

The Effect of E-Billing System, Transaction Speed, and Data Accuracy on Bill Payment Effectiveness: The Mediating Role of Payment Process Efficiency

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ABSTRACT: This study aims to examine the effect of the e-billing system, transaction speed, and data accuracy on bill payment effectiveness, both directly and indirectly through payment process efficiency as a mediating variable. The study employed a quantitative explanatory approach involving 120 employees from the finance and payment functions of manufacturing companies in East Java, Indonesia. Data were collected using a structured questionnaire and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. The results indicate that the e-billing system, transaction speed, and data accuracy have positive and significant effects on payment process efficiency. The three variables also have positive and significant direct effects on bill payment effectiveness. Furthermore, payment process efficiency has a positive and significant effect on bill payment effectiveness. The indirect effect analysis shows that payment process efficiency significantly mediates the relationships between the e-billing system and bill payment effectiveness, transaction speed and bill payment effectiveness, and data accuracy and bill payment effectiveness. These findings indicate that digital billing technology, faster transaction processing, and accurate financial information can improve payment outcomes, particularly when they are supported by an efficient payment process. The study highlights the importance of integrating digital systems with efficient business processes to improve the effectiveness of bill payment in manufacturing companies.

KEYWORDS: E-Billing_System; Transaction_Speed; Data_Accuracy; Payment_Process_Efficiency; Bill_Payment_Effectiveness; PLS-SEM

I. INTRODUCTION

The increasing digitalization of financial management has changed the way manufacturing companies handle billing and payment activities (Aditi, 2017). Processes that were previously dependent on paper invoices, manual verification, and repeated administrative checks are increasingly being supported by electronic billing systems integrated with Enterprise Resource Planning (ERP) platforms (Munawir, 2021). Through this integration, information related to invoices, purchase orders, goods receipts, and payment status can be accessed within a common system, reducing the need for repeated data entry and improving coordination between organizational functions (Sadiq, 2020). Previous studies have shown that ERP implementation can improve the integration of business processes and provide operational and financial benefits when the technology is aligned with organizational practices (Rexhepi, 2025). The adoption of e-billing systems is expected to make payment administration more structured and transparent (Calderon, 2024). Digital billing allows invoices to be submitted, verified, and monitored electronically, which can shorten administrative procedures and reduce the possibility of document duplication or loss (Alshameri, 2024). However, the presence of technology alone does not always lead to better organizational outcomes. The success of an information system depends on how users perceive its usefulness and ease of use, as well as on the quality of the system and the information it produces (Severin, 2025). Therefore, an e-billing system is likely to contribute to payment performance when it is reliable, well integrated, and supported by accurate information.

In manufacturing companies, the payment process involves a large number of transactions and requires coordination among purchasing, receiving, accounting, and finance departments (Ady, 2018). Even when an ERP-based e-billing system has been implemented, practical problems may still arise. Delays in invoice verification, inconsistencies between invoice, purchase order, and goods receipt data, incomplete validation, and occasional system errors can interrupt the payment workflow (Edith, 2014). Research on ERP implementation has indicated that technological competence, information sharing, and post-implementation practices are important factors that influence whether integrated systems translate into improved organizational performance

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(Desi, 2025). Transaction speed is another important aspect of digital payment systems. Faster transaction processing can reduce waiting time between verification, approval, and settlement, allowing finance departments to complete payment obligations more efficiently. Information systems research has demonstrated that system responsiveness influences user productivity and satisfaction, suggesting that processing speed has practical implications for the effectiveness of system use (Oktaria, 2023). In an ERP-based payment environment, timely transaction confirmation and minimal processing delays can therefore support a smoother payment workflow and reduce administrative bottlenecks.

Data accuracy is equally critical because payment decisions depend on correct and consistent financial information (Karanja, 2018). Errors in invoice amounts, vendor details, purchase order records, or goods receipt information may result in repeated verification, payment revisions, or disputes with suppliers (Reinka Sekar, 2024). According to the Information Systems Success Model, information quality is one of the main determinants of system success and organizational benefits (McLean, 2003). Studies on integrated information systems have also emphasized that accurate and shared information across departments contributes to more efficient business processes and better organizational outcomes (Desi, 2025). The relationship between digital technology and organizational performance is often explained through improvements in business processes rather than through technology adoption alone. Information technology capabilities can enhance organizational performance when they first improve process agility, coordination, and operational efficiency (Darteh, 2024). Similarly, information system capabilities have been found to influence firm performance through improvements in decision-making and business process performance (Aydiner, 2019). These findings suggest that payment process efficiency may serve as an important mechanism through which e-billing systems, transaction speed, and data accuracy are converted into effective payment outcomes.

