Engineering and Technology Journal e-ISSN: 2456-3358
Volume 10 Issue 12 December-2025, Page No.-8211-8218
DOI: 10.47191/etj/v10i12.20, I.F. – 8.482

The Effect of Project Management Resource Quality on Timeliness in Multi-Construction Projects

Rinaldy Novaria
Master of Civil Engineering, Mercu Buana University, Jakarta, Indonesia.

ABSTRACT: This research addresses delays in multi-construction projects, which are often caused by inadequate human resource quality in project management. Factors such as insufficient competence, loyalty, discipline, integrity, and motivation negatively affect team productivity and project timelines. The study aims to identify key factors for successful multi-location project execution and examine the impact of HR quality on time performance. Using a quantitative approach with an explanatory design and employing the Slovin method for sample size determination, data were gathered through structured questionnaires and analyzed using SEM-PLS. Results indicate that time performance is significantly influenced by HR quality, with discipline and competence being crucial. The study suggests enhancing competency-based training, fostering work discipline, and implementing structured motivation techniques. It recommends that multi-project systems adopt integrated and adaptable HR management policies.

KEYWORDS: Competence, Discipline, Time Performance, Project Management, And Quality of Human Resources

1. INTRODUCTION

The construction industry plays a crucial role in national economic growth, primarily by developing quality infrastructure. However, this sector encounters significant challenges, particularly with frequent project delays in large-scale ventures or when handling multiple projects simultaneously. Such delays can result in increased costs, reduced quality, and damage to the contractor's reputation with project owners. Therefore, effective time management in construction project management is essential for ensuring successful project implementation and achieving planned targets.

Project management is a systematic process that encompasses planning, organizing, directing, and controlling resources to achieve project goals while adhering to defined parameters of scope, cost, quality, and time [1], [2]. In construction projects, time control is a critical success indicator, as delays can create a cascading effect on both cost and quality [3]. The causes of these delays can be technical or non-technical, with human resource management (HR) often playing a pivotal role. High-quality human resources facilitate effective coordination and communication among project stakeholders, ensuring that schedules are integrated and work productivity is sustained [4].

The quality of human resources in construction projects encompasses technical competence, work behavior, and integrity in fulfilling responsibilities [5]. Effective HR management is essential for maintaining project effectiveness, as human resources are the primary drivers of success in utilizing other resources, such as time, cost, and equipment [6]. In multi-project scenarios, where a contractor manages multiple projects at once, the importance of human resource quality intensifies due to heightened demands for coordination, discipline, and productivity. Poor HR management can lead to wasted time and overlapping schedules between projects [7].

This study analyzes five critical variables that influence the quality of project management within human resources: competence, loyalty, discipline, integrity, and work motivation. Competence refers to the combination of knowledge, skills, and attitudes necessary for effective job performance [8]. Loyalty signifies an employee's commitment to both the organization and the specific project [9]. Discipline involves adherence to established rules and procedures [10]. Integrity encompasses honesty and accountability in the workplace [11]. Finally, motivation serves as the primary driving force behind an individual's pursuit of goals [12]. Together, these five variables collectively impact the time performance of construction projects.

On-time performance in construction projects refers to the ability to complete tasks according to schedule without significant delays [1]. Human resource factors significantly impact the efficiency of project implementation by enhancing labor productivity and decision-making effectiveness in the field [4]. Specifically, discipline and work motivation directly affect the timeliness of project execution, while competence and loyalty improve coordination among teams working on multiple projects. Therefore, understanding the relationship between project management practices, the quality of human resources, and on-time performance is crucial for ensuring successful project completion within the designated timeline. Contractors in Indonesia encounter substantial challenges that often result in project delays, especially in multi-project environments where resources must be allocated simultaneously. Key obstacles include low work discipline, a shortage of technically skilled experts, and ineffective systems for employee motivation and loyalty. These factors contribute to reduced productivity, heightened team fatigue, and the risk of overlapping activities between projects, ultimately impeding the ability to meet deadlines.

This study adopts an innovative approach by combining empirical analysis of human resources project management quality with time performance across various construction projects. Utilizing SEM-PLS and IPA methods, it shifts focus from traditional technical scheduling optimization to the human factor as a key determinant of project success. The objective is to assess how the quality of human resources project management influences time performance in selected construction projects and to identify the critical factors requiring improvement. This research is urgent, as it provides empirical insights that can help contractors enhance their HR management strategies, ensuring timely project completion and sustainably boosting the competitiveness of national construction companies.

