

Analysis of The Impact of Resources on Time Performance in an Oncology Hospital Project

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ABSTRACT

This study analyzes the influence of resource factors on project completion time performance in an oncology hospital construction project, which has high complexity due to specialized facilities such as radiotherapy rooms with radiation shielding requirements. The variables examined include equipment, work methods, materials, human resources, and financial factors. Data analysis employed a quantitative approach using Partial Least Squares–Structural Equation Modeling (PLS-SEM) to examine structural relationships between latent variables. The inner model analysis yielded an R^2 value of 0.895, indicating that 89.5% of the variation in project time performance can be explained by the five factors. Direct hypothesis testing revealed that equipment is the most dominant variable (path coefficient 0.415; p -value 0.000), followed by work methods (0.258; p -value 0.012), materials (0.231; p -value 0.006), and human resources (0.142; p -value 0.014). Financial factors showed no significant effect (0.037; p -value 0.731). The study concludes that technical and operational factors—particularly equipment, work methods, materials, and human resources—have a greater influence on project delays than financial aspects. Recommended strategies include optimizing equipment management, strengthening efficient work methods, controlling material supply chains, and improving workforce competence and coordination to enhance time efficiency and project completion success.

KEYWORDS *time performance; equipment; work methods; materials; human resources.*



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INTRODUCTION

The success of a construction project depends on schedule and budget readiness. In an oncology hospital project, time is critical because it affects the availability of healthcare facilities that directly support cancer patients who require prompt and continuous treatment (Khilbran & Sakti, 2019; Mohammad Zaenal Arifin et al., 2022; Rodhi, 2024). However, in practice, constructing an oncology hospital presents highly complex challenges, as the project requires coordination with various stakeholders who understand the hospital's service functions. Each room must be designed with the appropriate function and meet stringent radiation safety standards, as stipulated in Minister of Health Regulation Number 40 of 2022.

Time performance constraints are often caused by suboptimal resource management during implementation, including human resources, equipment, materials, methods, and finances, which negatively affect time performance (delays). Therefore, an in-depth study is needed to analyze how these resource factors influence time performance in this project.

The observed phenomena at the project site indicate that inefficient use of resources can lead to delays due to several factors, such as inadequately skilled workers, late material delivery, improper use of equipment, suboptimal work methods, and delayed payments during project execution (Sudipta, 2013; Mangare et al., 2012; Tanning et al., 2022).

In addition, the Palembang Oncology Hospital project has specific characteristics not commonly found in other hospital projects, such as radiotherapy rooms with radiation-protective walls and the use of high-tech medical equipment. These features require continuous and structured planning and coordination of resources among various departments within the

hospital. Inaccurate management of any of these resources can disrupt overall workflows and potentially cause project delays (Pelaksanaan et al., 2022; Setyowati et al., 2020; Subagia, 2021).

This situation demonstrates the complexity of oncology hospital projects and highlights the need for a study that can provide a better understanding of the main factors affecting project time performance in the construction of Palembang Oncology Hospital (Faizar & Sumarman, 2016; Haq et al., 2019).

According to Moh Nur Soleh (n.d.), careful planning of manpower availability enables human resource management to ensure that construction projects have the appropriate number and types of workers needed, so that they can run smoothly and efficiently in accordance with predetermined plans (2024:31).

According to Muhammad Isnaini Hadiyatul Umam et al. (2018), work study and analysis of work methods essentially focus on how a particular type of work will be completed. By applying principles and techniques of optimal work arrangement within the work system, alternative implementation methods can be identified that provide the most effective and efficient results. A task is considered efficiently completed if it is finished in the shortest possible time.

According to Sritomo Wignyosoebroto (1995), work productivity is defined as the ratio between output and input. In this context, output is measured in units of production, while all inputs are expressed in monetary units.