This issue is particularly relevant to manufacturing companies that rely on SAP/ERP-integrated e-billing systems for high-volume financial transactions. The companies examined in this study PT Ultra Prima Abadi, PT Salim Ivomas Pratama Tbk, and PT Indolakto Purwosari have implemented digital billing systems to support invoice processing and payment administration. Nevertheless, the operational challenges described above indicate that the effectiveness of bill payment may depend not only on the existence of the e-billing system but also on the efficiency of the payment process through which transactions are completed. Although previous studies have discussed ERP implementation, information system quality, and organizational performance, fewer studies have simultaneously examined the effects of e-billing systems, transaction speed, and data accuracy on bill payment effectiveness while positioning payment process efficiency as a mediating variable in manufacturing companies (Hidayat, 2025). This study therefore addresses this gap by examining both the direct and indirect relationships among these variables. Specifically, the study investigates whether the e-billing system, transaction speed, and data accuracy improve bill payment effectiveness directly and whether these effects are strengthened through improvements in payment process efficiency among finance employees in manufacturing companies.

II. THEORETICAL FRAMEWORK AND HYPOTHESIS FORMULATION

A. Technology Acceptance Model

The Technology Acceptance Model (TAM) (Davis, 1989), explains how users accept and use information technology based on their perceptions of the usefulness and ease of use of the technology. Perceived usefulness refers to the extent to which a person believes that using a particular system can improve work performance, while perceived ease of use refers to the extent to which the system is considered easy to operate. In the context of financial administration, these two perceptions are relevant because employees are more likely to use a digital payment system when it helps them complete their tasks more effectively and does not create additional complexity (Severin, 2025). The implementation of an e-billing system in manufacturing companies can be viewed through the TAM perspective because the system is intended to provide practical benefits in processing invoices and payments. A system that allows employees to access billing information, conduct verification, and monitor payment status more easily can reduce dependence on manual procedures (Waiqotul, 2021). The perceived benefits of information technology can subsequently encourage users to utilize the system more consistently in their daily work activities (Severin, 2025).

In addition to TAM, information system success can also be understood through system quality and information quality (Herlita, 2021). The (Maharani, 2024) model explains that system quality and information quality contribute to system use, user satisfaction, and ultimately the benefits obtained by organizations from information systems. In this study, these concepts are relevant to the e-billing system, particularly because the payment process depends on the reliability of the system and the accuracy of the information generated by the system (Maharani, 2024).

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B. E-Billing System And Payment Process Efficiency

An e-billing system is a digital mechanism used to support billing administration by enabling billing information and related documents to be processed electronically (Chaurasiya, 2025). Within an integrated ERP environment (Grabski, 2001), e-billing can connect billing activities with purchasing, receiving, accounting, and payment functions. Such integration can reduce duplicated work and improve the flow of information between departments (Yusup, 2021). ERP research has shown that integrated information systems can provide organizational benefits by supporting coordination and integration across business processes (Desi, 2025). Payment process efficiency refers to the ability of an organization to complete payment activities with appropriate use of time and resources while minimizing unnecessary procedures and errors (Sadiq, 2020). When billing information is available electronically and verification can be performed through an integrated system, employees can process invoices without repeatedly transferring information between separate documents or systems. Information technology capabilities can improve business process performance when they facilitate coordination and make operational activities more responsive.

The findings of the study support this relationship. The direct-effect test shows that the e-billing system has a path coefficient of 0.551 toward payment process efficiency, with a t-statistic of 10.863 and a p-value of 0.000. Thus, the relationship is positive and statistically significant. Based on this theoretical and empirical reasoning, the first hypothesis is formulated as follows:

H1: The e-billing system has a positive and significant effect on payment process efficiency.

C. Transaction Speed And Payment Process Efficiency

Transaction speed describes how quickly a transaction can be processed from the beginning of the transaction until the information or payment is completed (Klinčar, 2021). In digital financial administration, transaction speed is important because delays at one stage may affect subsequent stages of verification, approval, and payment. Faster information processing can reduce waiting time and allow employees to complete administrative tasks within a shorter period. Information systems that respond quickly can support employee productivity because users spend less time waiting for system responses or completing repetitive procedures (McLean, 2003). System responsiveness is therefore an important aspect of effective information technology use, particularly when employees depend on the system to complete routine transactions (Afandi, 2022). In an integrated payment environment, faster transaction processing can also reduce administrative bottlenecks and support a more continuous payment workflow. The empirical results indicate that transaction speed has a positive and significant effect on payment process efficiency. The path coefficient is 0.420, with a t-statistic of 7.786 and a p-value of 0.000. Therefore, the second hypothesis is formulated as follows:

H2: Transaction speed has a positive and significant effect on payment process efficiency

D. Data Accuracy And Payment Process Efficiency

Data accuracy is essential in financial transactions because payment activities require information that is correct, complete, and consistent. Information such as invoice numbers, supplier details, transaction values, purchase orders, and goods receipt records must correspond with one another before a payment can be processed (Calderon, 2024). When inaccurate information enters the payment process, employees may need to perform additional checking or corrections, which can increase processing time and reduce efficiency (Chaurasiya, 2025). The importance of information accuracy is consistent with the Information Systems Success Model, which identifies information quality as an important component in achieving benefits from information systems. High-quality information supports users in carrying out their tasks and reduces problems caused by unreliable information (Maharani, 2024). In integrated business environments, accurate information can also facilitate coordination between departments and contribute to better business process performance (Darteh, 2024). The results of this study show that data accuracy positively and significantly affects payment process efficiency. The path coefficient is 0.499, with a t-statistic of 7.887 and a p-value of 0.000. Accordingly, the third hypothesis is formulated:

H3: Data accuracy has a positive and significant effect on payment process efficiency.

E. E-Billing System and Bill Payment Effectiveness

Bill payment effectiveness refers to the extent to which payment obligations can be completed appropriately, accurately, and on time (Collins, 2021). The effectiveness of payment is not determined only by whether a payment is eventually made, but also by whether the process produces the intended result without unnecessary errors or delays (Lailiyah, 2019). An effective information system can support these outcomes by providing reliable information and facilitating the completion of business processes (Karanja, 2018). The relationship between information technology and organizational performance has been examined in previous research. Information technology capabilities can contribute to organizational performance when they

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support business process improvements and enable organizations to respond more effectively to operational requirements (Darteh, 2024). Similarly, information system capabilities can influence organizational performance through business process performance and improved decision-making processes (Aydiner, 2019). In this study, the e-billing system has a positive and significant direct effect on bill payment effectiveness, with a path coefficient of 0.263, a t-statistic of 4.000, and a p-value of 0.000. Based on these findings, the fourth hypothesis is formulated:

H4: The e-billing system has a positive and significant effect on bill payment effectiveness.

F. Transaction Speed and Bill Payment Effectiveness

Transaction speed can influence payment effectiveness because timely processing allows financial obligations to be completed within the required period (Lailiyah, 2019). When transaction processing takes too long, payment deadlines may be missed even when the payment system itself is functioning properly. Faster transaction processing can therefore contribute to timely and effective completion of payment obligations (Steinbart, 2018).

The role of information technology in improving organizational performance is closely associated with its ability to improve operational processes (Mahapatra, 2020). Business process agility and information technology capabilities can help organizations respond more quickly to operational demands and improve performance outcomes (Darteh, 2024). Therefore, transaction speed is expected to have a positive relationship with the effectiveness of bill payments. The results of this study confirm this expectation. Transaction speed has a path coefficient of 0.135 toward bill payment effectiveness, with a t-statistic of 2.317 and a p-value of 0.021, indicating a positive and significant relationship. Thus:

H5: Transaction speed has a positive and significant effect on bill payment effectiveness.

G. Data Accuracy and Bill Payment Effectiveness

Accurate data provides a reliable basis for making payment decisions. Inaccurate invoice amounts, supplier information, or transaction records can cause payment corrections, rejected transactions, or delays in completing financial obligations (Jekri, 2022). Consequently, maintaining data accuracy is important not only for administrative efficiency but also for ensuring that payments are made to the correct party, for the correct amount, and according to the relevant transaction records. Information quality is one of the important elements determining the success and benefits of information systems (Maharani, 2024). When information is accurate and consistent, users can perform financial administration with greater confidence and fewer corrective procedures. This is particularly relevant in integrated ERP environments where information from different business functions must correspond before a payment can be finalized. The empirical results show that data accuracy has a positive and significant effect on bill payment effectiveness. The path coefficient is 0.167, with a t-statistic of 2.263 and a p-value of 0.024. Therefore:

H6: Data accuracy has a positive and significant effect on bill payment effectiveness.

H. Payment Process Efficiency And Bill Payment Effectiveness

Payment process efficiency represents an important mechanism for converting technological and operational improvements into actual payment outcomes (Afandi, 2022). A payment process that minimizes unnecessary steps, reduces errors, and completes transactions within an appropriate period is more likely to produce effective payment results (Isam, 2024). Research on information systems suggests that improvements in business process performance can become an important pathway through which information technology contributes to organizational performance (Aydiner, 2019). The findings of this study indicate that payment process efficiency has the strongest direct effect on bill payment effectiveness among the variables tested (Ningrum, 2023). The path coefficient is 0.562, with a t-statistic of 6.803 and a p-value of 0.000. This result indicates that improving the efficiency of the payment process is closely associated with more effective bill payment outcomes (Octaviani, 2024). Accordingly:

H7: Payment process efficiency has a positive and significant effect on bill payment effectiveness.

