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# Identifying Supply Chain Risks Influencing Contractor Profitability Using Structural Equation Modeling

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**ABSTRACT:** The construction supply chain involved complex interactions among stakeholders and was exposed to various risks that could affect contractor profitability. However, existing studies had rarely integrated Structural Equation Modeling (SEM) and the Relative Importance Index (RII) to simultaneously capture both statistical relationships and practitioners' perceptions, particularly in the context of high-rise building projects in Indonesia. This study aimed to identify and analyze supply chain risks in the flows of information, materials, and funds and to examine their influence on contractor profitability. Data were obtained from structured questionnaires distributed to 50 respondents across five high-rise projects in Surabaya. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) alongside RII. The SEM results revealed that all three flows, information, materials, and finances, significantly improved contractor profitability, with information flow having the strongest effect. The RII rankings indicated that information risks were the primary concern, particularly unclear communication and errors in conveying project scopes. Comparing the statistical significance identified by SEM with the practical perceptions captured by RII revealed key gaps between measured impacts and practitioners' views, thereby improving risk prioritization. Overall, this study advanced construction supply chain risk research by integrating SEM and RII methods, while providing practitioners with actionable recommendations to improve information sharing, streamline material handling, and strengthen financial management to enhance profitability.

**KEYWORDS:** Construction project; construction supply chain; risk identification; SEM; RII.

## 1. Introduction

Construction projects were complex activities aimed at delivering infrastructure within specific time and budget constraints. The full lifecycle covered all phases, from initial feasibility studies and technical design to construction implementation, supervision, and maintenance [1]. From 2020 to 2023, Indonesia's construction industry played a significant role in national economic growth, contributing an average of 10.21% to GDP [2]. This highlighted the strategic importance of the sector and underscored the need for efficient and effective management.

However, the construction industry also faced major challenges, including market dynamics, technological advancements, resource limitations, and increasing competitive pressures. In this context, companies were required to enhance performance to survive and remain competitive, which served as a benchmark of organizational success [3].

One crucial approach to improving company performance was the implementation of effective and collaborative supply chain management [4]. The construction supply chain (CSC) involved multiple interacting parties, including owners, consultants, contractors, subcontractors, and suppliers, and was characterized by three interrelated flows: information, materials, and funds [5]. From a supply chain risk management perspective, disruptions in any of these flows could propagate throughout the project network and negatively affect cost, time, quality, and ultimately contractor profitability [6]. In construction management practice, information flow supported coordination and decision-making, material flow ensured smooth logistics and production continuity, and fund flow maintained financial stability and liquidity, all of which were critical determinants of project and organizational performance.

Previous studies had extensively examined construction supply chain risks, focusing on issues such as material shortages, coordination problems, and financial constraints [7–15]. In Indonesia, several studies identified dominant CSC risks using descriptive approaches or analytical tools such as the RII [7–12]. Other studies applied SEM to analyze the relationships between risks and project performance. However, most prior research relied on a single analytical approach and emphasized general project performance indicators, with limited attention given to contractor profitability as a primary outcome variable. Moreover, empirical studies integrating SEM and RII to compare statistical relationships with practitioners' perceptions particularly in the context of high-rise building projects in Indonesia, remained limited.

Therefore, this study sought to address this gap by integrating Partial Least Squares PLS-SEM and RII to analyze CSC risks and their influence on contractor profitability in high-rise building projects in Surabaya. Specifically, this study addressed the following research questions: (1) How did risks in the flows of information, materials, and funds affect contractor profitability? (2) Which risk indicators were perceived by practitioners as the most critical based on RII? (3) How did the results of SEM and RII differ, and what were the implications of these differences for risk prioritization in practice? By addressing these questions, this study contributed to the development of CSC risk management theory and provided practical recommendations for contractors and project owners to mitigate risks and improve profitability.

## 2. Materials and Methods

### *2.1. Research design.*

This study adopted a quantitative, cross-sectional survey approach to examine the effect of construction supply chain risks on contractor profitability. The research model was developed based on three exogenous variables, information flow (X1), material flow (X2), and fund flow (X3), which influenced the endogenous variable, contractor profitability (Y), as illustrated in Figure 1. Table 1 presents the indicators used to measure the three risk flows, while Table 2 outlines the indicators used to assess contractor profitability. The relationships among these constructs were analyzed using PLS-SEM, and the RII was applied to rank the risk indicators based on practitioners' perceptions.

