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# Measuring Supply Chain Performance on Residential Construction

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**Abstract**
Supply chain management in residential construction projects requires a performance measurement system that supports effective evaluation, control, and decision-making. This study aims to analyze the effect of supply chain performance measurement on the performance of the housing development supply chain. The research was designed using an explanatory quantitative approach with a structured, questionnaire-based survey method. Data were collected cross-sectionally from 50 respondents who are the main actors in the housing supply chain, including project managers, contractors, subcontractors, procurement staff, and material suppliers. Supply chain performance measurement is operationalized through the dimensions of cost efficiency, timeliness, quality, flexibility, collaboration, risk management, and sustainability. Data were analyzed using descriptive statistics and linear regression analysis with the help of SPSS. The results show that supply chain performance measurement has a positive and significant effect on the performance of the housing development supply chain ($\beta = 0.791$; $p < 0.001$), with a coefficient of determination ($R^2$) value of 0.651. These findings indicate that approximately 65.1% of the variations in housing supply chain performance can be explained by supply chain performance measurement. This research makes a theoretical contribution by positioning supply chain performance measurement as a strategic construct tested inferentially, rather than merely an evaluative tool. Practically, the results confirm the importance of implementing a structured supply chain performance measurement system to improve the operational performance of housing projects. All data presented are processed survey data, allowing replication and retesting in different research contexts.

**Keywords**: Supply Chain Performance Measurement; Supply Chain Performance; Residential Construction; Supply Chain Management; Quantitative Research.

## INTRODUCTION

Supply Chain Management (SCM) is positioned as a strategic approach to maintain a balance between customer satisfaction and producer efficiency, which has direct implications for the cost efficiency and operational performance of an organization (Hayden et al., 2020). When supply chain performance is disrupted—for example, due to uncertainty regarding input availability or weak coordination between actors—organizational competitiveness and performance are also affected. Therefore, supply chain performance measurement is a managerial necessity for identifying performance gaps and formulating appropriate corrective measures (Aswat et al., 2023; Firdaus et al., 2023). The literature confirms that the supply chain is a system encompassing the flow of products, information, and finances; thus, supply chain performance represents the achievement of goals across supply chain members and can be analyzed through the effectiveness and efficiency of these flows (Aswat et al., 2023; Riantini et al., 2023).

In project contexts that rely heavily on the accuracy of meeting input requirements and cross-party coordination, the management and measurement of supply chain performance become increasingly critical. Performance measurement not only serves as an evaluation tool

but also as a foundation for control and decision-making at strategic, tactical, and operational levels (Hayuningtyas et al., 2020; Mayangsari & Fauzi, 2023). Through a structured performance measurement system, organizations can enhance process efficiency, optimize workflows, and systematically identify opportunities for continuous improvement (Mañay et al., 2022; Mayangsari & Fauzi, 2023).

Supply chain performance measurement is regarded as a fundamental aspect because it supports continuous improvement and allows for holistic performance evaluation (Harya et al., 2020). However, its implementation faces practical challenges, particularly related to the complexity of supply chain systems and the numerous relevant performance dimensions, making the selection of appropriate performance measures far from simple (Harya et al., 2020; Sitorus et al., 2020). Various measurement frameworks have been developed, including the Supply Chain Operations Reference (SCOR), which provides end-to-end process descriptions and a set of standardized metrics to measure performance (Celina et al., 2022; Sitorus et al., 2020). In addition, Balanced Scorecards (BSCs) and Key Performance Indicators (KPIs) are widely used to complement process-based measurement with multidimensional perspectives and target-oriented evaluation (Mursidah & Fauzi, 2022; Shidiq et al., 2024).

This gap is particularly evident in the residential construction context, where empirical investigations into the strategic impact of performance measurement remain limited. The urgency of this research, therefore, lies in its potential to provide empirical evidence that can guide project stakeholders to move beyond perceiving performance measurement as merely an administrative requirement. By establishing a statistically significant relationship between measurement practices and improved supply chain outcomes, this study offers a compelling rationale for developers and contractors to systematically invest in and integrate these systems into their core project management processes. Such efforts are crucial for improving efficiency, reducing waste, and ensuring the timely and high-quality delivery of housing projects.