I. Payment Process Efficiency As A Mediating Variable

The relationship between information technology and organizational performance may not always occur entirely through a direct pathway (Klinčar, 2021). Previous research has demonstrated that business process capabilities can act as mechanisms through which information technology capabilities contribute to organizational performance (Rahmawati, 2025). Similarly, information system capabilities may influence firm performance through improvements in business process performance (Aydiner, 2019). These findings provide a basis for positioning payment process efficiency as a mediator in the present study. The indirect-effect results show that the e-billing system has a positive and significant indirect effect on bill payment effectiveness through payment process efficiency, with a coefficient of 0.310, a t-statistic of 6.005, and a p-value of 0.000. Therefore:

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H8: The e-billing system has a positive and significant indirect effect on bill payment effectiveness through payment process efficiency. Transaction speed also shows a positive and significant indirect effect through payment process efficiency, with a coefficient of 0.281, a t-statistic of 5.753, and a p-value of 0.000. Thus:

H9: Transaction speed has a positive and significant indirect effect on bill payment effectiveness through payment process efficiency. Finally, data accuracy has a positive and significant indirect effect on bill payment effectiveness through payment process efficiency, with a coefficient of 0.236, a t-statistic of 5.347, and a p-value of 0.000. Therefore:

H10: Data accuracy has a positive and significant indirect effect on bill payment effectiveness through payment process efficiency.

III. RESEARCH METHOD

A. Research Design

This study employed a quantitative research approach with an explanatory design. The explanatory approach was selected because the study aimed to examine the relationships between the e-billing system, transaction speed, data accuracy, payment process efficiency, and bill payment effectiveness. The research model was designed to examine both direct relationships between the independent variables and the dependent variable and indirect relationships through payment process efficiency as a mediating variable.

The analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) (Sarstedt, 2022) with SmartPLS 4.0. PLS-SEM was used because the research model consists of several latent variables and includes a mediating relationship (Hair, 2010). The analysis focused on examining the path coefficients, t-statistics, and p-values obtained through the bootstrapping procedure. A relationship was considered statistically significant when the t-statistic exceeded 1.96 and the p-value was below 0.05 at a 5% significance level.

B. Population And Sample

The population of this study consisted of employees involved in financial and payment-related activities in the manufacturing companies selected as the research objects. The study involved 120 respondents who were selected using a saturated sampling technique. The respondents were employees who had direct experience with the e-billing system and payment administration process, allowing them to provide information relevant to the variables examined in the study.

The research was conducted at PT Ultra Prima Abadi, PT Salim Ivomas Pratama Tbk, and PT Indolakto Purwosari. These companies were selected because their payment administration activities utilize an integrated e-billing system within an SAP/ERP environment. The use of an integrated digital system provides an appropriate setting for examining how system implementation, transaction speed, and data accuracy are related to payment process efficiency and bill payment effectiveness.

C. Research Variables

The research model consisted of three independent variables, one mediating variable, and one dependent variable. The e-billing system was treated as the first independent variable (X1) (Lailiyah, 2019), transaction speed as the second independent variable (X2) (Mentari, 2018), and data accuracy as the third independent variable (X3) (Calderon, 2024). Payment process efficiency was positioned as the mediating variable (Z) (McLean, 2003), while bill payment effectiveness was the dependent variable (Y) (Rahmawati, 2025).

The conceptual relationship among the variables was developed based on the Technology Acceptance Model and information systems literature. The model assumes that a well-functioning e-billing system, faster transaction processing, and more accurate data can improve payment process efficiency. Improved payment process efficiency is then expected to contribute to more effective bill payment outcomes. The model also examines whether the three independent variables influence bill payment effectiveness directly.

D. Data Collection

The data were collected using a structured questionnaire distributed to respondents who met the research criteria. The questionnaire was designed to measure respondents' perceptions regarding the implementation of the e-billing system, transaction speed, data accuracy, payment process efficiency, and bill payment effectiveness. Each construct was represented by several indicators that reflected the operational definition of the respective variable. The collected responses were subsequently processed and analyzed using SmartPLS 4.0. Before testing the structural relationships, the measurement model was evaluated to ensure that the indicators adequately represented their respective constructs.

