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Human Resource Competencies and Their Influence on Time Performance in Construction Projects

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Abstract. Human resource competencies play a crucial role in determining the success of construction projects, particularly in achieving project time performance. However, previous studies have predominantly focused on general performance indicators, with limited emphasis on the quantitative relationship between specific competency types and time performance in high-rise construction projects. This study aims to identify key human resource competencies and examine their influence on project time performance. A quantitative approach was employed, using questionnaire surveys and expert validation, and the data were analyzed using descriptive and nonparametric statistical methods. The findings reveal that 23 technical (hard skills) and 28 non-technical (soft skills) competencies are required. The most dominant hard skill is the understanding of structural work implementation, while the most influential soft skill is proactiveness and initiative. The results also indicate that technical competencies have a stronger relationship with time performance (60.7%) compared to non-technical competencies (56.8%). This study contributes by providing a structured quantitative assessment of competency-performance relationships, offering practical insights for improving workforce development strategies in construction projects.

Keywords: Human Resources Competencies, Construction Project, Project Time Performance, Soft Skills, Hard Skills

INTRODUCTION

A construction project is an activity to produce a building that has functional value and supports infrastructure development in Indonesia. Construction development requires important elements, such as money, man, material, machine, and methods [1] Human Resources (HR) is an aspect that needs attention in addition to other resources, the construction project arena also requires the support of a qualified workforce, namely those with maximum ability and competencies in their fields. The human resources involved in the project are expected to have competencies commensurate with their fields of work. Competencies constitute one of the four key aspects of labor management, alongside discipline, loyalty, and motivation. In research conducted by Willy & Sekarsari (2020), discipline is the factor most influencing project performance, with a Relative Importance Index (RII) of 0.923, while competencies rank third, with an RII of 0.875 [1]. These findings show that competencies are not a major factor in project performance, even though they are directly related to task implementation and have their own assessment standard, namely the Indonesian National Work Competency Standard (SKKNI).

Competencies refer to aspects directly connected to job performance and are assessed against specific standards, namely the Indonesian National Work Competency Standards (SKKNI). According to SKKNI, Competencies encompass a synthesis of domain knowledge, practical abilities, and a positive work ethic. Construction projects face various problems related to inadequate human resource competencies that are poorly aligned with their fields of skill [2]. Incompetent human resources can reduce project performance and cause various problems, including delays in completing work [3]. Delays in the completion time of a work item can affect the work schedule afterward, leading to

differences in implementation time and realization. The Project delays may serve as an indicator of inadequate time performance.

Every project has unique characteristics, which makes human resource management in each project face different challenges. These include limited and diverse knowledge and skills among personnel (competence), differences in backgrounds and workplace cultures, and individual worker needs that often do not align with the project's goals [5]. High-quality performance is generally defined as fulfilling specific requirements, norms, standards, and guidelines; being effective and efficient; delivering meaningful benefits; and ensuring safety and comfort [6].

Furthermore, project delays are often associated with insufficient labor competencies and inadequate workforce allocation, which directly affect productivity and time performance [1]. To address these issues, effective project management and the availability of competent human resources are essential. High-quality human resources can lead to successful project implementation, organizational growth, and optimal profitability [4]. Therefore, construction personnel are required to master both technical competencies (hard skills) and non-technical competencies (soft skills), as both play significant roles in project execution. Hard skills are primarily related to technical tasks, such as interpreting drawings and analyzing the construction process, while soft skills involve communication abilities, teamwork, and work attitudes.

Despite the recognized importance of human resource competencies, most previous studies have focused on general performance factors without clearly distinguishing the relative contributions of technical and non-technical competencies to project time performance. This indicates a research gap in the quantitative understanding of how different types of competencies influence time performance in construction projects. This study contributes by providing a quantitative comparison of the influence of hard and soft skills on project time performance using nonparametric statistical analysis.

This research is conducted on a building construction project undertaken by PT—x as the contractor. The study aims to identify the competencies required by field implementers and to analyze their influence on project time performance as specified in the initial contract. The findings are expected to provide practical insights for improving workforce competencies, particularly for fresh graduates entering the construction industry, by highlighting the importance of both technical (hard skills) and non-technical (soft skills) competencies and their relationship with project performance.