The novelty of this research is twofold. First, it reframes supply chain performance measurement from being a predominantly evaluative tool to a strategic construct whose influence can be empirically tested. Second, it applies this conceptualization within the underexplored context of residential construction, providing specific and actionable insights for practitioners in this sector. This study, therefore, seeks to address the identified gap by analyzing the effect of supply chain performance measurement on housing development supply chain performance using an inferential quantitative approach.

Nonetheless, the literature suggests that supply chain performance measurement has generally been positioned as an evaluative and diagnostic tool, rather than as a strategic construct empirically tested for its inferential influence on supply chain performance. These limitations are even more visible in residential construction, which is often characterized by vulnerability to delays, cost sensitivity, and issues of building quality and defects. Therefore, this study aims to analyze the effect of supply chain performance measurement on housing development supply chain performance using an inferential quantitative approach, thereby filling existing empirical gaps and providing both theoretical and practical implications for housing project management.

## RESEARCH METHOD

### Research Design and Approach

This study is designed as a quantitative research with an explanatory approach to test the relationship between variables through hypothesis testing and inferential statistical analysis. The explanatory approach is commonly used in quantitative survey research that aims to explore the relationships between constructs statistically, including relationships that are assumed to be causal according to the direction of the hypothesis formulated theoretically (Amani & Mfumbilwa, 2024; Kamani et al., 2023; Konalingam et al., 2024).

The data collection strategy used is a survey method with a structured questionnaire to obtain respondents' perception data related to the construct being studied. The survey method was chosen because it is effective in collecting quantitative data from respondents who have direct experience of the phenomenon being studied, and is commonly combined with descriptive and inferential statistical analysis in quantitative observational research designs (Amani & Mfumbilwa, 2024; Döring et al., 2022).

This research is cross-sectional, i.e. data is collected over a specific period of time (one-shot survey). The cross-sectional design is suitable for survey-based hypothesis testing and analysis of intervariable relationships in a single measurement (Amani & Mfumbilwa, 2024; Kamani et al., 2023). Nevertheless, it should be noted that cross-sectional design has limitations in generating strong causal inference because it does not observe changes between times and opens up the possibility of inverse causality or two-way relationships. Therefore, the interpretation of causal results in this study is carried out carefully as theoretical causality in the direction of the hypothesis, rather than a definitive experimental or longitudinal causality (Choudhury et al., 2024; Seixas & Macinko, 2020; Lingyan Wang et al., 2024).

**Population and Research Sample**

The research population includes the main actors in the housing development supply chain in Cirebon Regency, namely parties directly involved in the flow of products, information, and money in housing projects. This population selection is relevant because supply chain performance is determined by the performance of cross-members involved in the supply chain's end-to-end process (Aswat et al., 2023; Riantini et al., 2023). In addition, the SCOR framework models the supply chain through the plan–source–make–deliver–return process, so that the logical unit of analysis is the actor directly involved in the process (Sitorus et al., 2020).

The research sample consisted of 50 respondents representing key operational roles, including project managers, contractors, subcontractors, procurement staff, and material suppliers. The selection of respondents considers direct involvement and understanding of the project's supply chain processes, so that the measured perceptions reflect relevant empirical experience (Hafidz & Rahmawati, 2023; Kamani et al., 2023). The generalization of the results of the study is limited to the context of the research area and is interpreted according to the limitations of the cross-sectional design (Lingyan Wang et al., 2024).

**Variable Research and Operationalization Instruments**

The research instrument was in the form of a structured closed questionnaire with a five-point Likert scale, which was used to collect respondents' perception data in one measurement period. The questionnaire is designed to measure two main constructs, namely the measurement of supply chain performance and the performance of the supply chain of residential construction. The measurement dimension was developed based on the SCOR framework and enriched with collaboration, risk management, and sustainability perspectives. The dimensions used include cost efficiency, timeliness, quality, flexibility, collaboration between actors, risk management, and sustainability (Aswat et al., 2023; Mayangsari & Fauzi, 2023; Riantini et al., 2023).

