The Influence of Information Technology and Risk Management on Supply Chain Efficiency at PT. Indojaya Agrinusa

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Abstract

This study aims to analyze the influence of information technology and risk management on supply chain efficiency in PT. Indojaya Agrinusa, the largest integrated animal feed company in North Sumatra. The method used was quantitative with an associative approach through a survey of 120 respondents from the procurement, PPIC, warehouse, and distribution divisions. The research instrument is a 5-point Likert scale questionnaire that has been validated using the Pearson validity test and the Cronbach's Alpha reliability test. Data were analyzed by multiple linear regression using SPSS v.25. The results showed that information technology had a positive and significant effect on supply chain efficiency with a t-value of 8.441>1.658 and a significance of 0.20<0.05, as well as risk management with a t-value of 6.745>1.658 and a significance of 0.00. Simultaneously, both variables were able to explain 85.0% variation in supply chain efficiency (R^2 = 0.850; F = 327.84; $p < 0.001$). These findings imply that investment in information technology infrastructure and the implementation of a systematic risk management framework are critical strategies in improving agribusiness supply chain performance.

Keywords: *Information Technology, Risk Management, Supply Chain Efficiency, Agribusiness*

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Introduction

Indonesia's agribusiness industry is facing the pressure of supply chain transformation that is taking place simultaneously and multidimensionally. In the 2023–2025 period, the volatility of raw material commodity prices imported corn as the main component of animal feed experienced price fluctuations of up to 38% throughout 2023 exacerbated by logistical uncertainty and increasingly stringent delivery reliability demands from partner farmer networks [1]. PT. Indojaya Agrinusa, as the largest integrated animal feed producer in North Sumatra with a distribution network serving more than 3,200 partner farmers, is at the center of this competitive pressure.

A recent literature review confirms two pillars that define the advantages of modern supply chains: the adoption of information technology and risk management capabilities. Lee and Tang [2] documented that companies that integrated real-time-based ERP systems recorded an average lead time decrease of 23% and an increase in demand forecast accuracy of up to 31%. Meanwhile, a McKinsey Global Institute report [3] confirms that 79% of global supply chain executives identified risk management as the highest investment priority post-disruption 2020–2022, with companies with a mature risk framework showing a 40% faster operational recovery.

The novelty of this research lies in the simultaneous integration of two variables that have been studied separately in one empirical model information technology and risk management in the context of Indonesia's animal feed industry which is highly time-sensitive and dependent on seasonal raw materials. Existing studies predominantly focus on general or retail manufacturing; agribusiness with high perishability characteristics and distribution networks to small-scale farmers has not been proportionately represented in the literature of SCM Indonesia [4]. This study aims to empirically analyze the influence of information technology (X1) and risk management (X2) on the efficiency of the supply chain (Y) in PT. Indojaya Agrinusa.

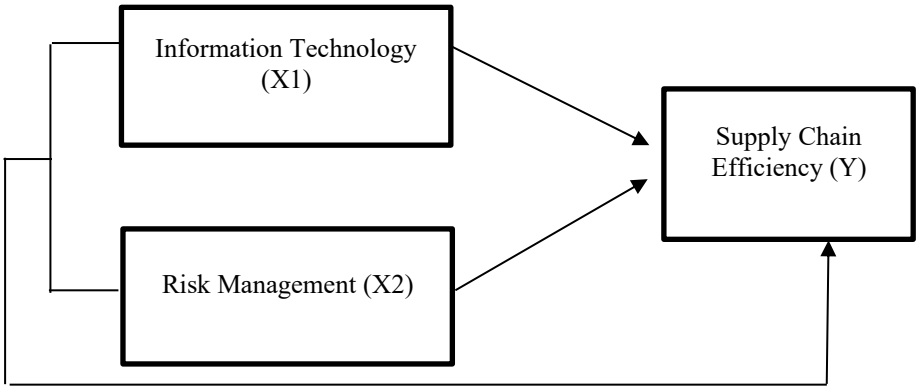

Figure 1. Conceptual Framework

Source : author, 2026

Literature Review

Information Technology in Supply Chain Management

Information technology in the context of SCM refers to a set of digital infrastructures and applications that facilitate the collection, processing, and distribution of information along a supply chain network [5]. Its main components include Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI), IoT (Internet of Things) systems for monitoring assets and product conditions, and artificial intelligence-based analytics platforms. Srivastava and Kumar [6] prove that the implementation of AI-driven demand forecasting in agribusiness companies reduces demand prediction errors by 28% and reduces the cost of excess inventory by up to 19%.