The table (as described in the text) presents a series of studies related to project management and construction, highlighting key methodologies and research gaps. Gentisya Tri Mardiani examines software project completion time using the PERT method but does not analyze external factors such as technological change. Mickson Pinori et al. investigate factors causing delays in building construction projects, yet do not study how project management technology might mitigate these delays. Edi Nurhadi Kulo and colleagues analyze heavy equipment productivity in road construction but do not consider environmental factors. A.A. Diah Parami Dewi and I Gusti Ketut Sudipta explore human resource aspects in construction projects, without linking human resources to new technologies. Sugiyarto and colleagues study residual construction materials and waste costs, but do not connect these with human resources and technology. Nova Nevila Rodhi's research on human resource performance in projects overlooks external influences such as technological change. Aris Sujarwo and Prof. Dr. Wateno Oetomo use the Earned Value method to analyze project performance but do not address factors such as the impact of the pandemic. Jerianus Tanning and colleagues report improved labor productivity in the Trans Studio Mall project but do not examine the role of HR training in productivity. Leather Betel Nut and Deri Etiquette analyze rescheduling of power house projects in hospitals, without assessing the impact of delays on total project cost. Finally, Mohammad Syafei's study on oncology hospital projects identifies a gap in the literature, noting that no prior research has specifically addressed the influence of resource factors on time performance in oncology hospital projects (Fitriana & Santosa, 2020; Kurniawan & Anggraeni, 2020; Wirabakti et al., 2014).

Based on this background, this study formulates three main research questions: first, to identify key resource factors that affect time delays in completing an oncology hospital project; second, to analyze the extent to which each factor—human resources, materials, equipment,

work methods, and finances—influences project time performance; and third, to determine mitigation or remediation strategies that can be implemented to optimize project completion time (Waktu et al., 2015).

The objectives of this analysis are to identify and classify resource factors that affect oncology hospital project completion time performance, to analyze the degree of influence of each factor on project time performance, and to provide data-driven strategic recommendations to improve the efficiency of oncology hospital project management. This research is expected to benefit multiple stakeholders. For construction practitioners, it serves as a reference for developing better resource planning to minimize delays in hospital projects, particularly oncology projects. For policymakers, including government and health agencies, it provides an evidence-based foundation for policy-making, hospital project planning and supervision, as well as for those responsible for the operation and maintenance of oncology hospital buildings. For academics and researchers, this study adds to the scientific literature on time management in hospital construction projects and the optimal utilization of resources.

METHOD

Research Design

This study uses a quantitative approach with descriptive and analytical methods to analyze the impact of resource factors on time performance in the construction of oncology hospital projects. The quantitative approach was chosen because this study objectively measures the relationship between variables through numerical data and statistical analysis.

The design of this study is structured to test the relationship between the independent variables, which include human resources (X1), materials (X2), equipment (X3), work methods (X4), and finance (X5), and the dependent variable, namely project time performance (Y). Individual and combined analyses were conducted to determine the extent of the influence of each variable and to identify the dominant factors that most affect the project's time performance.

Data were collected through questionnaires distributed to individuals directly involved in project implementation, such as project managers, technical staff, and field workers. A Likert scale was used for measurement, allowing the data to be processed statistically.

Data analysis was carried out using multiple linear regression, supported by validity tests, reliability tests, t-tests, F-tests, and the coefficient of determination (R^2). The results of the analysis are expected to provide an empirical overview of the impact of resource factors on time performance in oncology hospital construction projects and to serve as a basis for developing more effective project management recommendations.

Data and Data Collection Methods

Data was collected through the distribution of questionnaires to related parties in the oncology hospital construction project.

1. Data Primer

Primary data is data collected directly by researchers for specific research purposes. This data is original and has never been processed or analyzed before. Primary data collection is carried out through various methods, such as surveys, interviews, observations, and experiments.

1. The data was obtained through a **questionnaire** that was distributed to:
 - a. Project Manager
 - b. Site Engineer
 - c. Supervisory Consultant
 - d. Implementing Contractor
 - e. Team Leader Consultant
 - f. Project Operations Manager
 - g. Project Staff
 - h. Assigner (PPK)
 - i. Assigning Staff
2. Field observation of oncology hospital project

2. Data Seconds

Secondary data is data that has been collected and processed by other parties for purposes different from the research being conducted. This data is usually available in the form of reports, articles, books, databases, or other sources of information that are accessible to researchers. Secondary data can be used to support research, provide context, or compare with primary data collected by researchers such as:

1. Project report documents (time schedule, RAB, weekly reports).
2. Literature study from international journal articles and previous reports.