2. RESEARCH METHODS

This study seeks to analyze how the quality of project management resources influences time performance across various construction projects. Specifically, it will assess the impact of human resource quality—encompassing competence, loyalty, discipline, integrity, and work motivation—on the effectiveness of concurrently managed construction projects. Additionally, the study aims to model the relationships between these variables using a multivariate statistical approach and identify key factors that need enhancement to ensure the timely success of the projects.

The research employs a quantitative design with a descriptive-verification approach, utilizing the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method. It focuses on three construction projects managed simultaneously by a national contractor: the Driving Range Project in Jakarta, the Factory Construction Project in Serang, Banten, and the Villa Development Project in Bali. The study was conducted over six months, encompassing the data collection phase through observation and questionnaire distribution, followed by data analysis using SmartPLS 4 software and Importance Performance Analysis (IPA) for testing. This design was selected for its ability to effectively explain the causal relationships between latent variables, even with a relatively small yet complex sample size.

The study focuses on project management personnel from three construction projects, including project managers, field technicians, project administration staff, supervisory consultants, and representatives from the implementing contractor. A purposive sampling method was employed, selecting participants based on specific criteria relevant to the research objectives, such as a minimum of two years of experience in construction projects and direct involvement in project time management. Using the Slovin formula with a 5% error rate, a representative sample of 70 respondents was derived from a total population of 85 individuals. This sample size meets the minimum requirement for SEM-PLS analysis, which is at least 5 to 10 times the number of indicators used.

The research procedure consists of several stages. First, the researcher conducts a literature review to establish a theoretical framework and formulate a hypothesis. Next, research instruments, in the form of validated questionnaires created with input from construction management experts, are developed. Then, data collection occurs through field observations and the distribution of questionnaires to respondents directly involved in the project. Following this, the collected data is processed and analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method via the SmartPLS 4 program to assess the relationships between latent variables. Finally, the analysis results are interpreted considering existing theories and research, leading to strategic conclusions and recommendations.

A closed-ended questionnaire utilizing a four-point Likert scale (1 = strongly disagree to 4 = strongly agree) was employed to assess respondents' opinions on various indicators related to each research variable. The independent variables include competency (X1), loyalty (X2), discipline (X3), and integrity (X4), while Motivation (Z) serves as a mediating variable, and time performance (Y) is the dependent variable. Before distribution, the instrument underwent expert validation and reliability testing, including Cronbach's Alpha and composite reliability, to ensure the dependability of each construct. Validity was assessed through convergent validity (outer loading > 0.7) and discriminant validity based on the Fornell-Larcker criteria.

The data analysis process in the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach consists of two key stages: measurement model analysis (outer model) and structural model analysis (inner model). The inner model analysis evaluates the relationships between latent variables by examining the path coefficients, R^2 values, and effect sizes (F^2). In contrast, the outer model analysis assesses the validity and reliability of the indicators associated with each variable. Hypothesis testing is performed using the bootstrapping technique with a significance level of 5%. Additionally, Critical Performance Analysis (IPA) is employed to identify priority indicators for improvement, specifically aimed at enhancing project time performance. This strategy aims to provide a robust empirical understanding of how the effectiveness of time control in multi-construction projects is influenced by the quality of HR implementation.

3. RESULTS AND DISCUSSION

This study analyzes the impact of project management implementation and the quality of human resources—encompassing competence, loyalty, discipline, and integrity—on timely performance in various construction projects, with motivation serving as a mediating variable. Additionally, the study aims to identify the dominant variables that contribute most significantly to the successful on-time completion of projects. Below is a diagram outlining the research flow.

The characteristics of the respondents provide an overview of the participants in this study, detailing their age, gender, education level, job title, and length of work experience in the construction sector. This information is crucial for understanding the respondents' backgrounds, as these factors can influence their perceptions of the quality of HR implementation and project time performance.