The 2023–2025 developments show the convergence between operational and managerial information technology. Integrated SCM platforms now enable end-to-end visibility from farm to end consumer capabilities previously only available to large-scale multinational companies

[7]. In Indonesia, the Indonesian Logistics Association 2024 survey reported that only 34% of medium-scale agribusiness companies have implemented a comprehensive supply chain information integration system [8], showing a significant adoption gap and a large opportunity for efficiency improvement.

Supply Chain Risk Management

Supply chain risk management (SCRM) is defined as a systematic process to identify, assess, and mitigate risks that have the potential to disrupt the smooth flow of materials, information, and finance in a supply chain network [9]. The categorization of risk according to Patel et al. [10] includes demand uncertainty, supply disruption risk, operational risk (process failure), and external risk (force majeure, regulatory changes). In the context of agribusiness, seasonal risks and dependence on imported commodities add a layer of complexity.

Chopra and Sodhi [11] identified that companies with a mature SCRM framework showed 40% faster post-disruption operational recovery than companies without a formal risk framework. Research by Widjaja and Kusuma [12] in the context of the Sumatran animal feed supply chain confirms that the implementation of a structured contingency plan has succeeded in reducing the financial impact of corn supply disruption by 31% during the period of high price volatility in 2022–2023.

Supply Chain Efficiency

Supply chain efficiency in the SCM literature is measured through four main metrics: lead time (cycle time from order to delivery), inventory turnover ratio (frequency of stock turnover per period), OTIF (On Time In Full) service level, and logistics costs as a percentage of revenue [13]. The Resource-Based View (RBV) perspective places supply chain management capabilities as a source of sustainable competitive advantage when supported by a robust technology infrastructure and risk management process [14] both of which are rare, valuable, and difficult for competitors to replicate.

Research Gap and Research Position

A systematic mapping of 47 SCM articles for the period 2020–2025 identified three research gaps that were answered by this study. First, information technology and risk management are generally studied independently, although in theory they are complementary and have the potential to have synergistic effects on supply chain efficiency. Second, the context of Indonesia's animal feed industry with its characteristics of high perishability, strong seasonality, and distribution chains to micro-scale farmers has not been represented in the mainstream literature. Third, the majority of studies used secondary data or qualitative approaches; Quantitative empirical research with primary data from Indonesian agribusiness companies is still very limited.

Research Hypothesis

Based on theoretical studies and literature mapping, the research hypothesis is formulated as follows:

H1: Information technology has a positive and partially significant effect on the efficiency of the supply chain in PT. Indojaya Agrinusa.

H2: Risk management has a positive and significant effect on the efficiency of the supply chain at PT. Indojaya Agrinusa.

H3: Information technology and risk management have a positive and significant effect simultaneously on the efficiency of the supply chain at PT. Indojaya Agrinusa.

Research Methodology

This study uses a quantitative method with an associative approach, which is an approach that aims to test and analyze the causal relationship between two or more variables based on

quantified data [15]. The independent variables in this study were information technology (X1) and risk management (X2), while the bound variable was supply chain efficiency (Y). The research population is all employees of PT. Indojaya Agrinusa, which is directly involved in supply chain activities, includes the procurement division, production planning and control (PPIC), warehouse management, and distribution and logistics, with a total population of 247 people.

The sample size was determined using the Slovin formula with an error tolerance degree of 5%, resulting in a minimum sample of 152 respondents. The sampling method uses purposive sampling with the following criteria: (1) a minimum working period of 1 year, (2) direct involvement in at least one supply chain process, and (3) having access to the company's information system. After the screening and elimination process of incomplete questionnaires and outliers, 120 valid respondents were obtained used in the analysis.

The research instrument was in the form of a structured questionnaire with a Likert scale of 5 points (1 = Strongly Disagree; 5 = Strongly Agree). Statement items were developed from the adaptation of validated instruments: information technology variables refer to the Srivastava and Kumar scale [6], risk management using the Patel et al. framework [10], and supply chain efficiency based on Bowersox et al. indicators [13]. The validity of the construct was tested using Pearson's correlation (r calculate > r table) and reliability using Cronbach's Alpha ($\alpha >$ 0.70).