Population and Sampling Methods

1. **Population:** The population used is parties related to the oncology hospital project that is being built in Palembang such as Cancer Doctors, Radiologists, Commitment Making Officials (PPK) of the Palembang RSMH hospital support team, Construction Management Consultants, Implementing Contractors, Planning Consultants, Ministry of Health which in this case is represented from PMU.
2. **Samples:** Oncology projects that have documentation and respondents who are willing to be interviewed or fill out questionnaires.

The sampling method uses **purposive sampling**, where samples are selected based on the criteria of relevance to the research topic and the affordability of data access as well as the accuracy of the criteria in the field to be researched.

Analysis Method

After the author conducted a correlation analysis of the 5 (five) most significant variables that were the main causes that affected the performance of time in the Oncology Hospital project, the author then conducted an analysis to test the reliability. This analysis aims to check the accuracy of questionnaire items distributed based on these 5 main variables, in order to determine whether these variables have consistent measurements when used repeatedly to assess the same.

In this study, the analysis method used aims to identify and evaluate the impact of each resource factor on the performance of the Oncology Hospital project completion time.

RESULT AND DISCUSSION

Characteristics of Respondents

1. Characteristics of Respondents according to the level of education

The results of data analysis showed that most of the respondents had a Bachelor's degree (S1), followed by respondents with a Master's degree (S2), with a small number remaining with a Diploma (D3). The predominance of S1 and S2 educated respondents indicates that most have sufficient academic backgrounds to understand the technical and managerial aspects of construction projects, especially high-complexity hospital projects such as Oncology Hospitals. This educational composition provides confidence that the responses submitted by the respondents are based on a strong understanding of resource issues and time performance in the project

2. Characteristics of Respondents by Position

In terms of position, respondents consisted of various positions that had strategic responsibilities within the project, including field technical staff, site engineers, site managers, project managers, supervisory consultants, and project owners. This variation in the position reflects a broad view in the evaluation of resource management as well as the achievement of project time performance. Respondents from operational to managerial levels allowed this study to get a more objective picture of the field situation, both in terms of technical implementation and decisions taken.

3. Characteristics of Respondents by agency

Looking at agencies or work affiliates, respondents came from implementing contractors, supervisory consultants, and representatives of project owners. The high number of respondents from contractors and consultants shows that research data is obtained from those directly involved in daily construction activities, while respondents from project owners provide perspectives on control and strategic decisions. The diversity of respondent agencies strengthens the validity of the research data because it illustrates the real conditions regarding coordination between parties in the Oncology Hospital project.

4. The influence of respondent characteristics on research

In general, the characteristics of the respondents in this study indicate that the applied data were obtained from individuals who have high ability, experience, and relevance to the focus of the study. Therefore, the results of the analysis obtained can reflect the state of resource management and project performance of the Oncology Hospital in an objective and accountable way in the academic world.

The Relationship Between Research Variables Based on the Theoretical Foundation

The theoretical basis of this study is that project time performance is an indicator of success that is greatly influenced by how effectively resource management is carried out. The theory of project management and the concept of 5M (People, Materials, Machines, Methods, Money) emphasizes that people, materials, tools, ways of working, and funds are key elements that interact with each other in determining the smooth implementation of the project. Efficiency theory states that tools and ways of working directly affect the acceleration in the execution of tasks, while materials and labor act as crucial supports for the continuity of construction activities. Funds function as a possible factor, namely ensuring that all activities can take place without being hindered by funding problems. Therefore, in theory, these five

variables are causally related to the project's time performance, either separately or simultaneously.