Table 1. Characteristics of Respondents by Age

Age	Number of Respondents	Percentage
<25 Years	1	1%
25-34 Years	26	37%
35-44 Years	36	51%
>45 Years	7	10%
Total	**70**	**100%**

Table 2. Characteristics of Respondents by Gender

Gender	Number of Respondents	Percentage
Man	46	66%
Woman	24	34%
Total	**70**	**100%**

Table 3. Characteristics of Respondents Based on Education

Education	Number of Respondents	Percentage
Master's Degree	10	14%
Bachelor's Degree	39	56%
Associate Degree	13	19%
Upper Intermediate	8	11%
Total	**70**	**100%**

Table 4. Characteristics of Respondents by Position

Position/Title	Number of Respondents	Percentage
Managerial/Team Leader	14	20%
Coordinator/Expert	8	11%
Field Supervisor	17	24%
Staff	31	44%
Total	**70**	**100,00%**

Table 5. Characteristics of Respondents by Project Location

Project Location	Number of Respondents	Percentage
Driving Range Project	36	51%
Factory Construction	20	29%
Villa Construction	14	20%
Total	**70**	**100%**

The data processing results from 70 respondents in this study reveal a diverse range of demographic and professional characteristics. In terms of gender, 66% identified as male and 34% as female, highlighting the male predominance in the construction workforce. Age-wise, the majority (51%) fell within the 36–45-year range, followed by 37% in the 26–35-year range. The remaining respondents included 1% under 25 and 10% over 45, indicating that many are in an active career phase with considerable field experience. Regarding educational attainment, 56% of respondents held bachelor's degrees, 19% had associate degrees, 14% possessed master's degrees, and 11% had upper intermediate qualifications. This suggests that most project management personnel have relevant academic backgrounds in civil engineering. In terms of job positions, the respondents included 20% project managers, 11% coordinators, 44% project administration staff, and 25% field supervisors, demonstrating a balanced representation across various levels of project management. Additionally, by project location, 51% of respondents were from the Driving Range project in Jakarta, 29% from the factory construction project in Serang, Banten, and 20% from the villa construction project in Bali. This distribution reflects the unique characteristics and realities of different construction projects across regions. External model evaluation was conducted to assess the validity and reliability of indicators used to measure latent constructs. The evaluation included tests for convergent validity, discriminant validity, and construct reliability.

3.1. Human Resource Factors Impacting Construction Management Performance

Convergent validity is evaluated by examining the loading factor, with an indicator considered valid if its loading value is ≥ 0.70 [13].

Table 6. Evaluation of The Outer Model

	Average Variance Extracted (AVE)	Information
X1. Competence	0,897	Valid
X2. Loyalty	0,867	Valid
X3. Discipline	0,864	Valid
X4. Integrity	0,857	Valid

Y. Time Performance	0,906	Valid
Z. Motivation	0,817	Valid

The instrument was assessed for validity and reliability through external model analysis, which demonstrated that all variable indicators had an external charge value exceeding 0.7 and an Average Variance Extracted (AVE) value greater than 0.5. Furthermore, the research construct met the reliability criteria, with the Composite Reliability value for all variables surpassing 0.7.

a) The competency variable (X1) has an AVE value of 0.897, demonstrating that its indicators effectively represent the competency construct.
b) The loyalty variable (X2) has an AVE value of 0.867, indicating that 86.7% of the variance in its indicators is explained by the loyalty construct.
c) The discipline variable (X3) has an AVE value of 0.864, which meets the criteria for convergent validity and shows a strong level of representation.
d) The integrity variable (X4) has an AVE value of 0.857, signifying that its indicators are consistent and appropriate for the integrity construct.
e) The time performance variable (Y) has the highest AVE value at 0.906, suggesting that this construct is the most effective in explaining its indicators.
f) Although the motivation variable (Z) has the lowest AVE value among all variables, it remains valid as it significantly exceeds the minimum threshold of 0.50.

a. Discriminant Validity Test

The discriminant validity test confirms that each construct in the research model is distinct, indicating that each variable measures a unique concept without significant overlap. According to [14], a construct is considered to have good discriminant validity when the square root of its √AVE value exceeds its correlations with other constructs.

Table 7. Discriminant Validity Test

	X1	X2	X3	X4	And	With	Information
X1. Competence	**0.947**						Valid
X2. Loyalty	0.852	**0.931**					Valid
X3. Discipline	0.873	0.914	**0.930**				Valid
X4. Integrity	0.853	0.923	0.912	**0.926**			Valid
Y. Time Performance	0.875	0.932	0.933	0.944	**0.952**		Valid
Z. Motivation	0.862	0.884	0.812	0.900	0.867	**0.904**	Valid

Table 7 above shows that the square root of the AVE value (highlighted as the bold diagonal value) for each construct is greater than the correlation values of other constructs in the same column and row. This indicates that each variable exhibits strong discriminant validity.

b. Construct Reliability Test

The construct reliability test evaluates how consistently the indicators of a construct represent the latent variables being measured. In other words, it reflects the stability and consistency of measurement results for a given construct.

