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Analysis Level of Interest in The Last Planner System (LPS) and Factors Influencing The Level of its Implementation

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Abstract: This study aims to analyze the factors influencing the difficulty of implementing the Last Planner System (LPS) among contractors in Malang City. A quantitative approach was employed through questionnaires distributed to contractors involved in construction projects, supported by interviews to validate field findings. The data were analyzed using descriptive techniques and factor weighting to identify the variables that most significantly affect the challenges of LPS implementation. The results indicate that four major factors contribute to the level of difficulty in applying LPS: limited understanding and competence of human resources, lack of management support and commitment, weak coordination and communication among project teams, and resistance to organizational cultural change. The most influential factors are managerial and organizational behavioral aspects, particularly related to management commitment and readiness for collaborative work culture. These findings confirm that successful LPS implementation relies not only on technical tools but also on organizational readiness to adopt a culture of collaboration, transparency, and accountability. The study recommends strengthening human resource capacity, enhancing managerial support, optimizing routine coordination, and transforming organizational culture to improve the effectiveness of LPS implementation in Malang City.

Keywords: Collaboration; Communication; Cultural change; Human resources; Last Planner System

Introduction

The construction industry plays a strategic role in economic growth and infrastructure development; however, it continues to face persistent challenges such as project delays, cost overruns, quality deficiencies, and resource waste (Abdelalim et al., 2025; Sanusi, 2024). These issues are also evident in Malang City, which has a high level of construction investment, infrastructure spending exceeding IDR 200 billion in 2025, and a relatively high Construction Cost Index. Such conditions highlight the urgent need for more efficient, accountable, and adaptive project management systems.

The Last Planner System (LPS) is a lean construction–based project management approach that emphasizes collaborative planning, commitment-based production control, and waste reduction (Singh, 2025; Warid & Hamani, 2023). Previous studies have demonstrated that LPS can improve schedule reliability, productivity, and overall project efficiency (Ojinta & Enyinna, 2025; Power et al., 2021; Shehab et al., 2023). Nevertheless, its practical implementation remains challenging due to factors such as limited understanding of LPS principles among contractors, insufficient trained human resources, resistance to organizational change, and inadequate managerial support (Perez & Ghosh, 2018).

Despite the significant scale and complexity of construction projects in Malang City, empirical studies examining contractors' understanding of LPS and the

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factors influencing the difficulty of its implementation in this local context remain limited (Damayanti et al., 2021). Therefore, this study aims to analyze the importance and performance levels of Last Planner System principles and to identify the key factors hindering its implementation based on contractors' perceptions in Malang City using the Importance–Performance Analysis (IPA) method. The findings are expected to provide empirical evidence to support the development of more effective construction project management strategies in similar urban contexts.

Method

The study was conducted at contractor companies operating in Malang City, East Java. The research subjects consisted of medium- to large-scale contractors with experience in implementing modern project management systems, particularly Lean Construction. A total of 56 respondents participated in the study, including project managers, site engineers, and field supervisors who are directly involved in project planning and control.

Data Collection Techniques

The primary instrument used in this study was a closed-ended questionnaire employing a five-point Likert scale (1–5). The questionnaire included indicators related to the understanding of LPS principles (such as master schedule, lookahead planning, weekly work plan, and Percent Plan Complete), as well as indicators of implementation difficulty (management support, resistance to change, and team coordination) (Ballard & Tommelein, 2021). In addition to the questionnaire, brief interviews were conducted with several key respondents to strengthen the quantitative analysis. This technique was used to obtain deeper insights into the challenges encountered during the implementation of LPS in the field.

Data Analysis Techniques

The collected data were analyzed using the Importance–Performance Analysis (IPA) method. This method is used to identify the gap between the level of importance and the level of performance for each LPS principle (Xiao et al., 2024). The analysis steps include: (a) Calculating the mean values of importance and performance for each indicator. (b) Determining the position of each indicator on the IPA Cartesian diagram to identify priority factors for improvement. (c) Interpreting the results based on the four quadrants: (1) Concentrate Here, (2) Keep Up the Good Work, (3) Low Priority, and (4) Possible Overkill.