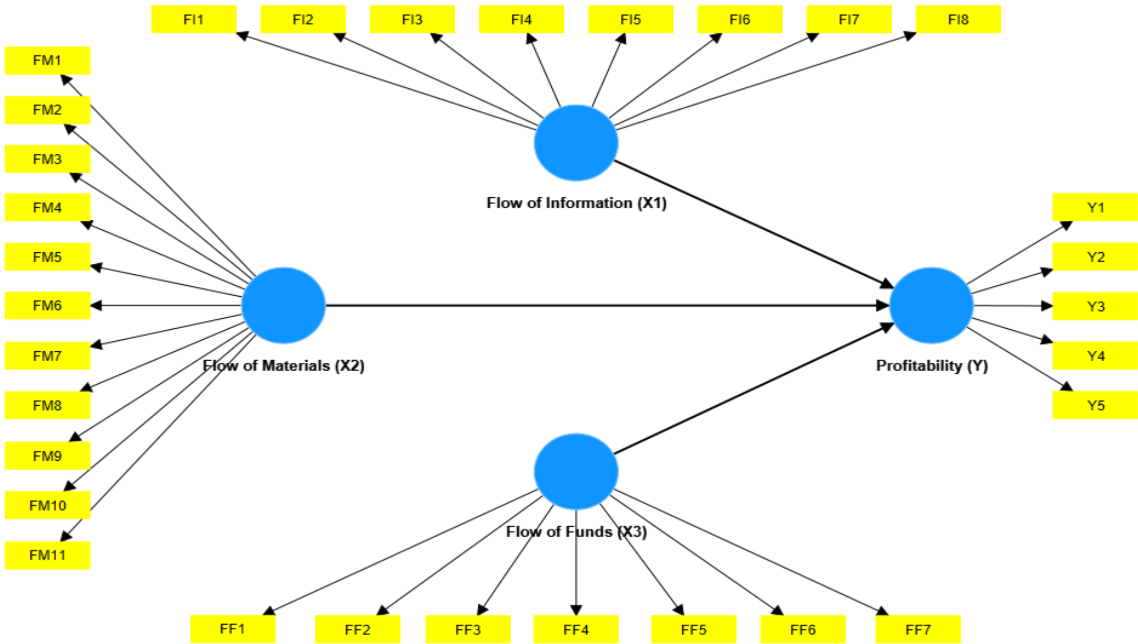


**Figure 1.** Structural model relationship.

**Table 1.** Predictor variables (X).

| Variables | Code | Risk of Event | References |
|---|---|---|---|
| Flow of Information | FI1 | Incomplete information on drawings and material specifications | [8, 9] |
| | FI2 | Lack of equipment and human resources to exchange information | [7−10] |
| | FI3 | Ambiguity or errors in obtaining scope of work information from owner and designer | [8, 9] |
| | FI4 | Manipulation of information by subcontractors or suppliers | [7−10] |
| | FI5 | Errors in exchanging information regarding material or work specifications | [8, 11] |
| | FI6 | Negotiations with suppliers did not go smoothly | [7, 10, 12] |
| | FI7 | Poor monitoring of procurement documents | [7, 10, 12] |
| | FI8 | Low frequency of coordination meetings | [7, 10, 12] |
| Flow of Materials | FM1 | Subcontractor's work results below standard | [8, 9] |

Note: Table continues with FM2–FM11 and FF1–FF7 as in the original text.

**Table 2.** Response variables (Y).

| Variables | Code | Risk of Event | References |
|---|---|---|---|
| Profitability | Y1 | Resource productivity | [16] |
| | Y2 | Cost overruns | [17] |
| | Y3 | Project delays | [16] |
| | Y4 | Quality of work | [16] |
| | Y5 | Construction project location characteristics | [17] |

### *2.2. Questionnaire development and indicator adaptation.*

The questionnaire items were adapted from relevant previous studies on construction supply chain risks and contractor performance [7–17]. The adaptation process was conducted in three main stages. First, indicators were identified from prior studies and evaluated for their relevance to the context of high-rise building projects in Indonesia. Second, several items were reworded to align with local practices and commonly used terminology. Third, the draft questionnaire was reviewed by two academics and two experienced project managers to assess its validity and clarity, and minor revisions were made based on their feedback. The final instrument consisted of 26 indicators representing the three risk flow constructs (8 for information flow, 11 for material flow, and 7 for fund flow) and 5 indicators measuring contractor profitability. All items were measured using a five-point Likert scale ranging from 1 (very uninfluential) to 5 (very influential). This scale was selected because it is widely used in construction management research and provides sufficient sensitivity without overcomplicating the response process.