METHODOLOGY

This study was conducted on a building construction project located in Jakarta, namely the Facility Support Telkomsel Smart Office (FSTSO) project. The research employs a quantitative approach using non-parametric analysis and descriptive methods, with data collected through questionnaire distribution [7]. A non-probability, saturated sampling method was applied, involving 30 respondents from various positions, including construction manager, engineering, QA/QC, SHE, supervisor, and field personnel. The study includes independent variables, namely technical competencies (X1) and non-technical competencies (X2), and a dependent variable, namely project time performance (Y). The questionnaire was validated by experts with extensive experience in construction projects through a two-stage validation process conducted before and after data analysis. A closed-ended Likert-scale questionnaire (1–5) was employed. Data analysis was performed using SPSS 25, starting with validity and reliability tests, followed by descriptive and non-parametric analysis.

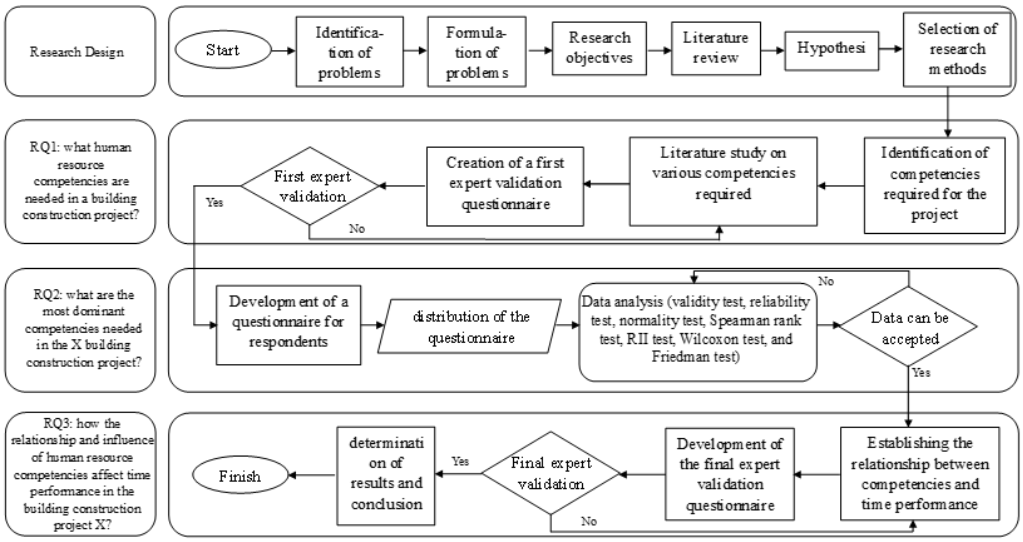


FIGURE 1. Research Flowchart

Data Collection

The research uses a questionnaire-based data collection method comprising three phases: initial expert validation, respondent validation, and final expert review. In the expert validation questionnaire, experts could provide feedback or perspectives on the indicators derived from literature reviews and SKKNI 193-2021. If the experts agree with the indicators' content, the research could proceed to the second-stage questionnaire for respondents. Following data collection from respondents, the process advances to the final stage of expert validation, during which experts provide feedback on the analysis results. The following are the indicators used in the research.

TABLE 1. Research Indicator Hard Skill

Variabel	Code	Hard Skill
X1	X1.1	Ability to check the suitability of APD and APK
	X1.4	Ability to understand K3 signs
	X1.5	Work insight and experience
	X1.6	Able to create information materials and instructions for the workforce
	X1.7	Ability to check the accuracy of information and work instructions
	X1.8	Ability to read and check work drawings
	X1.9	Ability to interpret contract documents
	X1.10	Ability to select and prepare resources
	X1.11	Ability to check and use work tools
	X1.12	Ability to interpret technical specifications and work procedures
	X1.13	Ability to operate various technologies for tasks
	X1.14	Ability to create reports properly and correctly
	X1.15	Understanding of the technical implementation of structural work
	X1.16	Ability to carry out each stage of building construction work
	X1.17	Ability to check the quality of work to ensure it complies with shop drawings
	X1.20	Ability to understand the Standard Operating Procedure (SOP) for each task item
	X1.21	Understanding of work methods in projects
	X1.22	Ability to check the quality of materials
	X1.23	Ability to create a Work Breakdown Structure (WBS)
	X1.24	Ability to organize and monitor the workforce
	X1.25	Operate technical drawing software.
	X1.26	Ability to analyze the risks of each work item
	X1. 28	Ability to read and create work progress/schedules