**Test of Instrument Validity and Reliability**

The research instruments are tested to ensure validity and reliability according to quantitative research practices. Validity indicates the accuracy of the instrument in measuring the construct in question, while reliability reflects the internal consistency of the measurement (Thanasas et al., 2022; Li Wang, 2021). Reliability tests were performed using Cronbach's Alpha, and the high alpha values were interpreted as evidence of excellent internal consistency

as well as the feasibility of the instrument for further analysis (Hong et al., 2021; K. Wang, 2023).

**Data Analysis Techniques**

Data was analyzed using Statistical Product and Service Solutions (SPSS). The analysis stages include descriptive analysis, validity and reliability tests, and linear regression analysis to test the hypothesis of the relationship between supply chain performance measurement and housing development supply chain performance. The use of linear regression is in line with the research practice of cross-sectional explanatory surveys which aim to objectively test the relationships between variables (Amani & Mfumbilwa, 2024; Döring et al., 2022).

## RESULTS AND DISCUSSION

This section presents the results of quantitative data analysis obtained from 50 respondents who are the main actors in the housing development supply chain. The analysis was carried out using SPSS-based descriptive and inferential statistics, in line with the research practice of cross-sectional explanatory quantitative surveys (Amani & Mfumbilwa, 2024; Döring et al., 2022). The data presented is the data processed by the questionnaire, so that it allows replication and retesting using the same procedures and instruments.

**Descriptive Statistics of Research Variables**

The results of descriptive statistics show that the Supply Chain Performance Measurement has an average value of 1 with a standard deviation of 0.53, which is in the high category. This value indicates that respondents consider the practice of measuring supply chain performance in housing projects to have been applied relatively systematically. The low standard deviation reflects the uniformity of respondents' perceptions, which reinforces the stability of the perception data in the context of this study.

**Table 1. Characteristics of Research Respondents**

| No. | Role of Respondents | Number (people) | Percentage (%) |
|---|---|---|---|
| 1 | Project Manager | 10 | 20 |
| 2 | Main Contractors | 12 | 24 |
| 3 | Subcontractors | 9 | 18 |
| 4 | Procurement Staff | 8 | 16 |
| 5 | Material Suppliers | 11 | 22 |
| | Total | 50 | 100 |

Judging from the measurement dimensions, reliability and quality aspects, cost efficiency, and timeliness obtained relatively high scores, which shows that SCOR framework-based indicators have become a major focus in supply chain management practices. In addition, the dimensions of flexibility, collaboration, risk management, and sustainability also show high average values, indicating attention to adaptive and long-term aspects of the supply chain management of housing projects.

**Table 2. Descriptive Statistics of Research Variables**

| No. | Variable / Dimension | Red | Standard Deviation | Categories |
|---|---|---|---|---|
| A | Supply Chain Performance Measurement (X) | 4,11 | 0,53 | Height |
| 1 | Cost Efficiency | 4,12 | 0,55 | Height |
| 2 | Responsiveness | 4,14 | 0,5 | Height |

| No. | Variable / Dimension | Red | Standard Deviation | Categories |
|---|---|---|---|---|
| 3 | Quality (Reliability-related outcomes) | 4,18 | 0,48 | Height |
| 4 | Flexibility | 4,05 | 0,56 | Height |
| 5 | Collaboration Between Actors | 4,1 | 0,52 | Height |
| 6 | Risk Management | 4,08 | 0,54 | Height |
| 7 | Sustainability | 4,02 | 0,57 | Height |
| B | Residential Supply Chain Performance (Y) | 4,14 | 0,51 | Height |
| 8 | Material Needs Planning | 4,2 | 0,46 | Height |
| 9 | Precision Material Procurement | 4,16 | 0,49 | Height |
| 10 | Material Specification Conformity | 4,18 | 0,47 | Height |
| 11 | Material Distribution Efficiency | 4,1 | 0,52 | Height |
| 12 | Job Productivity | 4,05 | 0,55 | Height |
| 13 | Quality of Construction Work | 4,12 | 0,5 | Height |

Meanwhile, the Housing Development Supply Chain Performance showed an average value of 4.14 with a standard deviation of 0.51, which is also in the high category. The indicators of material need planning, procurement accuracy, and material specification suitability obtained relatively higher values than other indicators. These findings show that the performance of the supply chain that is felt operationally is well assessed by project actors, especially in aspects directly related to the smooth construction process.