*2.3. Construct specification (reflective vs. formative)*

All constructs in this study were specified as reflective. The indicators were assumed to reflect the underlying latent variables and were therefore expected to be correlated. Changes in the latent construct (e.g., information flow risk) were assumed to cause corresponding changes in all associated indicators. This specification was consistent with previous studies on supply chain risk and project performance that applied PLS-SEM [22, 31].

*2.4. Sampling and respondents.*

The study involved 50 respondents from five high-rise building projects (minimum four floors) in Surabaya. These projects were selected because high-rise construction typically involved greater complexity, stronger interdependence among supply chain actors, and higher risks related to coordination, logistics, and financial management, making them suitable for this research context. The respondents included project managers, site managers, engineers, quality control personnel, quantity surveyors, supervisors, logistics staff, and cost control officers who were directly involved in project execution and decision-making processes. A sample size of 50 was considered adequate for PLS-SEM based on the “10-times rule,” which recommends a minimum sample size equal to ten times the maximum number of structural paths directed at a particular construct. Since the endogenous construct (contractor profitability) had three incoming paths, the minimum required sample size was 30. Therefore, a sample of 50 exceeded this threshold and was sufficient for exploratory and predictive analysis.

*2.5. Data collection procedure.*

Structured questionnaires were distributed directly to respondents involved in the selected projects. Participation was voluntary, and respondents were assured of confidentiality and anonymity to minimize response bias. To reduce the potential for common method bias, the questionnaire included clear instructions, neutral wording, and varied item phrasing.

*2.6 Data Analysis Techniques*

Data were analyzed using SmartPLS 4. The PLS-SEM analysis followed a two-stage approach: (1) evaluation of the measurement model, including assessment of convergent validity, discriminant validity (using the Fornell–Larcker criterion and/or HTMT ratio), and reliability (Cronbach’s alpha and composite reliability); and (2) evaluation of the structural model, including standardized path coefficients (β), t-statistics, p-values, coefficient of determination ($R^2$), effect size ($f^2$), predictive relevance ($Q^2$), multicollinearity (VIF), and model fit index (SRMR). In addition, the RII was calculated to rank the risk indicators based on respondents’ perceptions and to enable comparison with the SEM results.

## 3. Results and Discussion

### *3.1. Measurement model evaluation.*

To assess convergent validity, loading factors were examined, with values above 0.70 considered satisfactory for each indicator. However, loading values above 0.50 were still regarded as practically acceptable [21]. Indicators with final loading values below 0.50 were considered invalid and were removed from the model. Convergent validity was also evaluated using the Average Variance Extracted (AVE), which measures the extent to which the variance of the indicators is explained by the latent construct. An AVE value of 0.50 or higher indicated adequate convergent validity [22]. Composite Reliability (CR) was used to assess the internal consistency of the indicators in measuring each construct; higher CR values indicated greater reliability. Reliability analysis in this study employed both Cronbach's alpha and composite reliability. Cronbach's alpha values ranging from 0.70 to 0.90 were considered satisfactory to good [23]. As shown in Table 3, all constructs met the required validity and reliability criteria. Discriminant validity was evaluated using the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. The square root of the AVE for each construct exceeded its correlations with other constructs, and all HTMT values were below the threshold of 0.90, indicating adequate discriminant validity. In addition, the Standardized Root Mean Square Residual (SRMR) value was below 0.08, confirming that the overall model demonstrated a good fit.