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E. Data Analysis

Data analysis was performed using PLS-SEM with SmartPLS 4.0 (Sarstedt, 2022). The analysis consisted of evaluating the measurement model and the structural model. The measurement model was assessed to determine the validity and reliability of the indicators, while the structural model was used to examine the hypothesized relationships among the constructs. The structural analysis focused on the path coefficient, t-statistic, and p-value. The path coefficient was used to identify the direction and magnitude of the relationship between variables. The t-statistic was used to evaluate the significance of the relationship, while the p-value was used as the basis for determining whether the proposed hypothesis was statistically supported. A hypothesis was accepted when the t-statistic was greater than 1.96 and the p-value was less than 0.05. The direct-effect analysis examined seven relationships: the effects of the e-billing system, transaction speed, and data accuracy on payment process efficiency; the effects of the three independent variables on bill payment effectiveness; and the effect of payment process efficiency on bill payment effectiveness. The indirect-effect analysis was then conducted to determine whether payment process efficiency mediated the relationships between the three independent variables and bill payment effectiveness. The mediation analysis was particularly important because the research did not only examine whether digital and operational factors directly influence payment effectiveness. It also examined whether their influence operates through a more efficient payment process. This approach is consistent with previous information systems research suggesting that the contribution of information technology to organizational performance can occur through improvements in business processes (Aydiner, 2019).

IV. RESULTS AND DISCUSSION

A. Result

1. Direct Effect Test

The direct effect test was conducted using the bootstrapping procedure in SmartPLS 4.0. The evaluation focused on the path coefficient, t-statistic, and p-value. A relationship was considered significant when the t-statistic was greater than 1.96 and the p-value was below 0.05. The direct effect test examined the effects of the e-billing system, transaction speed, and data accuracy on payment process efficiency and bill payment effectiveness, as well as the effect of payment process efficiency on bill payment effectiveness.

Table I. Direct Effect Test Results

Relationship	Original Sample (O)	Sample Mean (M)	STDEV	T-Statistics	P-Values	Result
E-Billing System (X1) → Payment Process Efficiency (Z)	0.551	0.550	0.051	10.863	0.000	Significant
Transaction Speed (X2) → Payment Process Efficiency (Z)	0.420	0.420	0.054	7.786	0.000	Significant
Data Accuracy (X3) → Payment Process Efficiency (Z)	0.499	0.498	0.063	7.887	0.000	Significant
E-Billing System (X1) → Bill Payment Effectiveness (Y)	0.263	0.270	0.066	4.000	0.000	Significant
Transaction Speed (X2) → Bill Payment Effectiveness (Y)	0.135	0.139	0.058	2.317	0.021	Significant
Data Accuracy (X3) → Bill Payment Effectiveness (Y)	0.167	0.177	0.074	2.263	0.024	Significant
Payment Process Efficiency (Z) → Bill Payment Effectiveness (Y)	0.562	0.549	0.083	6.803	0.000	Significant

Source: Processed by the researcher.

The results show that all seven direct relationships are positive and statistically significant. The e-billing system has a positive effect on payment process efficiency, with a path coefficient of 0.551, a t-statistic of 10.863, and a p-value of 0.000. This indicates that better implementation of the e-billing system is associated with higher payment process efficiency. In an integrated financial environment, digital systems can reduce dependence on manual procedures, improve information flow, and support the coordination of business activities (Alshameri, 2024). This finding is consistent with previous research showing that IT capabilities can improve organizational outcomes when they are integrated with business processes rather than treated merely as technological investments (Darteh, 2024). The positive effect of the e-billing system on payment process efficiency

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also supports the argument that information technology creates value through the improvement of operational processes. (Aydiner, 2019) found that IT capabilities do not automatically produce better firm performance; instead, their benefits emerge when IT is coherently integrated with the organization's ability to manage and optimize business processes. Therefore, the significant result obtained in this study suggests that the e-billing system contributes to efficiency because it becomes part of the payment workflow rather than functioning as an isolated technological tool.

Transaction speed also has a positive and significant effect on payment process efficiency. The path coefficient of 0.420, t-statistic of 7.786, and p-value of 0.000 indicate that faster transaction processing is associated with a more efficient payment process. In practical terms, faster processing can reduce waiting time, accelerate verification and approval activities, and minimize administrative delays. This result suggests that efficiency in digital payment administration is not determined solely by the availability of an electronic system but also by how quickly transactions can move from one stage to another. Data accuracy has a similarly positive and significant effect on payment process efficiency. The path coefficient is 0.499, with a t-statistic of 7.887 and a p-value of 0.000. This relatively high coefficient indicates that accurate information is an important component of an efficient payment process. Errors in invoice information, transaction values, or supporting documents can require repeated verification and correction, thereby increasing processing time. From an information systems perspective, the quality of information is closely related to the benefits organizations obtain from their systems because reliable information supports users in performing their tasks more effectively (Maharani, 2024).