Instrument Validity and Reliability Testing

Validity Test

The validity test was conducted using the Pearson Correlation method to ensure that each questionnaire item was able to measure the intended variable, while the reliability was assessed using Cronbach's Alpha with SPSS version 26 (Malapane & Ndlovu, 2024). A coefficient value of $\alpha \geq 0.70$ is considered to indicate good reliability (Kilic, 2016; Mohamad et al., 2015).

Result and Discussion

Validity test

Based on the validity test results shown in the Table 1, all items in the Importance and Performance variables in assessing the Last Planner System (LPS) principles were declared valid because they had calculated r values greater than the table r (0.444). This indicates that each item consistently represents the construct being measured. Theoretically, Ballard (2000) stated that LPS is a production planning system in construction that focuses on increasing plan reliability through implementer commitment and collaboration between parties. The validity of the items in the Importance variable indicates that respondents consider LPS principles, such as collaborative planning and workflow control, to be important aspects of construction project implementation (Fernandez-Solis et al., 2013).

Furthermore, the validity of all items in the Performance variable indicates that the research instrument is capable of measuring the level of accurate implementation of LPS principles in the field (Dadashnejad & Valmohammadi, 2019). This aligns with Pereira et al. (2013) assertion that LPS success depends heavily on the interconnectedness of short-term planning, team commitment, and performance measurement through percent plan complete (PPC). Thus, valid items in the performance variable reflect that the measured performance aspects, such as consistency of plan implementation and coordination between parties, are relevant indicators for assessing LPS implementation.

In the variable "Factors Influencing the Difficulty Level of LPS Implementation," all items were also declared valid, indicating that the factors influencing the difficulty level of LPS implementation have been well identified. According to Akanbi et al. (2019); Koskela (1992), the lean construction concept—the basis of LPS—requires a paradigm shift from traditional approaches to a production system oriented toward flow, value, and waste reduction. Therefore, challenges in LPS implementation often relate to human factors, organizational culture, and the readiness of the project management system (El-Sabek & McCabe, 2018). The

validity of the items in this variable indicates that the instrument is able to accurately capture these factors (Alumran et al., 2012).

Overall, the results of this validity test strengthen the alignment between the research instrument and the theoretical foundation used. A valid instrument indicates that the theoretical concepts regarding the Last Planner System and lean construction have been accurately translated into research indicators, allowing subsequent analysis to serve as a reliable basis for evaluating LPS implementation in construction projects.

Table 1. Validity Test Results

Variable		Item	r (Calculated)	r (Table)	Description
Assessment of Last Planner System Principles	Importance	P1a	0.814	0.444	Valid
		P2a	0.871	0.444	Valid
		P3a	0.767	0.444	Valid
		P4a	0.654	0.444	Valid
		P5a	0.621	0.444	Valid
		P6a	0.805	0.444	Valid
		P7a	0.822	0.444	Valid
		P8a	0.812	0.444	Valid
		P9a	0.771	0.444	Valid
		P10a	0.732	0.444	Valid
	Performance	P1b	0.733	0.444	Valid
		P2b	0.737	0.444	Valid
		P3b	0.738	0.444	Valid
		P4b	0.807	0.444	Valid
		P5b	0.600	0.444	Valid
		P6b	0.789	0.444	Valid
		P7b	0.676	0.444	Valid
		P8b	0.793	0.444	Valid
		P9b	0.762	0.444	Valid
		P10b	0.613	0.444	Valid
Factors Influencing the Difficulty Level of LPS Implementation		P1	0.482	0.444	Valid
		P2	0.585	0.444	Valid
		P3	0.730	0.444	Valid
		P4	0.682	0.444	Valid
		P5	0.493	0.444	Valid
		P6	0.484	0.444	Valid
		P7	0.498	0.444	Valid
		P8	0.745	0.444	Valid
		P9	0.808	0.444	Valid
		P10	0.666	0.444	Valid
		P11	0.481	0.444	Valid
		P12	0.716	0.444	Valid