**Table 3.** Validity and reliability results.

| Variables | Code | Loading Factor | Cronbach's Alpha | rhoa_a | Composite Reliability | AVE |
|---|---|---|---|---|---|---|
| Flow of Information | FI1 | 0.736 | 0.9 | 0.91 | 0.92 | 0.59 |
| | FI2 | 0.722 | | | | |
| | FI3 | 0.8 | | | | |
| | FI4 | 0.78 | | | | |
| | FI5 | 0.894 | | | | |
| | FI6 | 0.706 | | | | |
| | FI7 | 0.725 | | | | |
| | FI8 | 0.763 | | | | |
| Flow of Materials | FM1 | 0.597 | 0.914 | 0.922 | 0.927 | 0.54 |
| | FM2 | 0.671 | | | | |
| | FM3 | 0.641 | | | | |
| | FM4 | 0.805 | | | | |
| | FM5 | 0.806 | | | | |
| | FM6 | 0.723 | | | | |
| | FM7 | 0.758 | | | | |
| | FM8 | 0.648 | | | | |
| | FM9 | 0.826 | | | | |
| | FM10 | 0.768 | | | | |
| | FM11 | 0.799 | | | | |
| Flow of Funds | FF1 | 0.791 | 0.861 | 0.865 | 0.894 | 0.547 |
| | FF2 | 0.769 | | | | |
| | FF3 | 0.735 | | | | |
| | FF4 | 0.737 | | | | |
| | FF5 | 0.68 | | | | |
| | FF6 | 0.684 | | | | |
| | FF7 | 0.77 | | | | |
| Profitability | Y1 | 0.842 | 0.863 | 0.866 | 0.901 | 0.645 |
| | Y2 | 0.801 | | | | |
| | Y3 | 0.772 | | | | |
| | Y4 | 0.828 | | | | |

| Variables | Code | Loading Factor | Cronbach's Alpha | rhoa_a | Composite Reliability | AVE |
|---|---|---|---|---|---|---|
| | Y5 | 0.77 | | | | |

*3.2. Structural model evaluation.*

The coefficient of determination ($R^2$) was used to evaluate the extent to which the predictor variables explained the variance in the dependent variable. $R^2$ values of 0.75, 0.50, and 0.25 indicate strong, moderate, and weak explanatory power, respectively [24]. As shown in Table 4, the adjusted $R^2$ value was 0.558, indicating that information flow, material flow, and fund flow jointly explained 55.8% of the variance in contractor profitability, while the remaining 44.2% was attributable to factors beyond the scope of this study.

**Table 4.** R square test.

| Variables | R-square | R-square adjusted |
|---|---|---|
| Profitability | 0.558 | 0.529 |

The effect size ($F^2$) assesses the contribution of each predictor construct to the endogenous construct. $F^2$ values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively [22]. As presented in Table 5, information flow has a medium effect on profitability, while material flow and fund flow have small effects.

**Table 5.** F square test.

| Variables | Profitability (Y) |
|---|---|
| Flow of Information (X1) | 0.176 |
| Flow of Materials (X2) | 0.122 |
| Flow of Funds (X3) | 0.077 |

Predictive relevance was evaluated using the $Q^2$ statistic obtained through the blindfolding procedure. A $Q^2$ value greater than 0 indicates predictive relevance, whereas a value below 0 indicates otherwise [25]. Table 6 shows that profitability has a $Q^2$ value of 0.338, confirming that the model has predictive relevance.

**Table 6.** Q square test.

| | SSO | SSE | $Q^2$ |
|---|---|---|---|
| Flow of Information | 400 | 400 | 0 |
| Flow of Materials | 550 | 550 | 0 |
| Flow of Funds | 350 | 350 | 0 |
| Profitability | 250 | 165.399 | 0.338 |

Multicollinearity was examined using the Variance Inflation Factor (VIF). VIF values greater than 10 indicate potential multicollinearity [26], although values above 3 may also signal collinearity issues [27]. Table 7 demonstrates that all VIF values fall below critical thresholds, indicating no multicollinearity problems.

**Table 7.** The multicollinearity test.

| s | VIF |
|---|---|
| Flow of Information | 1.655 |
| Flow of Materials | 1.561 |
| Flow of Funds | 1.716 |

Hypothesis testing was performed using the bootstrapping procedure in PLS-SEM. A p-value below 0.05 and a T-statistic above 1.96 indicate significant relationships [28]. Table 8 presents the path coefficient results. The standardized path coefficients (β) indicate that information flow has the strongest effect on profitability, followed by material flow and fund flow.