TABLE 2. Research Indicator Soft Skill

Variabel	Code	Hard Skill
X2	X2.1	Ability to communicate in the workplace
	X2.2	Problem-solving skills
	X2.3	Good work attitude
	X2.4	Leadership skills
	X2.5	Ability to apply good self-management
	X2.6	Empathy in the workplace
	X2.7	Thoroughness in carrying out tasks
	X2.8	Carefulness in performing tasks
	X2.9	Cooperative attitude to create team unity
	X2.10	High enthusiasm for performing tasks
	X2.11	Ability to apply good time management
	X2.12	Being able to be disciplined at work
	X2.13	Being decisive in making decisions at work
	X2.14	Being quick to learn and understand situations
	X2.15	Being proactive and taking initiative
	X2.16	Being responsible for the work done
	X2.17	Being honest at work
	X2.18	Being results-oriented
	X2.19	Having emotional intelligence
	X2.20	Being committed to work
	X2.21	Having critical thinking skills
	X2.22	Being reliable at work
	X2.23	Able to listen to others' opinions
	X2.24	Able to argue logically at work
	X2.25	Able to work under pressure
	X2.26	Able to create synergy among workers
	X2.27	Able to obey all orders and rules
	X2.28	Able to achieve self-development/self-actualization in the workplace

TABLE 3. Research Indicator Time Performance

Variabel	Code	Time Performance
Y	Y.1	Completing jobs on time according to the contract
	Y.2	Effective and efficient management of resources

RESULT

Validity Test

The validity test was conducted using the Pearson Product-Moment correlation at the 5% significance level (r_table = 0.361, n = 30). The results show that all indicators have correlation coefficients (r_calculated) greater than r_table, indicating that all questionnaire items are valid and suitable for further analysis [1].

Reliability Test

Reliability testing was performed using Cronbach's Alpha to evaluate internal consistency. The results indicate that all variables have Cronbach's Alpha values exceeding 0.60 [8].

TABLE 4. Reability Test Results

Variable	Cronbach Alpha	N
X1	0,974	23
X2	0,979	28
Y	0,924	2

These values indicate that all variables have very high reliability, and the instrument is consistent for further analysis.

Normality Test

This test is used to determine whether the data are normally distributed and to continue the analysis [1]. Nonparametric analysis is a statistical approach that operates independently of any data distribution and does not depend on strict assumptions [9]. Data are normally distributed if the p-value is > 0.05. If the p-value is < 0.05, the distribution is not normal. If the data are not normally distributed, nonparametric analysis can be used; if they are, parametric analysis can be used.

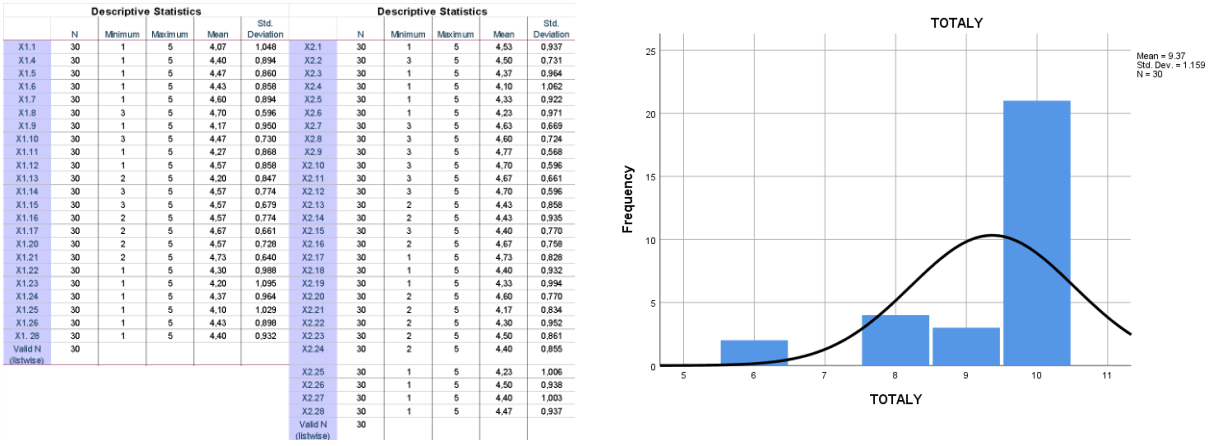
TABLE 5. Normality Test Results

Data	Normality Value
Total Variable	0,001
Average Variable	0,001
X1.1 - X1.28	0,000
X2.1 - X2.28	0,000
Y1 and Y2	0,000

The data in this research do not fulfill the parametric test requirement of normality because the Asymp. Sig value is < 0.005; it could be analyzed using a nonparametric test, which does not require the assumption of normality.