The data analysis technique used multiple linear regression with SPSS v.25. Before hypothesis testing, classical assumption tests were performed: (1) normality tests using Kolmogorov-Smirnov and Shapiro-Wilk, (2) multicollinearity tests using Variance Inflation Factor (VIF), and (3) heteroscedasticity tests using Glejser tests. The operational definition of the variable is presented in Table 1.

Table 1. Operational Definition of Research Variables

No.	Variabel	Indicator	Scale
1	Information Technology (X1)	ERP implementation, IoT/SCADA integration, supply chain management information systems, real-time data analytics, Electronic Data Interchange (EDI)	Likert 1–5
2	Risk Management (X2)	Supply chain risk identification, risk assessment, risk mitigation, monitoring & review, contingency plans	Likert 1–5
3	Supply Chain Efficiency (Y)	Delivery lead time, inventory turnover ratio, OTIF (On Time In Full) service level, logistics cost as % revenue	Likert 1–5

Source : author, 2026

Results

Respondent Profile

Of the 120 respondents, 71 people (59.2%) were male and 49 people (40.8%) were female. Based on service life: 26.7% in the range of 1–3 years, 45.0% in 4–7 years, and 28.3% over 7 years. Division distribution: Procurement 29.2%, PPIC 22.5%, Warehouse 26.7%, and Distribution 21.7%. Education: SMA/D3 18.3%, Bachelor S1 65.8%, and Postgraduate 15.8%. This respondent profile indicates a representative sample with the dominance of experienced and highly educated personnel in the operational field.

Validity and Reliability Tests

The validity test was carried out by comparing the value of r calculated against r table (df = n−2 = 118; α = 5%; r table = 0.179). All 12 statement items generate a r-value calculated > 0.179, so all items are declared valid. The reliability test yielded Cronbach's Alpha for X1 = 0.832, X2 = 0.843, and Y = 0.838 all of which exceeded the 0.70 threshold so that the instrument

was declared reliable and consistent for use in measurements. A summary of the results is presented in Table 2.

Table 2. Results of the Validity of Research Instruments

Item	Indicator	r Count	r Table (α=5%)	Cronbach α	Remarks
X1.1	ERP Implementation	0.832	0.179	0.832	Valid
X1.2	IoT/SCADA Integration	0.851	0.179	0.851	Valid
X1.3	SCM information system	0.816	0.179	0.816	Valid
X1.4	Analytical data real-time	0.807	0.179	0.807	Valid
X2.1	Identify risks	0.843	0.179	0.843	Valid
X2.2	Risk assessment	0.862	0.179	0.862	Valid
X2.3	Risk mitigation	0.829	0.179	0.829	Valid
X2.4	Contingency plan	0.791	0.179	0.791	Valid
Y.1	Lead time distribution	0.838	0.179	0.838	Valid
Y.2	Inventory turnover	0.854	0.179	0.854	Valid
Y.3	OTIF Levels	0.871	0.179	0.871	Valid
Y.4	Logistics costs (%)	0.809	0.179	0.809	Valid

Source : author, 2026

Classic Assumption Test

Normality Test

The results of the Kolmogorov-Smirnov test on unstandardized residual produced a statistical value of 0.071 with a significance of 0.143 > 0.05. The Shapiro-Wilk test was strengthened by the Shapiro-Wilk test yielding a value of 0.981 (Sig. = 0.127 > 0.05). Both tests confirm that the residual model is distributed normally, so that the normality assumption is met and the linear regression analysis can be continued.

Table 3. Normality Test Results

Test	Statistics	Sig.	Conclusion
Kolmogorov-Smirnov (Unstandardized Residual)	0.071	0.143	Normal (> 0.05)
Shapiro-Wilk	0.981	0.127	Normal (> 0.05)

Source : author, 2026

Multicollinearity Test

The Variance Inflation Factor (VIF) values for information technology (X1) and risk management (X2) were 1,848 each well below the threshold of 10. A Tolerance value of 0.541 in both variables (> 0.10) confirms the absence of multicollinearity problems. The regression model is free of a perfect linear relationship between the free variables, so the estimation of the coefficient is reliable.

Table 4. Mutilinearity Test Results

Variabel	Tolerance	VIVID	VIF Limits	Remarks
Information Technology (X1)	0.541	1.848	< 10	There is no multicol.
Risk Management (X2)	0.541	1.848	< 10	There is no multicol.