**Table 8.** Path coefficient testing.

| | T statistics | P values |
|---|---|---|
| Flow of Information -> Profitability | 3.972 | 0.000 |
| Flow of Materials -> Profitability | 2.878 | 0.004 |
| Flow of Funds -> Profitability | 2.229 | 0.026 |

### *3.3. The influence of information flow on profitability.*

The results confirmed that information flow had a positive and significant effect on contractor profitability, as indicated by a T-statistic of 3.972 (>1.96) and a p-value of 0.000 (<0.05). Among the three flows, information flow demonstrated the strongest influence. This finding was consistent with previous studies that identified information flow as the most influential factor, while others ranked it second. Effective information sharing improved coordination, reduced uncertainty and errors, accelerated decision-making, and ultimately enhanced profitability. Therefore, improving the quality of communication and documentation should be considered a strategic priority for contractors.

### *3.4. The influence of material flow on profitability.*

Material flow also demonstrated a positive and significant effect on contractor profitability, with a T-statistic of 2.878 (>1.96) and a p-value of 0.004 (<0.05). This result supported the second hypothesis. Previous studies showed varying rankings, with some identifying material flow as the most influential factor and others placing it third. Risks related to material flow, such as delayed deliveries and substandard material quality, were major contributors to cost overruns and project delays. These risks were particularly critical in high-rise construction projects, where sequencing and timely material supply were essential. Strengthening logistics management and supply chain coordination could therefore improve project performance and profitability.

### *3.5. The influence of fund flow on profitability.*

Fund flow likewise had a positive and significant effect on contractor profitability, as indicated by a T-statistic of 2.229 (>1.96) and a p-value of 0.026 (<0.05), thereby supporting the third hypothesis. Previous research reported different rankings of fund flow compared to other risk categories. Financial issues such as delayed payments from owners and unexpected costs disrupted cash flow and adversely affected procurement, payroll, and daily operations. Consequently, contractors needed to implement effective financial planning, secure appropriate payment terms, and negotiate proactively to maintain cash flow stability, minimize disruptions, and safeguard profitability.

### *3.6. RII.*

The RII method was applied to rank risk indicators based on respondents’ perceptions using a five-point Likert scale. RII values ranging from 0.800 to 1.000 indicated high significance [29]. The RII results presented in Table 9 showed that ambiguity or errors in scope-of-work information (FI3) ranked first, with a value of 0.916. This was followed by incomplete drawings and specifications (FI1) and errors in technical information exchange (FI5), both with RII values of 0.912, highlighting the critical importance of accurate and consistent communication. Other highly ranked risks included information manipulation (FI4), delayed payments from owners (FF1), economic instability (FF6), and owner requests exceeding contract specifications (FM2). All of these indicators fell within the high-significance category.

**Table 9.** RII analysis result.

| Indicator | Risk of Event | RII | Rank |
|---|---|---|---|
| FI3 | Ambiguity or errors in obtaining scope of work information from the owner and designer | 0.916 | 1 |
| FI1 | Incomplete information on drawings and material specifications | 0.912 | 2 |
| FI5 | Errors occur in the exchange of information regarding material or work specifications between contractors and subcontractors or suppliers | 0.912 | 2 |
| FI4 | Manipulation of information by subcontractors or suppliers | 0.904 | 3 |
| FF1 | The owner does not pay for work progress | 0.904 | 3 |
| FF6 | The occurrence of an economic crisis | 0.896 | 4 |
| FM2 | The owner demands quality work results above the contract | 0.884 | 5 |
| FF5 | The prices given by suppliers to contractors are less competitive | 0.880 | 6 |
| FM3 | The quality of materials from contractor suppliers is below standard | 0.876 | 7 |
| FM4 | Slow mobilization of resources (materials, tools, labor) from suppliers or subcontractors | 0.872 | 8 |
| FF3 | There has been an increase in tax or fuel tariff policies | 0.872 | 8 |
| FI2 | The lack of equipment and human resources owned by the company to exchange information | 0.868 | 9 |
| FM1 | The results of the subcontractor's work are below standard | 0.868 | 9 |
| FF2 | Errors in cost estimation | 0.868 | 9 |
| FF7 | Currency exchange rate fluctuations | 0.868 | 9 |
| FM5 | The difficulty of obtaining the type of raw materials that the owner wants | 0.864 | 10 |
| FM6 | Difficult project locations make it difficult to supply materials or bring in heavy equipment | 0.864 | 10 |
| FI6 | Negotiations did not go smoothly with the suppliers | 0.860 | 11 |
| FM11 | Instability of material supply by suppliers to contractors | 0.856 | 12 |
| FM9 | Lack of reliable personnel in supervision or control | 0.852 | 13 |
| FM8 | Occurrence of work accidents | 0.848 | 14 |
| FM10 | Restrictions on imports of materials and equipment to support production | 0.848 | 14 |
| FI8 | Low frequency of coordination meetings between parties involved in the construction process | 0.844 | 15 |
| FI7 | Poor procurement document monitoring process | 0.840 | 16 |
| FF4 | Policy errors in the payment system | 0.840 | 16 |
| FM7 | Declining labor productivity | 0.832 | 17 |