Table 8. Construct Reliability

	Cronbach's alpha	Composite reliability (rho_c)	Information
X1. Competence	0,971	0,978	Reliable
X2. Loyalty	0,969	0,975	Reliable
X3. Discipline	0,969	0,975	Reliable
X4. Integrity	0,958	0,968	Reliable
Y. Time Performance	0,974	0,980	Reliable
Z. Motivation	0,955	0,964	Reliable

The results in Table 8 show that all research variables have Cronbach's Alpha and Composite Reliability values exceeding the minimum threshold of 0.70. In fact, most of these values surpass 0.95, indicating that all constructs exhibit very high reliability.

3.2. The Influence of Human Resource Factors on Time Performance in Multi-Construction Projects

The purpose of inner model evaluation, also known as structural model evaluation, is to assess the strength of relationships between latent variables in the research model. This analysis involves testing the predictive values of R^2, f^2, and Q^2 to evaluate the predictability and influence among latent constructs.

a. Coefficient of Determination (R^2)

The determination coefficient (R^2) measures how well exogenous variables explain the variation in endogenous variables within a structural (inner) model. In contrast, adjusted R^2 modifies R^2 by considering the number of exogenous constructs in the model, offering a more precise evaluation of the model's strength [13].

Table 9. Determination Coefficient (R^2) Test Results

	R-square	R-square adjusted	Information
Y. Time Performance	0,933	0,927	Strong
Z. Motivation	0,874	0,867	Strong

The test results indicated that this research model has strong explanatory power, with both endogenous variables—motivation and time performance—showing R^2 values greater than 0.75. Furthermore, the model's ability to account for 92% of the variation in time performance underscores its strategic potential for enhancing project efficiency. For example, project management can improve resource allocation planning at the beginning of a project by focusing on areas likely to face time constraints, thereby reducing the risk of delays. These findings suggest that structural models are not only highly predictive but also effective in clarifying the relationships between variables in research.

b. Effect Size (f^2)

The effect size test (f^2) assesses the individual contribution of each exogenous variable to the endogenous variable [13].

Table 10. Effect Size (f^2)

	X1	X2	X3	X4	Y	Z	Information
X1. Competence					0,032	0,286	Keep
X2. Loyalty					0,088	0,148	Small
X3. Discipline					0,098	0,193	Keep
X4. Integrity					0,215	0,327	Keep
Y. Time Performance							
Z. Motivation					0,001		Very Small

The test results in Table 10 indicate that most exogenous variables exert a small to moderate influence on the endogenous variables in the model.

c. Predictive Relevance Test (Q^2 Predict)

The Q^2 Predict test was conducted to assess the predictive accuracy of structural models regarding the values of endogenous constructs (dependent variables). This test is essential for assessing the Partial Least Squares Structural Equation Modeling (PLS-SEM) model, as it shows the model's effectiveness in explaining and predicting observational data [13].

Table 11. Predictive Relevance (Q^2 Predict)

	Q^2predict	Information
X2. Motivation	0,926	Big
Y. Project Time Performance	0,818	Big

According to the results in Table 11, all endogenous constructs have a Q^2 predictive value exceeding 0.35, signifying that the model demonstrates strong predictive power.

1) The motivation variable (X2) shows a Q^2 predictive value of 0.926, indicating that the research model can account for over 92% of the variation in motivational constructs. This value falls within the large category, reflecting the model's excellent predictive capabilities for motivational variables.
2) The Project Time Performance variable (Y) has a Q^2 predictive value of 0.818, also classified as large. This means that the model can explain more than 81% of the variations in project time performance with high predictive accuracy.

