on bridge projects. By using these methods, project managers can identify and manage risks, reduce waste, and ensure that projects stay on budget. Implementing an effective control model is critical to achieving bridge project success in terms of cost, time, and quality.

Design changes during construction can disrupt construction performance, increase cost overruns, and cause delays in implementation. Design changes need to be properly controlled so that they do not have a significant impact on project cost and time performance. Heavy equipment control that affects time performance includes heavy equipment availability, heavy equipment quality, and heavy equipment mobility. Good equipment management can increase productivity and efficiency of equipment use, thus having a positive impact on project cost and time performance. Labor productivity greatly determines the success of a construction project. Effective labor productivity control can optimize the use of human resources, thereby increasing project cost and time performance. Materials are the largest cost component in construction project implementation, so they are an important element in project cost control. Good material control includes planning needs, procurement, storage, and efficient use of materials.

The application of the right control model can mediate the influence of these factors on cost and time performance/ Preparation of accurate schedules and budgets as a basis for control, Cost control through implementation budget plans concerning quality, volume, and unit price of work. A good reporting and evaluation system for material, equipment, and labor control. Control of design changes through effective change management. By implementing the right control model, the influence of these factors on cost and time performance can be optimized. Effective control will ensure efficient use of resources, thereby improving the overall cost and time performance of the project.

CONCLUSION

Based on the results of the research that has been conducted, the researcher concluded that design, labor, materials and equipment have a significant influence on the control model in bridge construction projects. The control model in bridge construction projects has a significant impact on time performance and cost performance. Design has a positive and significant effect on cost performance through the mediation of the control model in construction projects. Design has a positive and significant effect on time performance through the mediation of the control model in construction projects. Equipment has a positive and significant effect on cost performance through the mediation of the control model in construction projects. Equipment has a positive and significant effect on time performance through the mediation of the control model in construction projects. Labor has a positive and significant effect on cost performance through the mediation of the control model in construction projects. Labor has a positive and significant effect on time performance through the mediation of the control model in construction projects. Material has a positive and significant effect on cost performance through the mediation of the control model in construction projects. Material has a positive and significant effect on time performance through the mediation of the control model in construction projects

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REFERENCES

Choudhry, R. M., Aslam, M. A., Hinze, J. W., & Arain, F. M. (2014). Cost and schedule risk analysis of bridge construction in Pakistan: Establishing risk guidelines. *Journal of Construction*

Engineering and Management, *140*(7), 4014020.

Fazil, M. W., Lee, C. K., & Tamyez, P. F. M. (2022). The moderating effect of project complexity on the relationship between organizational controls and cost estimation performance: A conceptual model. *IOP Conference Series: Earth and Environmental Science*, *1067*(1), 12045.

Gunduz, M., & Tehemar, S. R. (2020). Assessment of delay factors in construction of sport facilities through multi criteria decision making. *Production Planning & Control*, *31*(15), 1291–1302. https://doi.org/10.1080/09537287.2019.1704903

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer Nature.

Harsoyo, Y. A., & Panara, N. (2021). Evaluasi Risiko-Risiko Keterlambatan pada Pelaksanaan Proyek Pembangunan Gedung Kampus C Universitas ‘Aisyiyah Yogyakarta. *Dinamika Teknik Sipil: Majalah Ilmiah Teknik Sipil*, *14*(2), 52–57.

Hernandi, Y., & Tamtana, J. S. (2020). Faktor-Faktor Yang Mempengaruhi Produktivitas Pekerja Pada Pelaksanaan Konstruksi Gedung Bertingkat. *JMTS: Jurnal Mitra Teknik Sipil*, *3*(2), 299–312.

Isramaulana, A., & Yuliana, C. (2017). *Analysis Of Factors Cause Delay Project Construction Bridge In The City Of Banjarmasin*.

Lakaoni, K. D., & Waty, M. (2023). Dampak Change Order Proyek Konstruksi Bangunan Gedung Bertingkat Sedang. *JMTS: Jurnal Mitra Teknik Sipil*, *6*(2), 367–382.

Mulyadi, L., Iskandar, T., & Sjarief, R. O. (2019). Analisa Pembengkakan Biaya Pelaksanaan Proyek-Proyek Pembangunan/Pemeliharaan Jalan di Kabupaten Probolinggo. *Jurnal Teknik Sipil INFO MANPRO*, *6*(1), 37–50.

Pahlawati, N., Rozy, N., & Anwar, S. (2019). Analysis Of Cinapel Bridge Project Construction Management On The Cisundawu Toll Road. *Journal of Green Science and Technology*, *3*(3).

Perdana, K. A., & Widjajakusuma, J. (2022). Evaluasi Kinerja Dengan Penerapan Metode Earned Value Analysis Terhadap Waktu Dan Biaya Proyek (Studi Kasus Gedung Showroom Mobil Mewah Di Jakarta). *Journal of Syntax Literate*, *7*(9).

Putri, M. K. (2019). *Pengaruh Rantai Pasok Peralatan Terhadap Keberhasilan Proyek Konstruksi Bangunan Gedung Di Wilayah Surakarta Menggunakan Regresi Linear Berganda*.

Rehman, M. A., & Ishak, M. S. Bin. (2022). Role of governmental regulatory controlling procedures between political hazards and risk management. *European Project Management Journal*, *12*(2), 34–49.

Susanto. (2009). *Evaluasi Kinerja Waktu dan Biaya Pada Proyek Bangunan Bertingkat Dengan Pendekatan Metode Earned Value Studi kasus Proyek ABC di PT X*. UI Press.

Terry, G. R., & Rue., L. W. (2020). *Dasar-dasar Manajemen, Terjemahan R Supomo dan Eti* (Edisi Revi). Bumi Aksara.

Vigneshwar, R. V. K., & Shanmugapriya, S. (2023). Investigating the factors affecting construction site productivity–a case of India. *Engineering, Construction and Architectural Management*, *30*(2), 963–985.

Wahyuningtyas, A., & Waskito, J. P. H. (2021). Analisa faktor faktor penyebab keterlambatan proyek pembangunan jembatan joyoboyo. *Axial: Jurnal Rekayasa Dan Manajemen Konstruksi*, *9*(2), 71–78.

Wirabakti, D. M., Abdullah, R., & Maddeppungeng, A. (2017). Studi Faktor-Faktor Penyebab Keterlambatan Proyek Konstruksi Bangunan Gedung. *Konstruksia*, *6*(1). https://doi.org/10.24853/jk.6.1.%25p