Descriptive Analysis

Descriptive statistics are typically used to analyze collected data, which is then presented as descriptions or explanations without the intention of making generalized conclusions [10].



Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X1.1	30	1	5	4,07	1,048
X1.4	30	1	5	4,40	0,894
X1.5	30	1	5	4,47	0,860
X1.6	30	1	5	4,43	0,858
X1.7	30	1	5	4,60	0,894
X1.8	30	3	5	4,70	0,596
X1.9	30	1	5	4,17	0,950
X1.10	30	3	5	4,47	0,730
X1.11	30	1	5	4,27	0,868
X1.12	30	1	5	4,57	0,858
X1.13	30	2	5	4,20	0,847
X1.14	30	3	5	4,57	0,774
X1.15	30	3	5	4,57	0,679
X1.16	30	2	5	4,57	0,774
X1.17	30	2	5	4,67	0,661
X1.20	30	2	5	4,57	0,728
X1.21	30	2	5	4,73	0,640
X1.22	30	1	5	4,30	0,988
X1.23	30	1	5	4,20	1,095
X1.24	30	1	5	4,37	0,964
X1.25	30	1	5	4,10	1,029
X1.26	30	1	5	4,43	0,898
X1. 28	30	1	5	4,40	0,932
Valid N (listwise)	30				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X2.1	30	1	5	4,53	0,937
X2.2	30	3	5	4,50	0,731
X2.3	30	1	5	4,37	0,964
X2.4	30	1	5	4,10	1,062
X2.5	30	1	5	4,33	0,922
X2.6	30	1	5	4,23	0,971
X2.7	30	3	5	4,63	0,669
X2.8	30	3	5	4,60	0,724
X2.9	30	3	5	4,77	0,568
X2.10	30	3	5	4,70	0,596
X2.11	30	3	5	4,67	0,661
X2.12	30	3	5	4,70	0,596
X2.13	30	2	5	4,43	0,858
X2.14	30	2	5	4,43	0,935
X2.15	30	3	5	4,40	0,770
X2.16	30	2	5	4,67	0,758
X2.17	30	1	5	4,73	0,828
X2.18	30	1	5	4,40	0,932
X2.19	30	1	5	4,33	0,994
X2.20	30	2	5	4,60	0,770
X2.21	30	2	5	4,17	0,834
X2.22	30	2	5	4,30	0,952
X2.23	30	2	5	4,50	0,861
X2.24	30	2	5	4,40	0,855
X2.25	30	1	5	4,23	1,006
X2.26	30	1	5	4,50	0,938
X2.27	30	1	5	4,40	1,003
X2.28	30	1	5	4,47	0,937
Valid N (listwise)	30				

FIGURE 2. Descriptive Analysis SPSS

Each question has a different minimum value. Variables X1.1, X1.4, X1.5, X1.6, X1.7, X1.9, X1.11, X1.12, X1.22, X1.23, X1.24, X1.25, X1.26, and X1.28 have a minimum value of 1 on the response scale. Meanwhile, variables

X1.13, X1.16, X1.17, X1.20, and X1.21 have a minimum value of 2, while variables X1.8, X1.10, X1.14, and X1.15 have a minimum value of 3. For the maximum value, all variables have the highest response scale of 5. Additionally, the mean values of the variables vary, with the lowest being 4.07 for variable X1.1 and the highest 4.73 for variable X1.17.

Each question has a different minimum value. Variables X2.1, X2.3, X2.4, X2.5, X2.6, X2.17, X2.18, X2.19, X2.25, X2.26, X2.27, and X2.28 have a minimum value of 1 on the response scale. Meanwhile, variables X2.13, X2.16, X2.20, X2.21, X2.22, X2.23, and X2.24 have a minimum value of 2, while variables X2.2, X2.7, X2.8, X2.9, X2.10, X2.11, X2.12, and X2.15 have a minimum value of 3. For the maximum value, all variables have the highest response scale of 5. Additionally, the mean values of the variables vary, with the lowest being 4.10 for variable X2.4 and the highest 4.77 for variable X2.9.

Correlation Analysis

Correlation analysis is performed to assess relationships among the variables under investigation. The Spearman test can be utilized as a statistical approach to assess the association among measured factors on an ordinal scale [11]. The correlation shows that a substantial number of competency indicators are significantly associated with project time performance. Specifically, 17 technical competency (X1) indicators correlate with Y1 and 19 indicators with Y2, while for non-technical competencies (X2), 26 indicators correlate with Y1 and 19 indicators with Y2, all with correlation coefficients greater than 0.362. These results indicate that both technical and non-technical competencies have meaningful relationships with time performance variables.