### *3.7. Comparison of SEM with RII.*

SEM loading factors represented the statistical contribution of indicators to their respective latent constructs, whereas RII reflected respondents perceived importance of those indicators. Differences between these two methods were therefore expected. Table 10 presents indicators with the smallest disparities, such as FI5, FM9, and FM11, indicating strong alignment between statistical results and practitioner perceptions. The overall comparison between SEM loading factors and RII values is illustrated in Figure 2, while Figure 3 highlights the magnitude of disparities between the two methods across selected indicators. In contrast, Table 10 also lists indicators with the largest disparities, including FM1 and FM3. These differences suggested that respondents might perceive certain risks as highly impactful in practice, even though their statistical contribution to the construct was relatively low. The average disparity observed in this study was 18.00%, which was higher than the 12.94% reported in [30] but lower than the 24.66% reported in [31]. This variation highlighted the influence of project context and respondent background on risk assessment. The substantial disparities observed for indicators such as FM1 and FM3 indicated that practitioners regarded these risks as frequent operational challenges, even if their statistical weight in the structural model was limited. Overall, SEM provided insight into systemic and structural relationships among constructs, whereas RII captured practical perceptions and operational concerns. Therefore, rather than relying on a single method, managers were encouraged to integrate both approaches—using SEM to identify strategically significant risk pathways and RII to prioritize pressing issues encountered in daily project implementation.

**Table 10.** Comparison of SEM loading factors and RII values (five smallest and five largest disparities)

| Category | Indicator | Risk of Event | LF | RII | Disparity |
|---|---|---|---|---|---|
| Smallest Disparity | FI5 | Errors occur in the exchange of information regarding material or work specifications between contractors and subcontractors or suppliers | 0.894 | 0.912 | 2.01% |
| Smallest Disparity | FM9 | Lack of reliable personnel in supervision or control | 0.826 | 0.852 | 3.15% |
| Smallest Disparity | FM11 | Instability of material supply by suppliers to contractors | 0.799 | 0.856 | 7.13% |
| Smallest Disparity | FM5 | Difficulty in obtaining the type of raw materials required by the owner | 0.806 | 0.864 | 7.20% |
| Smallest Disparity | FM4 | Slow mobilization of resources (materials, tools, labor) from suppliers or subcontractors | 0.805 | 0.872 | 8.32% |
| Largest Disparity | FM1 | The results of the subcontractor's work are below standard | 0.597 | 0.868 | 45.39% |
| Largest Disparity | FM3 | The quality of materials from contractor suppliers is below standard | 0.641 | 0.876 | 36.66% |
| Largest Disparity | FM2 | The owner demands quality work results above the contract | 0.671 | 0.884 | 31.74% |
| Largest Disparity | FM8 | Occurrence of work accidents | 0.648 | 0.848 | 30.86% |
| Largest Disparity | FF6 | Occurrence of an economic crisis | 0.684 | 0.896 | 30.99% |