Key Resource Factors Affecting Time Delays in Oncology Hospital Project Completion

Based on the internal model analysis using a Partial Least Squares–Structural Equation Modeling (PLS-SEM) approach, supported by the R-square (R^2) value and direct hypothesis testing, it can be concluded that time performance in the completion of the oncology hospital project is significantly influenced by several key resource factors—namely equipment, human resources, materials, and work methods—whereas the financial factor does not have a significant effect.

The internal model evaluation showed an R^2 value of 0.895 and an adjusted R^2 of 0.885 for the time performance variable. This indicates that 89.5% of the variation in project time performance can be explained by the variables of equipment, finance, human resources, materials, and methods, while the remaining 10.5% is influenced by factors outside the research model. The high R^2 value demonstrates that the structural model used has very strong and reliable predictive ability in explaining the factors affecting time performance in the construction project.

The direct hypothesis test results showed that the equipment factor (FA) had the most dominant influence on project time performance, with a path coefficient of 0.415 and a p-value of 0.000. This finding confirms that the availability, adequacy, and effective use of equipment are critical in ensuring smooth work implementation. Delays in equipment procurement, equipment breakdowns, or low levels of operational readiness can directly hinder work progress and delay project completion. Therefore, equipment management—from needs planning and maintenance to operational control—must be a top priority in oncology hospital project management.

Furthermore, the method factor (FM) also had a significant influence on time performance, with a path coefficient of 0.258 and a p-value of 0.012. This indicates that the application of appropriate work methods, careful planning, and good coordination between work stages play an important role in ensuring that the project runs according to schedule. Effective work methods can minimize rework, increase implementation efficiency, and reduce potential delays due to procedural errors or lack of synchronization in field activities.

The material factor (FMat) was also shown to significantly affect project time performance, with a path coefficient of 0.231 and a p-value of 0.006. These findings suggest that timely availability of materials, in accordance with specifications and in sufficient quantities, is crucial for a smooth construction process. Delivery delays, quality mismatches, or suboptimal logistics management can disrupt workflows and directly result in project time delays.

In addition, the human factor (FMan) had a path coefficient of 0.142 with a p-value of 0.014, indicating a significant influence on project time performance. Although its contribution is relatively smaller than that of equipment, methods, and materials, the role of the workforce remains essential in achieving project time targets. Worker skills, experience, productivity, and discipline are key determinants of smooth work implementation. Lack of coordination, low productivity, or worker absenteeism can create bottlenecks leading to delays in project completion.

Meanwhile, the financial factor (FD) had the lowest path coefficient value, 0.037, with a p-value of 0.731, indicating no significant effect on project time performance. This suggests that, in the context of the oncology hospital project, funding is not the main obstacle to achieving time targets. This may be due to relatively secure fund availability and a well-functioning payment system, which do not hinder field implementation.

The PLS-SEM analysis results confirm that equipment, methods, materials, and human resources are the main resource factors affecting project time delays, with the equipment factor being the most dominant variable. Therefore, oncology hospital project management strategies should focus on optimizing technical and operational aspects—particularly equipment and work method management—to ensure that the project can be completed according to the planned schedule.

Compared to previous research, this study's results are consistent while offering a more comprehensive empirical contribution. Gentisya Tri Mardiani's study using the PERT method focuses more on time estimation and planning without directly examining resource factor effects. Mickson Pinori et al. identified various causes of building project delays but did not emphasize the dominant role of equipment within a structural model framework. Edi Nurhadi Kulo et al.'s research on heavy equipment productivity aligns with this study's findings, although it did not integrate method and material factors within a single analytical model. The studies by A.A. Diah Parami Dewi and I Gusti Ketut Sudipta and by Nova Nevila Rodhi emphasize human resource aspects, which were likewise shown to be significant here, albeit with a smaller contribution compared to equipment and methods. Sugiyarto et al.'s work on materials and waste costs is also relevant to this study's finding that material factors significantly influence project time performance.