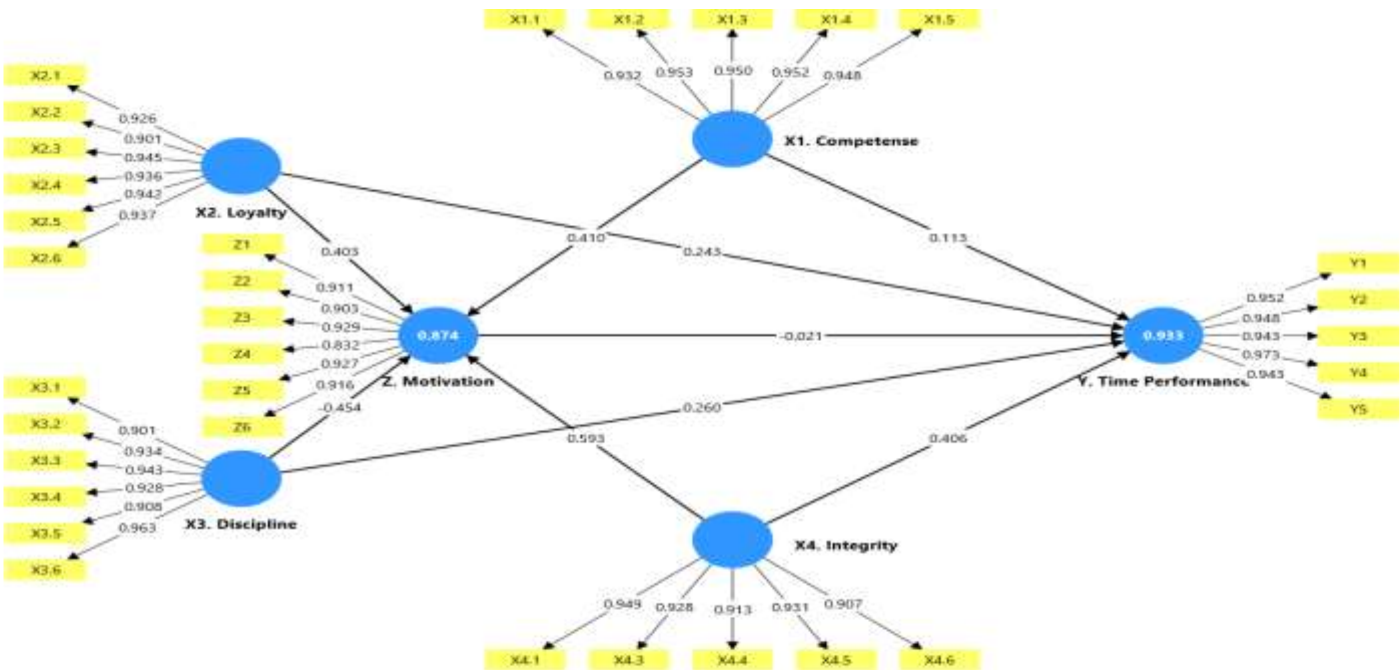

Figure 1 - Output Model of the SEM-PLS Algorithm

3.3 Key Factors Influencing Resource Quality Implementation in Multi-Project Construction Management

To determine the magnitude of the contribution or dominant influence of each indicator on the variable and each exogenous latent variable (X) on Y, the following equation is presented [13]:

$$X1 = 0{,}932X1.1 + 0{,}953X1.2 + 0{,}950X1.3 + 0{,}952X1.4 + 0{,}948X1.5 \quad (1)$$

$$X2 = 0{,}926X2.1 + 0{,}901X2.2 + 0{,}945X2.3 + 0{,}936X2.4 + 0{,}942X2.5 + 0{,}937X2.6 \quad (2)$$

$$X3 = 0{,}901X3.1 + 0{,}934X3.2 + 0{,}943X3.3 + 0{,}928X3.4 + 0{,}908X3.5 + 0{,}963X3.6 \quad (3)$$

$$X4 = 0{,}949X4.1 + 0{,}928X4.2 + 0{,}913X4.3 + 0{,}931X4.4 + 0{,}907X4.5 \quad (4)$$

$$Y = 0{,}952Y1 + 0{,}948Y2 + 0{,}943Y3 + 0{,}973Y4 + 0{,}943Y5 \quad (5)$$

$$Z = 0{,}911Z1 + 0{,}903Z2 + 0{,}929Z3 + 0{,}832Z4 + 0{,}927Z5 + 0{,}916Z6 \quad (6)$$

Table 12. Summary of Key Indicators

Variable	Number of Loads	Dominant Indicators	Loading Dominan	Dominant Contribution
X1	4,735	X1.2	0,953	20,13%
X2	5,587	X2.3	0,945	16,91%
X3	5,577	X3.6	0,963	17,27%
X4	4,628	X4.1	0,949	20,51%
Y	4,759	Y4	0,973	20,45%
Z	5,418	Z3	0,929	17,15%

The indicator with the highest value for each construct (X1.2, X2.3, X3.6, X4.1, Y4, and Z3) is the primary factor shaping the latent variables. This shows that these dimensions have a significant impact on the constructs assessed in this study.

