

The Impact of IoT and Production Tracking Systems on Delivery Timeliness in the Electronics Industry in Tangerang City

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ABSTRACT

The rapid adoption of Industry 4.0 technologies has encouraged manufacturing companies to integrate Internet of Things (IoT) solutions and production tracking systems to improve operational performance and delivery reliability. This study aims to analyze the impact of IoT implementation and production tracking systems on delivery timeliness in the electronics industry in Tangerang City. A quantitative research approach was applied using survey data collected from 150 employees involved in production and logistics activities. Data were measured using a five-point Likert scale and analyzed through Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) to evaluate both measurement and structural models. The results indicate that IoT implementation has a positive and significant effect on delivery timeliness by enabling real-time monitoring and faster operational coordination. Production tracking systems also show a strong positive influence by improving scheduling accuracy, workflow visibility, and decision-making processes. Furthermore, the integration of IoT and production tracking technologies contributes to better supply chain responsiveness and reduced delivery delays. These findings highlight the strategic role of digital monitoring systems in enhancing manufacturing performance and meeting customer delivery expectations. This study provides empirical insights for practitioners and contributes to the growing literature on smart manufacturing and technology-driven operational efficiency in Indonesia’s electronics sector.

Keywords: Internet of Things (IoT), Production Tracking Systems, Delivery Timeliness, Electronics Manufacturing, Tangerang City

1. INTRODUCTION

The acceleration of digital transformation in the manufacturing sector has reshaped how organizations manage production processes, logistics, and customer fulfillment. Within the framework of Industry 4.0, technologies such as the Internet of Things (IoT), big data analytics, and smart monitoring systems have become critical tools for improving operational efficiency and competitiveness [1], [2]. Manufacturing firms are increasingly integrating digital solutions into their production environments to enhance visibility, reduce uncertainty, and improve coordination across supply chain activities. In particular, the electronics industry characterized by complex assembly processes, short product life cycles, and high customer expectations—faces significant pressure to maintain delivery accuracy and timeliness [3].

Delivery timeliness has emerged as a key performance indicator in modern manufacturing operations, reflecting an organization’s ability to fulfill customer orders within agreed schedules [2]. Delays in production or logistics not only disrupt operational flow but also affect customer satisfaction, supplier relationships, and overall organizational reputation. In electronics manufacturing hubs such as Tangerang City, companies must manage dynamic demand fluctuations, tight production schedules, and intricate supplier networks. Consequently, the need

for real-time monitoring and data-driven decision-making has become increasingly important to ensure that production outputs align with delivery commitments.

One of the technological solutions gaining widespread attention is the implementation of IoT-based systems within production environments. IoT enables machines, devices, and sensors to communicate continuously, allowing managers to monitor production status, equipment performance, and inventory movement in real time [3], [4]. Previous studies have suggested that IoT adoption can improve operational transparency, enhance predictive maintenance capabilities, and reduce downtime. However, despite the growing interest in IoT, empirical evidence regarding its direct contribution to delivery performance, particularly in the Indonesian electronics industry, remains relatively limited.

In addition to IoT, production tracking systems play a crucial role in supporting operational coordination. Production tracking systems provide detailed information regarding work-in-progress status, production flow, and scheduling accuracy. By integrating tracking technologies with enterprise resource planning (ERP) or manufacturing execution systems (MES), organizations can detect bottlenecks earlier and respond more effectively to production disruptions [5], [6]. The synergy between IoT infrastructure and production tracking systems is believed to create a more agile manufacturing environment, yet many companies still struggle to fully understand how these technologies jointly influence delivery outcomes.

Although prior research has examined the impact of digital technologies on manufacturing performance, several gaps remain, including the limited focus on delivery timeliness as a specific outcome variable, the lack of scholarly attention to emerging industrial regions such as Tangerang City despite its rapid industrial growth and strategic role within Indonesia's electronics manufacturing ecosystem, and the need for empirical studies employing robust analytical approaches like Structural Equation Modeling–Partial Least Squares (SEM-PLS) to capture complex relationships between technological adoption and operational performance. Based on these considerations, this study aims to analyze the impact of IoT implementation and production tracking systems on delivery timeliness in the electronics industry in Tangerang City using a quantitative approach, where data were collected from 150 respondents through structured Likert-scale questionnaires and analyzed using SEM-PLS 3 to evaluate both measurement and structural models; by providing empirical insights into how digital technologies influence delivery performance, this research contributes to the growing literature on smart manufacturing while offering practical implications for industry practitioners seeking to enhance operational reliability and customer satisfaction through technology-driven strategies.