Thus, this study complements and strengthens prior research by providing empirical evidence, based on PLS-SEM, that construction project time delays—especially in oncology hospital construction—are more strongly influenced by technical and operational factors than financial ones. Remaining research gaps, such as the influence of project management technology, external factors, and human resource training and development, present opportunities for future studies to further enrich the understanding of how to improve time performance in construction projects.

The influence of each factor (people, materials, equipment, methods and finances) on the project time performance

Based on the results of the internal model analysis and direct hypothesis testing using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) method, it can be concluded that time performance in the oncology hospital project is influenced by a combination of several resource factors—namely human, material, equipment, method, and financial factors—with varying degrees of influence. The PLS-SEM approach enables examination of the direction and strength of relationships between latent variables simultaneously, providing a comprehensive picture of how each factor affects project time performance.

The internal model evaluation showed an R-square (R^2) value of 0.895 and an adjusted R-square of 0.885 for the time performance variable. This indicates that 89.5% of the variation in project time performance can be explained by equipment, finance, human resources, materials, and methods, while the remaining 10.5% is influenced by factors outside the research model. The high R^2 value confirms that the structural model used has excellent predictive

capability and is reliable in explaining the factors that affect construction project time performance.

When examined partially, the equipment factor is the most dominant variable affecting project time performance. This is reflected in a path coefficient of 0.415 with a p-value of 0.000, which is below the 0.05 significance threshold. These findings confirm that equipment availability, operational readiness, and effective utilization are critical to ensuring smooth field operations. Delays in equipment procurement, equipment failure, or insufficient quantities can hinder work progress and potentially cause schedule delays. Therefore, equipment management should be a top priority in project management strategies to minimize the risk of delays.

From a practical perspective for oncology hospital project management, the dominance of the equipment factor shows that availability, adequacy, and effective management of equipment are key levers for time efficiency in oncology hospital projects, which are characterized by high technology, strict precision requirements, and low tolerance for delays. Thus, equipment planning must be aligned with the critical path in the master schedule, and appropriate procurement strategies play a crucial role in controlling time performance. In other equipment-intensive, high-technology projects (such as specialized hospitals, industrial facilities, and certain infrastructure projects), a similar effect size ($\beta = 0.415$) is particularly relevant.

Furthermore, the method factor also has a significant effect on project time performance, with a path coefficient of 0.258 and a p-value of 0.012. This indicates that the application of appropriate, systematic, and well-planned work methods is essential for achieving project time targets. Inappropriate or poorly coordinated work methods can lead to rework, time wastage, and inefficiencies. Conversely, effective work methods consistent with project implementation standards increase efficiency and reduce potential delays.

Material factors likewise have a significant influence on project time performance, with a path coefficient of 0.231 and a p-value of 0.006. These findings confirm that timely availability of materials, in accordance with specifications and in sufficient quantities, is a key prerequisite for a smooth construction process. Delays in material delivery, quality discrepancies, or suboptimal inventory management can disrupt work execution and directly cause project delays. Therefore, well-planned and tightly controlled material management is one of the keys to achieving good time performance.

In addition, human factors have been shown to significantly affect project time performance, with a path coefficient of 0.142 and a p-value of 0.014. Although the contribution is relatively smaller than that of equipment, methods, and materials, the role of the workforce remains crucial. Productivity, skills, experience, discipline, and coordination among workers strongly determine the smooth execution of work. Lack of skill, low productivity, or poor coordination between work teams can slow work completion and negatively affect time performance. Therefore, human resource management through training, supervision, and effective work organization remains necessary to support project success.

Meanwhile, the financial factor has a path coefficient of 0.037 with a p-value of 0.731, indicating no significant direct effect on project time performance. This suggests that, in the oncology hospital project, funding is not the primary determinant of schedule adherence. This may reflect relatively secure fund availability and a well-functioning payment mechanism, which prevent significant disruption to field operations. Nonetheless, financial resources still

need to be managed properly, as delays in disbursements or payments can indirectly affect other operational factors.