3.3. Recommendations for Enhancing Multi-Project Performance in Construction Companies

To establish the priority scale of an attribute based on its importance and performance, we conducted an Importance and Performance Analysis (IPA). This study involved a thorough scientific analysis of all relevant variables, including Competency (X1), Loyalty (X2), Discipline (X3), Integrity (X4), Motivation (Z), and Project Time Performance (Y). The results are depicted in the following diagram:

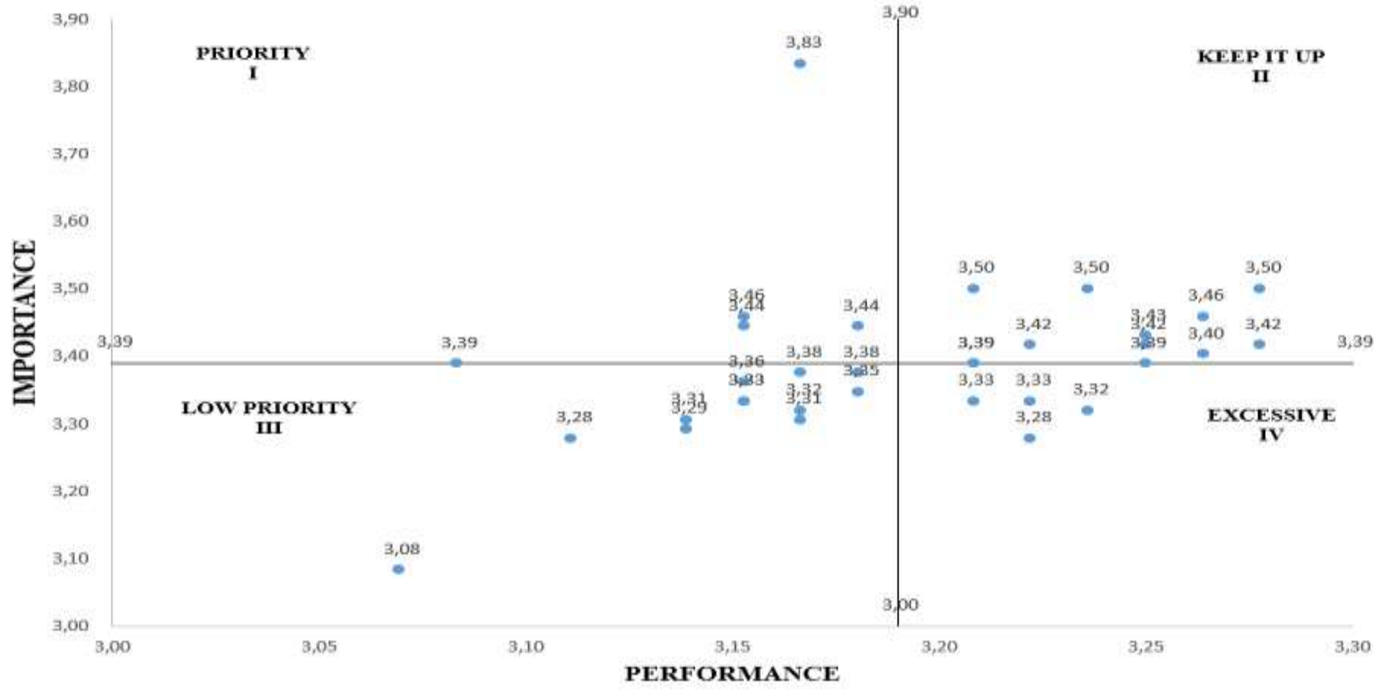

Figure 2 - Performance Analysis of the Importance of Diagrams (IPA)

The Importance Performance Analysis (IPA) results identified key areas for improvement, specifically in adhering to standard operating procedures (SOPs) and working hours, enhancing technical competence, and fostering a motivating work environment.

These findings are consistent with research [6], which shows that work discipline significantly influences productivity and timely project completion. Furthermore, studies [4] and [15] suggest that the experience and technical proficiency of the workforce directly affect the quality of construction execution. However, this study expands the discussion to include multiple projects, revealing that workload dynamics and labor allocation introduce more complex coordination challenges.