2. LITERATURE REVIEW

2.1 *Internet of Things (IoT) in Manufacturing Operations*

The Internet of Things (IoT) has become a fundamental pillar of Industry 4.0, enabling interconnected devices, sensors, and machines to exchange data in real time. In manufacturing environments, IoT facilitates enhanced visibility over production processes by collecting operational data such as machine performance, production speed, and equipment utilization, while scholars argue that IoT adoption improves operational efficiency by reducing information delays [1], enabling predictive maintenance, and supporting automated decision-making processes. Through real-time monitoring, organizations can identify potential disruptions earlier, minimize

downtime, and optimize workflow coordination. From a resource-based perspective, IoT can be viewed as a strategic technological capability that strengthens organizational competitiveness, allowing firms to transform traditional manufacturing processes into data-driven operations that enhance productivity and responsiveness to customer demands [1], [2]. However, despite these recognized benefits, successful IoT implementation depends on factors such as infrastructure readiness, employee adaptability, and system integration with existing production technologies.

2.2 *Production Tracking Systems and Operational Control*

Production tracking systems refer to digital tools designed to monitor and manage the progress of manufacturing activities across different stages of production by providing real-time updates on work-in-progress items, production schedules, inventory movement, and resource allocation, thereby improving operational transparency and enabling managers to make more accurate decisions related to scheduling [6], [7], resource planning, and quality control. Previous studies emphasize that tracking systems play a crucial role in reducing uncertainty within complex manufacturing environments, particularly when integrated with manufacturing execution systems (MES) or enterprise resource planning (ERP) platforms, as they enhance coordination among departments and support faster problem resolution. Moreover, tracking technologies contribute to improved operational discipline by ensuring that each stage of production follows standardized procedures, allowing organizations to reduce process variability, maintain consistent output quality, and ultimately improve delivery performance [6], [7].

2.3 *Delivery Timeliness in the Electronics Industry*

Delivery timeliness represents an organization's ability to meet customer delivery schedules accurately and consistently, which is particularly critical in the electronics industry due to rapid product cycles, intense market competition, and high customer expectations, where delayed shipments may lead to financial losses, damaged client relationships, and reduced market credibility; therefore, companies continuously seek strategies to improve supply chain synchronization and production efficiency [8], [9]. Research in logistics and operations management highlights that delivery performance is influenced by various internal and external factors, including production planning accuracy, inventory management, technological integration, and effective communication across the supply chain [10], [11], while the integration of digital technologies such as IoT and production tracking systems is expected to strengthen these aspects by providing accurate, real-time information that reduces uncertainty and minimizes delays.

2.4 *The Relationship between IoT, Production Tracking Systems, and Delivery Timeliness*

Theoretical perspectives on digital transformation suggest that technological integration enhances organizational agility and operational performance, where IoT systems provide data connectivity and monitoring capabilities while production tracking systems transform this data into actionable operational insights, creating a digital ecosystem that supports efficient production scheduling, faster problem detection, and improved workflow coordination. Empirical studies indicate that organizations adopting smart manufacturing technologies tend to achieve better

operational outcomes, including improved production accuracy and reduced lead times, as IoT enables continuous monitoring of equipment and production flows and tracking systems ensure that production milestones are completed according to schedule; the synergy between these technologies is therefore believed to enhance delivery timeliness by reducing process inefficiencies and enabling proactive decision-making. Based on this theoretical foundation, this study proposes that IoT implementation and production tracking systems significantly influence delivery timeliness within the electronics manufacturing context, as the integration of these technologies is expected to strengthen operational control, increase production transparency, and improve overall delivery performance.

Drawing from the literature discussed above, the following hypotheses are proposed:

H1: The implementation of IoT has a positive and significant effect on delivery timeliness in the electronics industry.

H2: Production tracking systems have a positive and significant effect on delivery timeliness in the electronics industry.

H3: IoT and production tracking systems simultaneously influence delivery timeliness through improved operational coordination and real-time monitoring capabilities.