The PLS-SEM analysis results show that equipment, method, material, and human factors significantly influence project time performance, whereas the financial factor does not have a significant direct effect. The equipment factor emerges as the most dominant variable, followed by methods, materials, and human resources. These findings confirm that successful project time performance does not depend on a single factor, but rather on the synergy and integrated management of all project resources, particularly technical and operational aspects. Consequently, project management must optimize equipment, work methods, materials, and workforce management in an integrated manner so that delays can be minimized and completion targets achieved as planned.

In relation to previous studies, these results are both relevant and reinforcing. Gentsiya Tri Mardiani's research using the PERT method focuses more on planning and time estimation, without directly examining resource factor effects. Mickson Pinori et al. identified various factors causing delays in building construction projects, consistent with this study's findings, but did not highlight the equipment factor as the dominant variable in a structural model. Research by Edi Nurhadi Kulo et al., which emphasizes heavy equipment productivity, supports the finding that equipment significantly influences project time performance. Studies by A.A. Diah Parami Dewi and I Gusti Ketut Sudipta and by Nova Nevila Rodhi, which stress human resource aspects, are also in line with this study's results, even though the human factor here contributes less than other technical factors. Sugiyarto et al.'s work on materials and waste costs further strengthens the conclusion that material factors significantly affect project time performance.

Thus, this study complements previous research by providing empirical evidence, based on PLS-SEM, that equipment, methods, materials, and human factors are the main determinants of construction project time performance, particularly in oncology hospital construction. Remaining research gaps—such as the impact of project management technology, external factors, and human resource training and development—represent important directions for future research to further enrich studies on improving time performance in construction projects.

Mitigation or improvement strategies that can be implemented to optimize project turnaround time

Based on the results of the internal model analysis and direct hypothesis testing using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) method, it is evident that equipment, method, material, and human factors have a significant effect on the time performance of the oncology hospital project, whereas financial factors do not have a direct significant effect. These findings provide a strong empirical basis for formulating mitigation or improvement strategies focused on optimizing technical and operational aspects of the project to minimize potential delays in completion time.

The equipment factor is the most dominant variable affecting project time performance and thus becomes a top priority in the mitigation strategy. Descriptive results show that the indicators “regularly conducted equipment maintenance and readiness” had the highest mean value (4.357), followed by “equipment suitability to job requirements” (mean = 4.321) and “adequacy of equipment quantity” (mean = 4.286). These findings indicate that successful

equipment management is largely determined by technical readiness and continuous maintenance.

However, the indicator “equipment failure rarely causes project delays” had the lowest mean (3.125) with a relatively high standard deviation, indicating that disruptions due to equipment failure remain a potential delay risk. Therefore, mitigation strategies should include more accurate equipment needs planning, procurement aligned with work specifications, and implementation of preventive maintenance systems and periodic inspections. In this way, equipment availability and readiness in the field can be ensured, and work disruptions that lead to schedule changes can be minimized.

The method factor also had a significant effect on project time performance, with a high overall mean value (4.404). The highest mean values were found in the indicators “work execution methods” and “work methods that improve time efficiency” (both 4.536). This shows that the application of appropriate and efficient work methods is a key determinant in maintaining project time targets.

Mitigation strategies for the method factor include preparing more detailed and integrated work procedures across work sections, strengthening coordination in line with established method flows, and applying work method innovations suited to field conditions. The indicator “minimal rework” had the lowest mean (4.250), indicating that there is still potential for method-related errors. Strengthening quality control and conducting periodic evaluations of work methods are therefore important to prevent rework that can disrupt time efficiency and cause schedule changes.

Material factors also play an important role in supporting project time performance, with an overall mean of 4.186. The indicators “material quality according to project standards” and “material shortages affecting project performance” both had the highest mean (4.232), reflecting that material quality and sufficiency are critical for smooth construction work.

Meanwhile, the indicators “material delivery from suppliers” and “material storage in the field” had relatively lower means (4.125), indicating ongoing challenges in logistics management. Mitigation strategies should therefore include selecting reliable suppliers, scheduling material deliveries in coordination with the work schedule, and improving on-site storage management to ensure orderly and safe material handling. Effective material management will help reduce delays due to logistical barriers and minimize project schedule changes.