The e-billing system also has a positive and significant direct effect on bill payment effectiveness. The path coefficient is 0.263, with a t-statistic of 4.000 and a p-value of 0.000. This finding indicates that improvements in the e-billing system can contribute directly to more effective bill payment outcomes. A digital billing system can support payment effectiveness by making billing information more accessible, simplifying verification, and reducing unnecessary manual activities. The result is in line with the broader information systems literature, which suggests that organizational benefits are more likely when information systems support actual business activities and improve the quality of operational processes (Maharani, 2024). Transaction speed also has a significant positive effect on bill payment effectiveness, although the magnitude of its direct coefficient is relatively smaller than the other direct relationships (Nugraha, 2024). The path coefficient is 0.135, with a t-statistic of 2.317 and a p-value of 0.021. This means that faster transactions contribute to more effective bill payments, although the effect is not as strong as the effect of payment process efficiency. The finding is reasonable because transaction speed represents one component of the broader payment process, whereas payment effectiveness depends on several factors, including accuracy, verification, and completion of the overall process.

Data accuracy has a positive and significant effect on bill payment effectiveness, with a path coefficient of 0.167, a t-statistic of 2.263, and a p-value of 0.024. The result indicates that accurate data supports the completion of payments with fewer corrections and administrative problems. Accurate billing information allows employees to ensure that the payment amount, recipient, and transaction records correspond to the underlying business transaction. This finding reinforces the importance of information quality in generating useful outcomes from information systems (Maharani, 2024). Among all direct relationships tested, payment process efficiency has the strongest effect on bill payment effectiveness, with a path coefficient of 0.562, a t-statistic of 6.803, and a p-value of 0.000. This result indicates that the ability to process payments efficiently is closely associated with the achievement of effective payment outcomes. An efficient process can reduce unnecessary administrative activities, minimize errors, and support the timely settlement of payment obligations.

This finding is also consistent with international research emphasizing the role of business process performance in translating information system capabilities into organizational performance. (Aydiner, 2019) found that business-process performance plays an important mediating role between information-system capabilities and firm performance. Similarly (Darteh, 2024) found that the effect of IT capability on organizational performance was fully mediated by business process agility in manufacturing firms. Thus, the relatively strong effect of payment process efficiency in this study provides empirical support for the argument that process improvement is an important pathway for obtaining value from digital systems.

2. Indirect Effect Test

The indirect effect test was conducted to determine whether payment process efficiency mediates the relationships between the three independent variables and bill payment effectiveness. The analysis used the specific indirect effects generated through SmartPLS bootstrapping. The results are presented in Table II.

Table II. Indirect Effect Test Results

Indirect Relationship	Original Sample	Sample Mean (M)	STDEV	T-Statistics	P-Values	Result
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	(O)					
E-Billing System (X1) → Payment Process Efficiency (Z) → Bill Payment Effectiveness (Y)	0.310	0.306	0.052	6.005	0.000	Significant
Transaction Speed (X2) → Payment Process Efficiency (Z) → Bill Payment Effectiveness (Y)	0.281	0.274	0.049	5.753	0.000	Significant
Data Accuracy (X3) → Payment Process Efficiency (Z) → Bill Payment Effectiveness (Y)	0.236	0.233	0.044	5.347	0.000	Significant

Source: Processed by the researcher.

The first indirect relationship shows that the e-billing system has a positive and significant effect on bill payment effectiveness through payment process efficiency. The indirect coefficient is 0.310, with a t-statistic of 6.005 and a p-value of 0.000. This result indicates that the contribution of the e-billing system to payment effectiveness is not limited to its direct effect. Part of its influence operates through the improvement of the payment process. This finding is consistent with (Jianping, 2016), who demonstrated that business process capabilities can mediate the relationship between IT capabilities and firm performance. The second indirect relationship also shows a positive and significant result. Transaction speed affects bill payment effectiveness through payment process efficiency with an indirect coefficient of 0.281, a t-statistic of 5.753, and a p-value of 0.000. This finding suggests that faster transactions become more meaningful for payment effectiveness when they contribute to a more efficient overall payment process. In other words, speed alone is not sufficient; the speed needs to be translated into an efficient workflow that allows payments to be completed properly.

The third indirect relationship indicates that data accuracy has a positive and significant effect on bill payment effectiveness through payment process efficiency. The indirect coefficient is 0.236, with a t-statistic of 5.347 and a p-value of 0.000. This finding emphasizes that accurate information contributes to payment effectiveness not only directly but also by reducing the need for corrections and repeated verification during payment processing. Overall, the indirect-effect results demonstrate that payment process efficiency plays an important mediating role in the research model. The finding is consistent with the process-based view of IT, which argues that the value of information technology is realized through its interaction with organizational processes. (Jianping, 2016) found that business process management capabilities can fully mediate the relationship between IT capability and firm performance, while (Aydiner, 2019) similarly demonstrated the importance of business-process performance in explaining how information-system capabilities contribute to firm performance.