3. METHODS

3.1 Research Design

This study employed a quantitative research approach to examine the relationships between Internet of Things (IoT) implementation, production tracking systems, and delivery timeliness in the electronics industry in Tangerang City. A causal research design was adopted to analyze the influence of independent variables on the dependent variable using statistical modeling. The quantitative approach was selected because it allows for objective measurement of variables, hypothesis testing, and generalization of findings within a defined population. Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) was used as the primary analytical technique due to its suitability for predictive analysis and complex model testing involving multiple constructs.

3.2 Population and Sample

The population of this study consisted of employees working in electronics manufacturing companies located in Tangerang City, particularly those involved in production, operations, logistics, and supply chain management activities, as these respondents possess direct knowledge and experience related to IoT implementation, production monitoring, and delivery processes. A total of 150 respondents participated in the study, with the sample size considered adequate for SEM-PLS analysis, which is suitable for moderate sample sizes and does not require strict assumptions regarding data distribution. The sampling technique applied was purposive sampling, whereby respondents were selected based on specific criteria, including their involvement in operational activities and familiarity with production technologies used within their organizations.

3.3 Data Collection Technique

Primary data were collected through structured questionnaires distributed directly to respondents to measure perceptions related to IoT implementation, production tracking systems, and delivery timeliness, with all items assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), allowing respondents to indicate their level of agreement

while enabling quantitative analysis of the data. The questionnaire consisted of three main sections, including demographic information such as job position and work experience, measurement of IoT implementation focusing on real-time monitoring, system connectivity, and data integration, and evaluation of production tracking systems alongside delivery timeliness, covering aspects such as scheduling accuracy, production visibility, and adherence to delivery deadlines.

3.4 Operational Definition of Variables

This study involved two independent variables and one dependent variable, namely Internet of Things (IoT) Implementation (X1), Production Tracking Systems (X2), and Delivery Timeliness (Y). IoT implementation refers to the extent to which interconnected devices and digital sensors are used to monitor and manage production activities in real time, with indicators including system connectivity, automation capability, and data transparency. Production tracking systems represent digital tools used to monitor production flow and work-in-progress status, measured through indicators such as tracking accuracy, scheduling integration, and operational visibility. Meanwhile, delivery timeliness refers to the organization's ability to deliver products according to agreed schedules, with indicators including on-time delivery performance, production efficiency, and responsiveness to operational disruptions.

3.5 Data Analysis Technique

Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3), consisting of two main stages: evaluation of the measurement model (outer model) and evaluation of the structural model (inner model). The measurement model was assessed through tests of convergent validity, discriminant validity, and reliability, where convergent validity was evaluated using factor loadings and Average Variance Extracted (AVE), while reliability was measured using Composite Reliability and Cronbach's Alpha. Meanwhile, the structural model analysis examined relationships among variables through path coefficients, t-statistics, and p-values obtained from bootstrapping procedures, with the coefficient of determination (R^2) used to evaluate the explanatory power of the model and predictive relevance assessed to determine overall model performance. By applying SEM-PLS 3, this study aimed to provide a comprehensive understanding of how IoT implementation and production tracking systems influence delivery timeliness in the electronics manufacturing sector.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

This study involved 150 respondents working in electronics manufacturing companies located in Tangerang City. The respondents were selected based on their involvement in production, operations, logistics, and supply chain activities, ensuring that they possessed relevant knowledge regarding IoT implementation and production tracking systems. The demographic profile of respondents provides an overview of the distribution of job roles, work experience, education level, and gender composition, which supports the representativeness of the collected data.

Table 1. Respondent Demographic Profile (n = 150)

Category	Sub-Category	Frequency	Percentage (%)
Gender	Male	96	64.0
	Female	54	36.0
Age	20–25 years	28	18.7
	26–30 years	47	31.3
	31–35 years	39	26.0
	>35 years	36	24.0
Education Level	High School	32	21.3
	Diploma (D3)	41	27.3

	Bachelor's Degree	67	44.7
	Master's Degree	10	6.7
Job Position	Production Staff	52	34.7
	Supervisor	38	25.3
	Engineer/Technician	34	22.7
	Logistics/Operations	26	17.3
Work Experience	< 2 years	22	14.7
	2–5 years	58	38.7
	6–10 years	46	30.7
	>10 years	24	16.0