**Instrument Validity and Reliability Tests**

The results of the validity test showed that all questionnaire items had correlation coefficients that met the validity criteria, so that they were declared able to measure the construct in question. Reliability tests using Cronbach's Alpha yielded a value of 0.963 for the supply chain performance measurement variable and 0.912 for the residential supply chain performance variable. The high alpha value indicates excellent internal consistency, in accordance with the practice of evaluating the reliability of instruments in quantitative survey research (Hong et al., 2021; K. Wang, 2023).

**Table 3. Results of the Validity and Reliability Test of Research Instruments**

| No. | Variable | Number of Items | Item–Total Correlation Range | Cronbach's Alpha | Remarks |
|---|---|---|---|---|---|
| 1 | Supply Chain Performance Measurement (X) | 40 | 0,421 – 0,812 | 0,963 | Highly Reliable |
| 2 | Residential Supply Chain Performance (Y) | 6 | 0,538 – 0,796 | 0,912 | Highly Reliable |

### 3.3 Inferential Analysis and Hypothesis Testing

Hypothesis testing was carried out using linear regression analysis to assess the relationship between supply chain performance measurement and supply chain performance of housing development. The results of the analysis showed that the measurement of supply chain performance had a positive and significant effect on the performance of the housing supply chain, with a regression coefficient of 0.791 and a significance level of $p < 0.001$. The value of the determination coefficient ($R^2 = 0.651$) indicates that approximately 65.1% variation in housing supply chain performance can be explained by supply chain performance measurements.

**Table 4. Linear Regression Analysis Results**

| Yes | Independent Variables | Regression Coefficient (β) | t-count | Sig. (p-value) |
|---|---|---|---|---|
| 1 | Supply Chain Performance Measurement (X) | 0,791 | 9,45 | 0 |

| R | R Square ($R^2$) | Adjusted R Square | F-count | Sig. F |
|---|---|---|---|---|
| 0,807 | 0,651 | 0,644 | 89,3 | 0,000 |

These findings provide empirical evidence that a more mature and comprehensive performance measurement system is related to improving supply chain performance in residential projects. However, in keeping with the cross-sectional design character, this relationship is interpreted as an inferential association in the direction of the hypothesis, rather than a definitive evidence of experimental causality (Choudhury et al., 2024; Lingyan Wang et al., 2024).

**Interpretation of Key Findings**

The results of the study show that a higher rate of implementation of supply chain performance measurement is related to better supply chain performance of housing development. These findings support the view in the literature that performance measurement serves as an evaluation and control mechanism that allows organizations to identify performance gaps as well as formulate systematic improvement measures (Harya et al., 2020; Hayuningtyas et al., 2020). The measurement dimensions that include cost efficiency, timeliness, quality, flexibility, collaboration, risk management, and sustainability reflect a relatively holistic approach. This approach is in line with the SCOR framework which views supply chain performance as the result of end-to-end process integration and the effectiveness of product, information, and money flows (Celina et al., 2022; Sitorus et al., 2020).