The mediation result is also consistent with evidence from manufacturing firms. (Darteh, 2024) found that the effect of IT capability on organizational performance was mediated by business process agility among manufacturing firms in China. Therefore, the present findings extend this perspective to the payment context by showing that e-billing, transaction speed, and data accuracy can contribute to bill payment effectiveness partly because they improve the efficiency of the payment process. Based on both the direct and indirect effect tests, all hypotheses from H1 to H10 are supported. The findings indicate that digital payment infrastructure, transaction processing speed, and information accuracy each contribute to payment outcomes, while payment process efficiency represents an important mechanism linking these factors to bill payment effectiveness. The results therefore suggest that manufacturing companies seeking to improve payment effectiveness should not focus only on implementing digital systems, but should also ensure that those systems improve the efficiency and reliability of the underlying payment processes.

B. Discussion

1. Direct Influence (Bootstrapping)

Discussion influence direct done For explain connection between variables that have been tested through bootstrapping method on the PLS-SEM model. Testing This aim For know whether E-Billing System (X1), Speed Transactions (X2), and Data Accuracy (X3) have an effect significant to Payment Process Efficiency (Z) and Effectiveness Payment Bill (Y), as well as whether Payment Process Efficiency (Z) has an effect to Effectiveness Payment Bill (Y). Interpretation results done based on mark coefficient path coefficient, t-statistic, and p-value. Relationship intervariable stated significant if t-statistic value is greater big than 1.96 and p-value more small from 0.05 at the level significance 5%. Based on results bootstrapping testing , all hypothesis influence direct (H1 to H7) shows positive and significant relationship . This is show that improvement quality E-Billing System , Speed Transactions , and Data Accuracy are capable increase Payment Process Efficiency as well as Effectiveness Payment Bills on the company manufacturing that becomes object study .

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Test results show that The E-Billing System (X1) has an effect positive and significant to Payment Process Efficiency (Z), with The t-statistic value is 10.863 and the p-value is 0.000. These results show that the more Good implementation E-Billing System , increasingly tall level Payment Process Efficiency in Companies manufacturing. In a way theoretical , results study This supports the Technology Acceptance Model (TAM) which explains that technology that is considered useful and easy used capable increase performance user . In study This , E-Billing System helps speed up administration payment , simplifying the verification process bills , as well as reduce dependence against potentially manual processes cause delays . At the company manufacturing with activity high transactions , the implementation of E -Billing is capable create a more seamless payment process fast , structured , and efficient .Findings This in line with (Aditi, 2017) stated that that system payment electronic can increase efficiency through improvement data accuracy and acceleration verification transactions .

Research results this also strengthens study previously shown that digitalization payment capable reduce time processing administration , minimizing error recording , and improving effectiveness operational company . Influence positive the supported by indicators E-Billing System , namely convenience usage , speed delivery information billing , and integration system payment . Convenience use can speed up settlement administration , delivery information bill can speed up the verification and approval process payment , while SAP/ERP integration allows invoice, Purchase Order (PO), and Goods Receipt (GR) data to be connected in a way automatic so that reduce input recurring and data errors . In a way practical , company need Keep going increase optimization E-Billing System via strengthening SAP/ERP integration , enhancements data validation , and improvement competence users . With Thus , the payment process can ongoing more fast , accurate , and efficient . Based on results Therefore , hypothesis H1 is accepted , which means The E-Billing System (X1) has an effect positive and significant to Payment Process Efficiency (Z).

b. Hypothesis 2

H2: Speed Transaction (X2) has an effect positive and significant to Payment Process Efficiency (Z).

Test results show that Speed Transaction (X2) has an effect positive and significant to Payment Process Efficiency (Z), with The t-statistic value is 7.786 and the p-value is 0.000. These results show that the more fast transaction process done , the more tall efficiency of payment processes in companies manufacturing . In a way theoretical , findings This support draft (McLean, 2003) explain that system information that is capable processing transaction in a way fast and accurate can increase effectiveness operational . Speed transaction help speed up processing payment , reduce time wait , and streamline the administrative process so that can support smoothness company cash flow . Research result This in line with study previously stated that improvement speed digital transactions can reduce time processing , minimizing obstacle administration , and improve efficiency payment .