Table 1 presents the results of the validity test of the research instrument used to assess the Last Planner System (LPS) principles and the factors influencing the difficulty level of LPS implementation. The validity test was conducted by comparing the calculated r value to the table r value of 0.444. A statement item is considered valid if the calculated r value is greater than the table r value.

Based on the test results, all items in the Importance and Performance variables in assessing the Last Planner System principles demonstrated calculated r values greater than the table r value, thus all items were deemed valid and suitable for use as a research instrument. A similar finding was found for the Factors Influencing the Difficulty Level of LPS Implementation variable, where all statement items met the validity criteria.

Thus, it can be concluded that the research instrument used has a good level of validity and is able to accurately measure the research variables, making it suitable for use in subsequent analysis stages.

Reliability Test

Based on the reliability test results presented in the Table 2, all research variables demonstrated Cronbach's Alpha (calculated α) values greater than the table α value of 0.60, thus all instruments were deemed reliable. The Assessment of Last Planner System Principles variable, for the Importance aspect, achieved an α value of 0.921, while the Performance aspect achieved an α value of 0.901. Furthermore, the Factors Influencing the

Difficulty Level of LPS Implementation variable also demonstrated a high α value of 0.853. These values indicate a very good level of internal consistency between items within each variable.

Theoretically, reliability refers to an instrument's ability to produce consistent measurement results when used repeatedly under relatively similar conditions. According to modern measurement theory, instruments with a Cronbach's Alpha value above 0.70 are categorized as having good reliability, while values above 0.80 indicate very strong reliability (Gottems et al., 2018; Taber, 2018). Therefore, the α value obtained in this study indicates that the statement items are highly correlated and consistently measure the same construct.

Table 2. Reliability Test Result

Variable	Alpha (Table)	Alpha (Calculated)	Description
Assessment of Last Planner System Principles – Importance	0.60	0.921	Reliable
Assessment of Last Planner System Principles – Performance	0.60	0.901	Reliable
Factors Influencing the Difficulty Level of LPS Implementation	0.60	0.853	Reliable

The high reliability values for the Importance and Performance variables indicate that the instrument is able to consistently measure respondents' perceptions regarding the importance and performance of the implementation of the Last Planner System (LPS) principles (Ahmad et al., 2024). This aligns with the LPS concept, which emphasizes integration between project planning and implementation elements, so the indicators used need to be mutually supportive and not partial. Meanwhile, the good reliability of the LPS implementation difficulty variable indicates that the various inhibiting factors measured are appropriate and consistent in representing the challenges of LPS implementation in the field.

Therefore, the results of this reliability test confirm that the research instrument is not only valid but also has a high level of reliability. A reliable instrument provides a strong foundation for subsequent data analysis, as the measurement results are reliable and reflect the actual conditions related to the implementation of the Last Planner System in construction projects.

Importance Performance Analysis (IPA)

The analysis using the Importance–Performance Analysis (IPA) method was carried out to identify the gap between the level of importance and the level of implementation of the Last Planner System (LPS) principles by contractors in Malang City. Based on the results of the questionnaire data processing for medium-to large-scale contractor respondents, the average importance score was 4.34, while the performance score was 3.27 on a 1–5 Likert scale. These values indicate that, in general, contractors have a high perception of the importance of implementing LPS principles, yet their actual implementation in the field remains suboptimal.

Item-Level Conformity Calculation

The item-level conformity calculation is used to measure the extent to which actual performance aligns with or meets the expectations of users or respondents. The conformity level is calculated using the Formula 1.

$$Tki = \left(\frac{X_i}{Y_i}\right) \times 100\% \quad (1)$$

The results of the conformity level calculation for each item can be seen in Table 3.