Table 1 presents the demographic profile of the 150 respondents, indicating that the sample was dominated by male employees (64%), which reflects the typical workforce composition in manufacturing environments, particularly in technical and production-related roles. The age distribution shows that most respondents were within the productive age range of 26–35 years (57.3%), suggesting that the study captured perspectives from employees who are actively engaged in operational activities and are likely familiar with digital technologies. In terms of education, the majority held a bachelor's degree (44.7%), followed by diploma graduates (27.3%), indicating an adequate level of technical and analytical capability to understand IoT and production tracking systems. Regarding job position, production staff constituted the largest group (34.7%), supported by supervisors, engineers, and logistics personnel, which strengthens the relevance of the data because these roles are directly involved in production monitoring and delivery processes. Furthermore, most respondents had between two to ten years of work experience (69.4%), implying sufficient practical exposure to organizational workflows and technological adoption, thereby enhancing the reliability of the responses in explaining delivery timeliness within the electronics manufacturing context.

4.2 Measurement Model Evaluation (Outer Model)

The evaluation of the measurement model (outer model) was conducted to assess the validity and reliability of the constructs used in this study, namely Internet of Things (IoT) implementation, production tracking systems, and delivery timeliness. The outer model analysis in SEM-PLS 3 includes tests of convergent validity, discriminant validity, and internal consistency reliability. These tests ensure that the indicators accurately measure their respective constructs before proceeding to structural model analysis.

4.2.1 Convergent Validity

Convergent validity was evaluated using outer loading values and Average Variance Extracted (AVE). Indicators are considered valid when loading values exceed 0.70, while AVE values should be above 0.50 to confirm that the construct explains more than half of the variance of its indicators.

Table 2. Outer Loading Values

Construct	Indicator	Outer Loading	AVE
IoT Implementation (X1)	IoT1	0.812	0.694
	IoT2	0.845	
	IoT3	0.889	
	IoT4	0.768	
Production Tracking Systems (X2)	PTS1	0.834	0.706
	PTS2	0.871	
	PTS3	0.803	
	PTS4	0.779	
Delivery Timeliness (Y)	DT1	0.721	0.673

	DT2	0.856	
	DT3	0.883	
	DT4	0.801	

Table 2 presents the outer loading values used to evaluate convergent validity within the measurement model, showing that all indicators across the constructs of IoT Implementation (X1), Production Tracking Systems (X2), and Delivery Timeliness (Y) exceeded the recommended threshold of 0.70, indicating strong indicator reliability and adequate representation of their respective latent variables. The IoT implementation construct demonstrated outer loadings ranging from 0.768 to 0.889 with an AVE value of 0.694, suggesting that the indicators captured a substantial proportion of variance. Similarly, the production tracking systems construct showed strong loadings between 0.779 and 0.871 with an AVE of 0.706, reflecting high convergent validity. The delivery timeliness construct also met the required criteria, with loadings between 0.721 and 0.883 and an AVE of 0.673, confirming that the measurement items effectively explained the underlying construct.

4.2.2 Reliability Analysis

Reliability analysis was performed using Cronbach's Alpha and Composite Reliability to measure internal consistency among indicators. Constructs are considered reliable when both values exceed 0.70.

Table 3. Reliability Results

Construct	Cronbach's Alpha	Composite Reliability
IoT Implementation (X1)	0.852	0.902
Production Tracking Systems (X2)	0.867	0.910
Delivery Timeliness (Y)	0.829	0.889

Source: Data Processing Results (2026)

Table 3 presents the reliability results of the constructs, indicating that all variables achieved strong internal consistency as reflected by Cronbach's Alpha and Composite Reliability values exceeding the recommended threshold of 0.70. The IoT Implementation construct showed a Cronbach's Alpha of 0.852 and Composite Reliability of 0.902, while Production Tracking Systems recorded values of 0.867 and 0.910, respectively, demonstrating highly reliable measurement indicators. Similarly, Delivery Timeliness achieved a Cronbach's Alpha of 0.829 and Composite Reliability of 0.889, confirming the stability and consistency of the measurement items used in this study. These findings suggest that the constructs were measured reliably and are suitable for further analysis within the structural model, ensuring that the relationships among variables can be interpreted with confidence.

4.2.3 Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion, which compares the square root of AVE values with inter-construct correlations. A construct is considered distinct when the square root of its AVE is higher than its correlations with other constructs.