The results of this study support human resource management theory, which suggests that disciplined work behavior, strong technical skills, integrity, and intrinsic motivation can improve both individual and organizational performance [5], [12]. Discipline is particularly crucial, as adherence to schedules, standard operating procedures (SOPs), and effective team coordination are essential for successful project time management. Furthermore, in situations with complex project workloads, a supportive work environment can enhance motivation, thereby increasing workforce commitment and loyalty.

These findings highlight the need for businesses to adopt more flexible HR management strategies. This includes implementing project-based competency training programs, establishing a clear system of rewards and penalties, and creating an environment that promotes teamwork and motivation. Additionally, to ensure a fair and measurable use of human resources, it is essential to strengthen the coordination structure for multi-project management.

The study's findings are limited by the small number of projects analyzed, which diminishes the applicability of the results to multi-project scenarios with similar characteristics. Additionally, the data were collected based on respondents' perceptions rather than direct performance observations, which may introduce subjective bias. To enhance clarity, future research should encompass a wider range of projects and utilize a mixed-methods approach.

4. CONCLUSION

This study analyzes the impact of project management resource quality on time performance across various construction projects. The SEM-PLS analysis of five key variables—Competency (X1), Loyalty (X2), Discipline (X3), Integrity (X4), and Motivation (Z)—shows that all indicators are valid, with outer loading values exceeding 0.7. The inner model results indicate that all independent variables positively and significantly influence time performance (Y), in the following order of impact: Discipline (X3), Competency (X1), Motivation (Z), Loyalty (X2), and Integrity (X4). This suggests that higher quality in project management human resources is associated with better success in meeting project timelines.

The discussion highlights that the discipline variable has the most substantial effect on project time performance, emphasizing the importance of adhering to standard operating procedures (SOPs) and work schedules. Technical competence also significantly contributes to effective job completion. However, improvements in social motivation and work environment support are necessary, as identified by Importance Performance Analysis (IPA). Empirically, enhancing project time performance can be achieved by simultaneously optimizing the five dimensions of human resources, with priority indicators for improvement being: X1.1 (Technical Competence), X3.1 (Discipline towards SOPs and Working Time), Y2 (Project Time Control Accuracy), and Z3 (Social Motivation and Work Environment Support).

Based on the findings of this study, we recommend that project management focus on enhancing technical competency training and discipline-based leadership, strengthening the reward and motivation system, and fostering a collaborative work environment. Academics can build on this research by integrating external variables such as organizational culture or project leadership style. Furthermore, construction practitioners can use these insights as a foundation for developing human resource development policies and performance evaluation systems to ensure the timely and sustainable completion of various construction projects.

REFERENCES

1. *PMBOK*. 2017.
2. H. Kerzner, “A Systems Approach to Planning,” 2009, *John Wiley & Sons, Inc.*
3. W. I. Ervianto, *Manajemen proyek konstruksi*. Penerbit Andi, 2023.
4. A. T. Gurmu and C. S. Ongkowijoyo, “Predicting Construction Labor Productivity Based on Implementation Levels of Human Resource Management Practices,” 2020.
5. L. M. Spencer and P. S. M. Spencer, *Competence at Work models for superior performance*. John Wiley & Sons, 2008.
6. Y. Willy and J. Sekarsari, “Analisis Aspek Sumber Daya Manusia Terhadap Kinerja Pekerja Proyek Konstruksi,” 2020.
7. J. Peng and F. Zhou, “Multi-Project Staff Scheduling Optimization Considering Employee Welfare in Construction Projects,” 2025.
8. R. E. Boyatzis, “Competencies in the 21st century,” 2008.
9. J. P. Meyer and N. J. Allen, “A Three-Component Conceptualization Of Organizational Commitment,” 1991.
10. V. Rivai, “Manajemen sumber daya manusia untuk perusahaan,” 2018.
11. S. M. R. Covey and R. R. Merrill, *The speed of trust: The one thing that changes everything*. Simon and Schuster, 2006.
12. S. P. Robbins and A. T. A. Judge, “Organizational Behavior. 18th Edition. New York City, NY, 2019,

USA: Pearson.

13. J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "The Results of PLS-SEM Article information," 2019.
14. C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," 1981.
15. T. F. A. Nisa, H. Suyoso, and S. Sukmawati, "Identifikasi Risiko Faktor Kualitas Sumber Daya Manusia Menggunakan Fault Tree Analysis Method Pada Pelaksanaan Pembangunan Bangunan Tinggi," 2022.