Table 3. Conformity Level Calculation for Each Item

Item	Importance (Yi)	Performance (Xi)	Tki %
P1	244	202	83
P2	239	205	86
P3	223	190	85
P4	226	196	87
P5	227	179	79
P6	219	185	84
P7	211	188	89
P8	223	186	83
P9	223	189	85
P10	212	184	87
Σ	2247	1904	848

Calculating the Total Conformity Level (Tki Total)
between X (Performance) and Y (Importance)
To calculate the total conformity level, the following formula is used:

$$Tki\ total = \left(\frac{1904}{2287}\right) \times 100\%$$
$$= 85\%$$

Thus, the total Tki value of 85% indicates that T_total < 100%, meaning that overall quality or performance is not yet satisfactory. The level of alignment between expectations (importance) and actual implementation (performance) remains insufficient.

Cartesian Diagram Analysis

The position of each attribute within the quadrants of the Cartesian diagram is shown in Figure 1. The diagram illustrates how the attributes are distributed across the four quadrants. Based on the data and the Importance–Performance Analysis (IPA) conducted in this study on contractors' understanding and the level of difficulty in implementing the Last Planner System (LPS) in Malang City, the position of the main LPS attributes in the IPA Cartesian diagram is as follows.

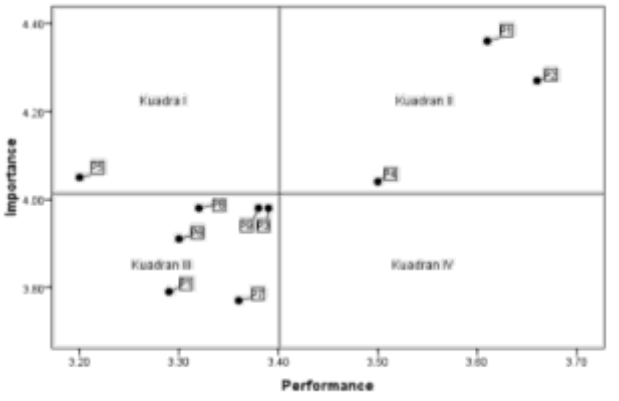

Figure 1. Attribute Placement

Quadrant I (Top Priority)

Quadrant I contains attributes considered to have high importance but low performance. One attribute falls into this category, namely Daily Huddle, with an importance score of 4.05 and a performance score of 3.20. This indicates that although daily huddles are highly important for the successful implementation of LPS, their execution in the field remains suboptimal and requires special attention for improvement.

Quadrant II (Maintain Performance)

Quadrant II consists of attributes with both high importance and high performance. Three attributes fall into this quadrant: Master Schedule (importance 4.36, performance 3.61), Phase Planning (importance 4.27, performance 3.66), and Weekly Work Plan (importance 4.04, performance 3.50).

Quadrant III (Low Priority)

Quadrant III includes attributes with low importance and low performance. Six attributes fall into this quadrant: Lookahead Planning, Commitment Plan, Percent Plan Complete (PPC), Rapid Learning, Collaboration and Communication, and Root Cause Analysis.

Quadrant IV (Overdone)

No attributes fall into Quadrant IV, indicating that there are no elements that are being excessively implemented despite having low importance. The results of the Importance–Performance Analysis (IPA) indicate that there are several critical factors in the implementation of the Last Planner System (LPS) that have high importance but low performance, making them top priorities for improvement. These factors include: insufficient formal training and socialization of LPS, low management support and commitment, limited coordination among project stakeholders, and resistance to change accompanied by an organizational culture that is not yet fully collaborative.