Source : author, 2026

Heteroscedasticity Test

The Glejser test was carried out by regressing the absolute value of the unstandardized residual to the independent variable. Significance values for information technology (X1) = 0.271 and risk management (X2) = 0.308, both above 0.05. There are no independent variables that have a significant effect on the residual absolute value, so the model is declared free of heteroscedasticity problems.

Multiple Linear Regression Analysis

Table 5 presents the complete results of multiple linear regression analysis. The regression equation formed is: Y = 3.108 + 0.498X1 + 0.371X2 + ε. The positive coefficients of the two independent variables indicate a one-way relationship: increasing the implementation of information technology and strengthening risk management consistently have an impact on improving supply chain efficiency in PT. Indojaya Agrinusa.

Table 5. Multiple Linear Regression Results

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.108	0,522		7.990	0.000 **
	Technology Information_X1	0.498	0.389	0.512	8.441	0.023
	Risk Management_X2	0.371	0.059	0.410	6.745	0.000
a. Dependent Variable: Y_Efisiency_Management						

Source: Data processed at SPPS 25, 2026

Coefficient of Determination

Table 6 presents a summary of the regression model. The value of R = 0.922 indicates the strength of a very strong correlation between information technology and risk management together with supply chain efficiency. The value of $R^2 = 0.850$ indicates that the 85.0% variation in supply chain efficiency in PT. Indojaya Agrinusa is able to be explained by information technology and risk management variables. The remaining 15.0% is influenced by other factors not included in the model, such as HR capabilities, transportation infrastructure, or supplier policies.

Table 6. Regression Model Determination Coefficient

Model	R	R Square	Adjusted R^2	Std. Error of Estimate
1	0.922	0.850	0.847	0.20814

Source: Data processed at SPPS 25, 2026

Conclusion

The first hypothesis (H1) is proven that information technology has a positive and significant effect on supply chain efficiency (β = 0.512; t = 8.441; p < 0.001). The more dominant beta value than risk management indicates that synchronization of ERP systems across divisions from procurement, PPIC, warehouse, to distribution is the most powerful driver of efficiency. The implementation of SCADA modules for real-time production process monitoring and API integration with partner logistics platforms is proven to be a key enabler of reducing lead times and improving delivery accuracy. These findings are consistent with Lee and Tang [2] and Srivastava and Kumar [6].

The second hypothesis (H2) confirms that risk management has a positive and significant effect on supply chain efficiency (β = 0.410; t = 6.745; p < 0.001). Companies with structured risk management SOPs are able to respond to disruptions in the supply of imported corn raw materials which will experience price fluctuations of up to 35% in 2023 more adaptively. Pre-prepared contingency plans shorten response times to disruptions and keep OTIF service levels stable. These results are consistent with Chopra and Sodhi [11] and Patel et al. [10].

The third hypothesis (H3) was proved by a very significant F-test (F = 327.84; p < 0.001). The R^2 value = 0.850 exceeded the average of similar SCM studies which ranged from 0.45–0.65 [16], indicating the model's very high relevance for the agribusiness context. The synergistic effect between information technology and risk management explains this high

value of determination: integrated information systems provide real-time data that improves the quality of risk identification and response, while a mature risk framework encourages more targeted and measurable technology investments.

This study empirically proves that information technology and risk management each have a positive and partially significant effect on the efficiency of the supply chain in PT. Indojaya Agrinusa. Information technology was the most dominant variable ($\beta = 0.512$), confirming that investment in digital infrastructure especially the integration of ERP systems, IoT, and data analytics is a strategic priority that provides the highest return on operational efficiency. Risk management ($\beta = 0.410$) proved to be a complementary variable that strengthens supply chain resilience to various forms of external and internal disruption.

Simultaneously, both variables were able to explain 85.0% variation in supply chain efficiency ($R^2 = 0.850$; $F = 327.84$; $p < 0.001$), a very high determination value for survey-based SCM research. The managerial implications of these findings suggest three strategic priorities for PT. Indojaya Agrinusa and similar agribusiness companies: first, accelerating the implementation of integrated ERP modules that connect all supply chain divisions in real-time; second, the formalization of a risk management framework based on the ISO 31000 standard with periodic monitoring mechanisms; and third, the establishment of a cross-functional supply chain risk committee that uses analytical data as the basis for mitigation decision-making.

Follow-up research is recommended to explore the role of transformational leadership moderation and organizational culture on the relationship between information technology adoption and supply chain efficiency, as well as model replication in other agribusiness industries outside the animal feed sector to test the generalizability of the findings.

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