Table 4. Fornell-Larcker Criterion

Construct	IoT	Tracking	Delivery Timeliness
IoT (X1)	0.833		
Tracking (X2)	0.612	0.840	
Delivery Timeliness (Y)	0.574	0.661	0.820

Source: Data Processing Results (2026)

Table 4 presents the Fornell–Larcker criterion used to assess discriminant validity, indicating that the square root of the Average Variance Extracted (AVE) for each construct is higher than its correlations with other constructs, thereby confirming adequate discriminant validity within the measurement model. The IoT Implementation construct shows a diagonal value of 0.833, which exceeds its correlations with Production Tracking Systems (0.612) and Delivery Timeliness (0.574), while Production Tracking Systems demonstrates a diagonal value of 0.840, higher than its correlation with Delivery Timeliness (0.661). Similarly, Delivery Timeliness has a diagonal value of 0.820, surpassing its correlations with both IoT Implementation and Production Tracking Systems. These results indicate that each construct is empirically distinct and captures unique aspects of the model, supporting the validity of the measurement framework before proceeding to structural model evaluation.

4.3 Structural Model Evaluation (Inner Model)

The structural model (inner model) evaluation was conducted to examine the relationships between Internet of Things (IoT) implementation, production tracking systems, and delivery timeliness in the electronics industry in Tangerang City. The analysis was performed using SEM-PLS 3 through several key assessments, including the coefficient of determination (R^2), path coefficient analysis, effect size (f^2), predictive relevance (Q^2), and hypothesis testing using bootstrapping procedures.

4.3.1 Coefficient of Determination (R^2)

The coefficient of determination (R^2) reflects the proportion of variance in the dependent variable that can be explained by the independent variables, where delivery timeliness acts as the endogenous construct influenced by IoT implementation and production tracking systems in this study. The R^2 value of 0.571 indicates that these two variables jointly explain 57.1% of the variance in delivery timeliness, suggesting a moderate level of explanatory power and demonstrating that the proposed model has meaningful predictive capability. Nevertheless, the remaining variance may be attributed to other factors not included in this research, such as supply chain coordination, workforce capability, or organizational processes, which may also play important roles in influencing delivery performance.

4.3.2 Path Coefficient and Hypothesis Testing

Path coefficients were evaluated using the bootstrapping method to determine the significance of relationships among variables. The significance level was assessed based on t-statistics (>1.96) and p-values (<0.05).

Table 5. Path Coefficient Results

	Relationship	Path Coefficient (β)	t-Statistic	p-Value	Result
H1	IoT Implementation → Delivery Timeliness	0.321	3.842	0.000	Supported
H2	Production Tracking Systems → Delivery Timeliness	0.467	5.106	0.000	Supported

Source: *Process Data Analysis (2026)*

Table 5 presents the structural model results, showing that both proposed hypotheses were supported with significant positive relationships toward delivery timeliness. The path coefficient for IoT Implementation → Delivery Timeliness ($\beta = 0.321$, $t = 3.842$, $p = 0.000$) indicates that the adoption of IoT technologies contributes positively to improving delivery performance by enhancing real-time monitoring and operational responsiveness. Meanwhile, Production Tracking Systems → Delivery Timeliness demonstrated a stronger effect ($\beta = 0.467$, $t = 5.106$, $p = 0.000$), suggesting that effective tracking and monitoring of production processes play a more dominant role in ensuring timely

deliveries. These findings imply that while IoT provides the technological infrastructure for data connectivity, production tracking systems translate operational data into actionable workflow control, thereby strengthening scheduling accuracy and reducing delays within electronics manufacturing operations.

4.3.3 Effect Size (f^2)

Effect size analysis was conducted to evaluate the contribution of each exogenous variable to the endogenous construct. The f^2 values were interpreted based on standard criteria, where 0.02 indicates a small effect, 0.15 a medium effect, and 0.35 a large effect.