Descriptive Percentage Analysis

The purpose of this descriptive analysis is to quantitatively illustrate the factors that influence the level of difficulty in implementing the LPS. The analysis was conducted on 56 respondents based on 12 statements (P1 to P12) related to the factors contributing to the challenges in implementing the Last Planner System (LPS). The total score for each respondent can be found in the appendix, with the overall total score amounting to 2,452. These factors include stakeholder coordination, resistance to change, and organizational cultures that are not yet fully collaborative.

Frequency Calculation

The frequency calculation can be seen in Table 4.

Table 4. Frequency Calculation

Scale	Percentage	Category	Frequency	%
1	0 - 24	Very Not Influential	0	0
2	25 - 49	Not Influential	2	4
3	50	Moderately Influential	1	2
4	51 - 74	Influential	23	41
5	75 - 100	Very Influential	30	54
Total			56	100

Based on the findings of the study, it was identified that overall, the factors influencing the level of difficulty in implementing LPS among contractor companies operating in Malang City were considered significantly influential, with an average percentage score of 73%, falling into the "Influential" category. This indicates that various internal and external factors pose substantial challenges that must be addressed for the implementation of LPS to run more optimally. The total scores and percentage results from the 56 respondents can be found in the appendix, while the average scores for the 12 evaluated factors are presented in Table 5.

Table 5. Average Value Per Item

Statement	Score Average
Management provides insufficient support for the implementation of LPS.	3.66
Inadequate resources for the implementation of LPS.	3.8
Collaboration and communication among project teams	3.88
Openness and support for transitioning to the use of LPS	3.57
Level of resistance or refusal toward the use of LPS	3.38
Limited training programs and formal skill development related to LPS	3.39
Insufficient technical knowledge to implement LPS in the project	4.13
Complexity of coordination across disciplines	3.5
Number of involved parties does not support the implementation of LPS	3.32
Frequently encountering issues during planning or execution	3.3
Organizational culture that does not provide adequate support	3.8
External and internal factors	3.52

The data in Table 5 indicate that contractors face significant challenges in the implementation of LPS. The questionnaire results show that the average respondent perception scores for various inhibiting factors range from 3.3 to 4.1 on a scale of 1 to 5, suggesting a moderate to high level of difficulty in applying the Last Planner System.

Based on the results of the analysis, it was found that the level of difficulty in implementing the Last Planner System (LPS) among contractors in Malang City is influenced by several interrelated factors, both technical and non-technical. These factors include limited understanding and competence of human resources, insufficient support and commitment from project management, weak coordination and communication among project teams, and resistance to shifting from conventional work methods to the collaborative LPS approach.

Conclusion

This study concludes that the successful implementation of the Last Planner System (LPS) in construction projects is strongly influenced by four main factors: human resource competence, management support and commitment, effective team communication coordination, and organizational cultural readiness for change. These findings indicate that the challenges of LPS implementation are more dominantly managerial and behavioral than technical. In general, the greatest difficulties lie in the low practical understanding of LPS, the lack of supportive managerial policies, the lack of regular communication forums, and resistance to collaborative work systems. Generalizations from this research indicate that contractors in other regions with similar organizational characteristics are likely to face similar obstacles, particularly in environments that still rely on conventional planning methods. Therefore, improving management systems and strengthening a collaborative culture are crucial prerequisites for the successful implementation of LPS more broadly. Practically, these findings emphasize the need to improve human resource capacity through Lean Construction training, strengthen managerial commitment to providing time and resources for implementation, establish regular coordination mechanisms such as daily huddles, and foster cultural change that emphasizes transparency and shared responsibility. These steps are crucial to supporting consistent LPS implementation and improving the reliability of construction project performance.

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Author Contributions

Conceptualization, M. A. R., I. A and A. M. H; methodology, M. A. R; software, M. A. R; validation, M. A. R., I. A and A. M. H; formal analysis, M. A. R; investigation, M. A. R; resources, I. A; data curation, M. A. R; writing—original draft preparation, M. A. R; writing—review and editing, I. A. and A. M. H; visualization, M. A. R; supervision, I. A; project administration, M. A. R. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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