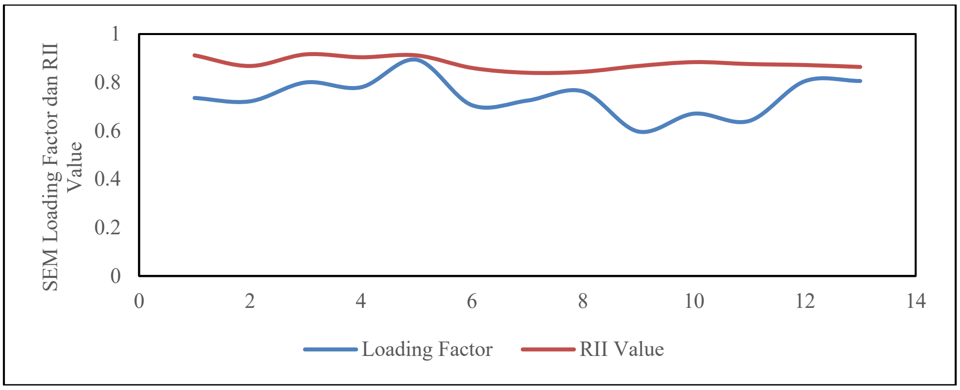


**Figure 2.** Comparison of SEM loading factor and RII value.

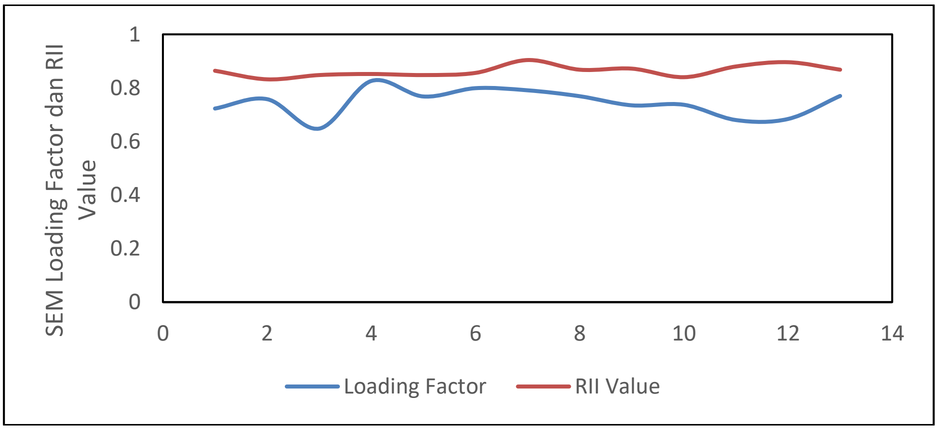


**Figure 3.** Comparison of SEM loading factor and RII value.

*3.8. Practical implications and risk mitigation strategies.*

Since information flow risks ranked highest, contractors should prioritize improving information management and team coordination. Recommended measures include establishing standardized communication protocols, strengthening quality control of drawings and specifications, increasing the frequency of coordination meetings, and implementing digital document management systems to minimize misunderstandings and errors. Regarding material flow, contractors should enhance supplier selection procedures, improve logistics planning, and maintain buffer stocks for critical materials to reduce the risk of delays and substandard supplies. For fund flow, clear payment terms should be established in contracts, cost estimation accuracy should be improved, and proactive cash flow planning should be implemented to ensure financial liquidity and prevent disruptions in procurement and payroll. Project owners also play an important role by ensuring timely payments and maintaining transparent financial communication to support smooth project execution. Collectively, these measures can enhance operational efficiency and strengthen contractor profitability. This study had several limitations. First, the sample size of 50 respondents from five high-rise projects may limit the generalizability of the findings. Second, the focus on high-rise building projects in Surabaya restricts the applicability of the results to other types of construction projects or geographic regions. Third, the use of self-reported questionnaire data may introduce perceptual bias. Future research should involve larger and more diverse samples across different project types and regions. In addition, incorporating objective performance data and conducting longitudinal studies would provide deeper insights into how supply chain risks evolve throughout the project lifecycle.

## 4. Conclusions

This study demonstrated that risks in the three construction supply chain flows information, materials, and funds, significantly influenced contractor profitability in high-rise building projects. The PLS-SEM results identified information flow as the most influential factor, while the RII analysis confirmed that information-related risks particularly unclear scope communication, were perceived as the most critical by practitioners. The comparison between SEM and RII revealed meaningful differences between statistical relationships and practical perceptions, highlighting the value of integrating both approaches for more effective risk prioritization. Overall, improving information management, strengthening material logistics, and ensuring financial stability are essential strategies for enhancing project performance and contractor profitability.

## Author Contributions

Fikri Arief Ananda: Contributions include Conceptualization, Data Curation, Formal Analysis, and Writing—Original Draft Preparation. I Nyoman Dita Pahang Putra: Contributions include Conceptualization, Methodology, Supervision, Writing—Review & Editing, and Resources.

## Data Availability Statement

The data supporting the findings of this study are available from the Corresponding Author (I Nyoman Dita Pahang Putra) upon reasonable request. The data (respondent questionnaire replies) are not publicly available due to the privacy and confidentiality of the project respondents.

## Competing Interest

The authors declare that they have no known financial, professional, or personal conflicts of interest that could have influenced the work reported in this study.

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