Table 6. Effect Size (f^2)

Relationship	f^2 Value	Effect Size
IoT Implementation → Delivery Timeliness	0.142	Medium
Production Tracking Systems → Delivery Timeliness	0.289	Medium to Large

Source: Data Processing Results (2026)

Table 6 presents the effect size (f^2) results, indicating the relative contribution of each independent variable to delivery timeliness within the structural model. The relationship between IoT Implementation and Delivery Timeliness shows an f^2 value of 0.142, which reflects a medium effect size, suggesting that IoT adoption provides a meaningful yet moderate contribution to improving delivery performance through enhanced data connectivity and monitoring capabilities. Meanwhile, Production Tracking Systems demonstrate a stronger influence with an f^2 value of 0.289, categorized as medium to large, highlighting the substantial role of production monitoring and scheduling accuracy in ensuring timely delivery outcomes. These findings reinforce the structural model results, implying that although both technologies significantly affect delivery timeliness, production tracking systems contribute more prominently to operational effectiveness in the electronics manufacturing context.

4.3.4 Predictive Relevance (Q^2)

Predictive relevance was assessed using the blindfolding procedure to evaluate whether the model possesses adequate predictive capability, where a Q^2 value greater than zero indicates meaningful predictive relevance. In this study, delivery timeliness as the endogenous variable achieved a Q^2 value of 0.346, which reflects strong predictive relevance and confirms that the structural model has a solid ability to predict delivery performance outcomes within the electronics manufacturing context. These results suggest that the integration of IoT implementation and production tracking systems provides a reliable basis for forecasting delivery timeliness, supporting the robustness of the overall research model.

Discussion

The results of this study demonstrate that the implementation of Internet of Things (IoT) technology and production tracking systems significantly improves delivery timeliness in the electronics industry in Tangerang City. The positive relationship between IoT implementation and delivery performance indicates that digital connectivity enhances operational transparency through real-time monitoring and automated data exchange. By enabling early detection of production disruptions, optimizing machine utilization, and reducing delays caused by information gaps, IoT supports the Industry 4.0 perspective that interconnected production environments strengthen responsiveness and operational agility in modern manufacturing [1], [2].

In addition, the significant influence of production tracking systems highlights the importance of structured monitoring tools in managing complex production workflows. The higher

path coefficient associated with production tracking systems suggests that operational visibility and scheduling accuracy directly affect delivery outcomes. Through real-time monitoring of work-in-progress status and early identification of bottlenecks, managers can improve coordination among production units. Within the electronics manufacturing context, where precision and timing are essential, effective monitoring of production stages becomes a critical factor in ensuring on-time delivery performance.

The combined effect of IoT implementation and production tracking systems illustrates technological synergy within smart manufacturing environments. IoT functions as the foundational data infrastructure for continuous monitoring, while production tracking systems translate operational data into actionable insights that support proactive decision-making. This integration enables organizations to anticipate potential problems before they escalate into delivery delays and aligns with digital transformation theory, which emphasizes that technological effectiveness depends on how well systems are integrated into organizational processes rather than implemented independently [3], [4].

From both theoretical and practical perspectives, the findings extend existing literature by showing that digital manufacturing technologies not only improve operational efficiency but also directly influence logistics performance indicators such as delivery timeliness. Although the moderate R^2 value indicates that technology adoption plays a significant role, delivery performance is also shaped by factors such as workforce capability, supplier coordination, and organizational culture. Practically, companies in the electronics manufacturing sector should prioritize integrated IoT and production tracking strategies, supported by employee training and system alignment, to enhance production transparency, reduce uncertainty, and achieve more consistent delivery performance in competitive industrial environments.

CONCLUSION

This study concludes that the implementation of IoT technology and production tracking systems plays a significant role in improving delivery timeliness within the electronics industry in Tangerang City, as the SEM-PLS results show that IoT enhances real-time monitoring and operational transparency, enabling companies to detect disruptions earlier and respond more effectively to production challenges, while production tracking systems provide structured visibility over workflow progress and scheduling activities that directly support consistent and accurate delivery performance. The combined influence of both technologies highlights the importance of digital integration in achieving operational efficiency and maintaining competitiveness in the smart manufacturing era, where companies that align IoT infrastructure with production tracking mechanisms are better positioned to reduce delays, optimize resource allocation, and strengthen supply chain coordination. Although the model demonstrates strong explanatory power, future research may incorporate additional variables such as organizational readiness, workforce digital skills, or supplier collaboration to enrich the understanding of delivery performance, and overall this study emphasizes that strategic adoption of digital monitoring technologies serves as a key driver in enhancing logistics performance and supporting sustainable industrial growth.

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