Wilcoxon Test

The Wilcoxon Signed Rank Test is employed in this research due to the data's deviation from normality, which justifies the use of nonparametric statistical techniques. The Wilcoxon test is applicable for analyzing ordinal-scale data [12]. The Wilcoxon test results reveal that several competency indicators have a statistically significant effect on project time performance. For technical competencies (X1), 8 indicators significantly influence Y1, and 8 indicators influence Y2 ($p < 0.05$). Meanwhile, for non-technical competencies (X2), 11 indicators significantly affect both Y1 and Y2. These findings confirm that both hard skills and soft skills contribute significantly to project time performance [14].

Relative Importance Index (RII)

This analysis is to obtain the average value of the variables to determine the most influential or dominant variable. Descriptive analysis can be seen in the Relative Importance Index (RII) value, which determines the order of the most important factors [1]. There are levels of RII importance, specifically:

1. High (H) = 0,8 – 1,00
2. High – Moderate (H–M) = 0,6 – 0,8
3. Medium (M) = 0,4 – 0,6
4. Medium – Low (M–L) = 0,2 – 0,4
5. Low (L) = 0,0 – 0,2

The RII analysis identifies the most dominant competencies influencing project time performance. For technical competencies, the highest-ranked indicator is understanding the technical implementation of structural work (X1.15) with an RII value of 0.91, followed by the ability to prepare work instructions (X1.6) with an RII value of 0.89. For non-technical competencies, proactiveness and initiative (X2.15) emerge as the most dominant factor with an RII value of 0.88. These results indicate that both technical expertise and proactive behavior are critical in achieving time performance.

Friedman Test

The Friedman test is a nonparametric alternative to the Two-Way ANOVA and is appropriate when the assumption of normality cannot be met. This test is utilized to evaluate the association among two or more related groups using ordinal data [15]. The Friedman test results demonstrate that both technical competencies (X1) and non-

technical competencies (X2) have a significant simultaneous effect on project time performance, as all p-values are less than 0.05. This indicates that the combined effect of multiple competency factors influences the project time performance.

DISCUSSION

The findings confirm that both technical and non-technical competencies play a significant role in influencing project time performance. The correlation and Wilcoxon test results indicate that multiple competency indicators contribute to performance outcomes, suggesting that project success is not determined by a single factor but by a combination of competencies.

Technical competencies, particularly the ability to understand structural work implementation and to develop work instructions, strongly influence time performance. These competencies are directly related to project execution, which explains their dominant contribution to timely completion. On the other hand, non-technical competencies, especially proactiveness and initiative, play an important role in supporting coordination, decision-making, and responsiveness in dynamic project environments.

The Friedman test further confirms that both competency groups simultaneously affect project time performance, indicating that effective project execution requires a balanced integration of technical expertise and behavioral skills. While technical competencies form the foundation of construction activities, non-technical competencies enhance efficiency and adaptability, particularly in managing project uncertainties.

Overall, these findings highlight the importance of developing both hard skills and soft skills to improve project time performance. Construction organizations should therefore implement integrated competency development strategies that strengthen technical capabilities while also enhancing behavioral and interpersonal skills.

CONCLUSION

This study confirms that both technical (hard skills) and non-technical (soft skills) competencies significantly influence project time performance. Among the technical competencies, understanding the technical implementation of structural work emerged as the most dominant factor, while proactiveness and initiative were identified as the most influential non-technical competencies. These findings indicate that project time performance is influenced by the combined contributions of multiple competency factors rather than a single dominant variable.

The results further suggest that technical competencies provide the foundation for effective project execution, while non-technical competencies support coordination, adaptability, and responsiveness in managing project activities. The significant simultaneous influence of both competency groups underscores the importance of balancing hard and soft skills to achieve optimal project performance.

Practically, these findings imply that construction organizations should prioritize integrated competency development programs that strengthen both technical expertise and behavioral capabilities. Such efforts may improve workforce performance and support timely project delivery.

This study is limited to a single construction project with a relatively small number of respondents, which may affect the generalizability of the findings. Therefore, future research is recommended to involve multiple projects with broader samples and to apply more advanced analytical approaches to examine further the relationship between human resource competencies and project performance.

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