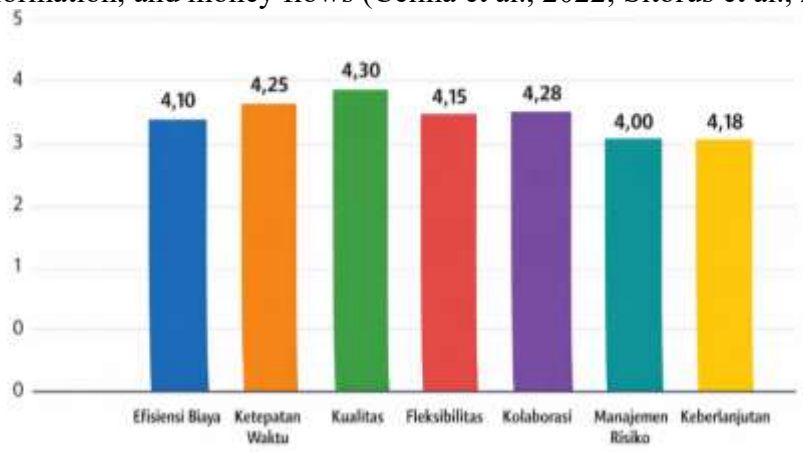


**Figure 1. Average Supply Chain Performance Measurement Dimension Score.**

Visualization of the average dimensional score (Figure 1) shows that the dimensions of timeliness and quality occupy a relatively high position, which indicates the attention of the project actors to the aspects of meeting schedules and the reliability of results. This underscores the relevance of SCOR attributes in capturing key issues of housing supply chain performance.

**Performance Measurement as a Strategic Construct**

In contrast to most previous studies that position supply chain performance measurement as a purely evaluative or diagnostic tool (Hafidz & Rahmawati, 2023; Stifany et al., 2020), the results of this study show that performance measurement can be treated as a strategic construct directly related to supply chain performance. The positive relationship

between the performance measurement variables and supply chain performance, visualized through scatter plots and regression lines (Figure 2), reinforces the finding that the more systematic and comprehensive the measurements applied, the better the supply chain performance achieved.

Although the relationships tested are inferential and cross-sectional data-based, the direction of the relationship consistent with the theory supports the theoretical causality argument in the direction of the hypothesis (Amani & Mfumbilwa, 2024; Kamani et al., 2023).

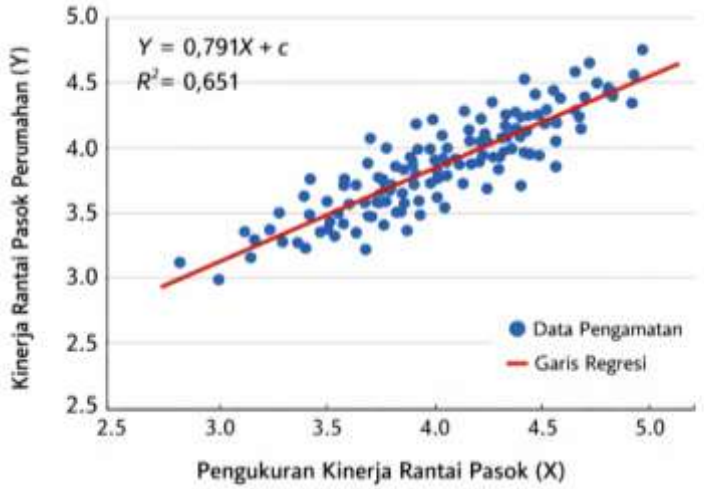


**Figure 2. Scatter Plots X and Y Relationships with Regression Lines**

**Relevance to the Context of Housing Projects and Implications**

The context of housing projects has distinctive characteristics, such as susceptibility to delays, material and labor cost sensitivity, and building quality and defect issues. The dimensions of timeliness, quality, and risk management and sustainability that obtained relatively high scores suggest that SCOR-based performance measurement is relevant to capture such complexity (Aswat et al., 2023; Riantini et al., 2023). Theoretically, this study strengthens the position of SCPM as a strategic variable in the study of construction supply chain management. In practical terms, these findings imply that housing developers and contractors need to integrate supply chain performance measurement systems in a structured manner to support data-driven decision-making and project performance improvement.

## CONCLUSION

This study aims to analyze the effect of supply chain performance measurement on the performance of the housing development supply chain using an explanatory quantitative approach based on a cross-sectional survey. Based on the results of inferential statistical analysis, this study concludes that supply chain performance measurement has a positive and significant effect on housing supply chain performance. The positive and significant regression coefficient ($\beta = 0.791$; $p < 0.001$) indicates that improvements in the quality and implementation of the supply chain performance measurement system are associated with enhanced performance in housing development supply chains.

The coefficient of determination ($R^2 = 0.651$) shows that 65.1% of the variation in housing supply chain performance can be explained by supply chain performance measurement, while the remaining percentage is influenced by other factors outside the research model. These findings provide empirical evidence that performance measurement functions not only as an evaluative tool but also as a strategic construct directly influencing supply chain performance in housing projects.

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