Although the contribution of human factors is relatively smaller than that of equipment and methods, this variable still has a significant effect on time performance, with a high overall mean (4.318). The indicator “coordination between labor teams” had the highest mean (4.625), demonstrating that effective coordination is crucial for accelerating work completion.

The indicators “labor productivity” (mean = 4.518) and “worker skills” (mean = 4.411) also show important roles in supporting time efficiency. By contrast, the indicator “number of workers according to needs” had the lowest mean (3.714), suggesting that workforce quantity is perceived as not fully optimal. Mitigation strategies for human factors may therefore include adjusting workforce numbers to field requirements, enhancing competencies through technical and managerial training, and strengthening coordination and supervision of work discipline. These efforts are expected to improve productivity and maintain steady work progress in line with the time plan.

Although the PLS-SEM results show that financial factors do not have a significant direct effect on project time performance, this variable still has a relatively high mean (4.304). The indicator “financial support that can minimize potential work delays” had the highest mean (4.375), confirming the importance of financial stability in supporting overall project smoothness.

Thus, mitigation strategies for financial factors are more preventive and supportive in nature, including ensuring fund availability according to project needs, maintaining smooth fund disbursement, and ensuring timely payments to equipment and material providers. Sound financial management will help prevent administrative disruptions that could indirectly affect technical factors.

The linkage of these mitigation strategies is reflected in the Project Time Performance variable, which has an overall mean of 4.157. The indicators “project runs according to the overall timeline” (mean = 4.268) and “working time efficiency is achieved as planned” (mean = 4.232) indicate that, with optimal management of equipment, methods, materials, and human resources, the project has a strong likelihood of being completed on time. However, the indicator “project schedule rarely undergoes significant changes” had the lowest mean (3.964), suggesting that schedule changes still need to be anticipated through more integrated mitigation strategies.

Mitigation or improvement strategies to optimize completion time for the oncology hospital project should therefore focus on optimizing equipment management as the top priority, followed by strengthening work methods, implementing effective material management, and improving human resource quality, while maintaining financial stability. The synergy of these strategies is expected to minimize schedule changes, increase implementation efficiency, and ensure that the project is completed within the planned timeframe.

Research Findings

Based on an analysis of the research results, underlying theories, and a review of the literature, the main findings of this study are as follows:

1. Equipment is considered the most influential factor on the project time performance of an Oncology Hospital.
2. Work methods, materials, and labor have been shown to have a significant impact on project time performance, in line with previous theories and research.
3. Work methods, materials, and labor have been shown to have a significant impact on project time performance, in line with previous theories and research.
4. The financial aspect did not show a great influence, indicating that project delays were more caused by technical and operational factors.
5. The relationship between resource elements is interrelated, so weaknesses in one factor can affect the overall project time performance.
6. The results of this study emphasize that the management of technical resources is an important element in improving the time performance of hospital projects that have a high level of complexity.
7. The Relationship of Research Results with the Resource-Based View (RBV) RBV views that the performance of an organization/project is determined by internal resources that are valuable and scarce and organized.

CONCLUSION

This study revealed that equipment, methods, materials, and human factors have a significant effect on the time performance of the oncology hospital project, while financial factors do not have a direct influence. With an R^2 value of 0.895, this structural model shows that 89.5% of the variation in time performance can be explained by these five factors. The equipment factor proved to be the most dominant, with a path coefficient of 0.415, followed by method (0.258), material (0.231), and human (0.142) factors, while financial factors had the lowest path coefficient (0.037) and were not significant. The main recommendation of this study is to strengthen the management of equipment, work methods, materials, and human resources to optimize project time performance, with a particular focus on equipment management as a strategic resource. Although financial factors are not directly significant, funding stability remains important as operational support. The study confirms that the success of project time performance is more influenced by technical and operational management than by the sheer amount of resources, and proposes integrating project management standards with Construction 4.0 technology to ensure a scalable and sustainable project control system.

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