Influence the reflected through indicator speed settlement transactions , minimum process delays , and accuracy time confirmation transactions . The more fast transaction processed and confirmed , the more effective payment process carried out . In a way practical , company need increase optimization system transaction through integration system , upgrade digital infrastructure , and monitoring of transaction processes so that payments can walk more fast and efficient . Based on results Therefore , the hypothesis H2 is accepted , which means Speed Transaction (X2) has an effect positive and significant to Payment Process Efficiency (Z).

c. Hypothesis 3

H3: Data Accuracy (X3) has an effect positive and significant to Payment Process Efficiency (Z).

Test results show that Data Accuracy (X3) has an effect positive and significant to Payment Process Efficiency (Z), with The t-statistic value is 7.887 and the p-value is 0.000. These results show that the more tall level data accuracy in system payments , the more also increases the efficiency of the payment process in the company manufacturing . In a way theoretical , findings This support (McLean, 2003) explain that quality accurate and reliable information reliable will increase effectiveness use system information . In SAP/ERP- based digital payment processes , data accuracy is very important. important For reduce input errors , nominal discrepancies , duplication documents , as well as speed up the validation and verification process payment .

Research result This in line with study previously stated that good data quality capable increase efficiency operational through subtraction error administration and acceleration of transaction processes . The influence positive the supported by indicators Data Accuracy , namely lack of data errors , accuracy information billing and validation automatic system . Accurate data enable payment process walk more fast Because reduce need inspection repeat and correct document . In a way practical , company need guard data quality through improvement validation automatic , integration SAP/ERP system , as well as

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supervision regarding the data input process so that payments can be made can done in a way more accurate and efficient . Based on results Therefore , hypothesis H3 is accepted , which means Data Accuracy (X3) has an effect positive and significant to Payment Process Efficiency (Z).

d. Hypothesis 4

H4: The E-Billing System (X1) has an effect positive and significant to Effectiveness Payment Bill (Y).

Test results show that The E-Billing System (X1) has an effect positive and significant to Effectiveness Payment Bill (Y), with The t-statistic value is 4.000 and the p-value is 0.000. These results show that the more Good implementation E-Billing System , increasingly tall effectiveness payment bills to the company manufacturing . In a way theoretical , findings This supports (Davis, 1989) Technology Acceptance Model (TAM) which explains that easy technology used and provide benefit for users can increase performance operational . Implementation The E-Billing system helps company increase control , transparency , and integration of payment processes through accuracy time payment , conformity of transaction nominal , and subtraction error administration .

Research result This in line with study previously stated that digitalization system payment capable increase effectiveness transaction through acceleration of administrative processes , improvement accuracy information and convenience payment status monitoring . Influence positive the supported by indicators E-Billing System , namely convenience use system , speed delivery information billing , and integration system payment . Third indicator the support creation payment more bills appropriate timely , accurate , and easy controlled . In a way practical , company need Keep going optimize E-Billing System via improvement SAP/ERP integration , strengthening transaction monitoring , and improving competence users for effectiveness payment bill can Keep going increase . Based on results Therefore , hypothesis H4 is accepted , which means The E-Billing System (X1) has an effect positive and significant to Effectiveness Payment Bill (Y).

e. Hypothesis 5

H5: Speed Transaction (X2) has an effect positive and significant to Effectiveness Payment Bill (Y).

Test results show that Speed Transaction (X2) has an effect positive and significant to Effectiveness Payment Bill (Y), with The t-statistic value is 2.317 and the p-value is 0.021. These results show that the more fast transaction process done , the more increase effectiveness payment bills to the company manufacturing . In a way theoretical , findings This support (McLean, 2003) explain that quality system information , including speed and reliability system , can increase effectiveness activity organization . In study this , speed transaction enable payment process ongoing more fast through subtraction time processing , acceleration verification and confirmation more transactions appropriate time .

Research result This in line with study previously stated that more digital transactions fast can reduce administrative processing time , increasing accuracy time payments , and support smoothness operational company . Influence positive the supported by indicators Speed Transactions , namely speed settlement transactions , minimum process delays , and accuracy time confirmation transaction . Third indicator the contribute in reduce obstacle payment as well as lower risk delays and revisions transactions . In a way practical , company need increase performance system transaction through optimization integration system , upgrade speed data processing , and monitoring channel payment for effectiveness payment bill can Keep going increase . Based on results Therefore , hypothesis H5 is accepted , which means Speed Transaction (X2) has an effect positive and significant to Effectiveness Payment Bill (Y).

f. Hypothesis 6

H6: Data Accuracy (X3) has an effect positive and significant to Effectiveness Payment Bill (Y).

Test results show that Data Accuracy (X3) has an effect positive and significant to Effectiveness Payment Bill (Y), with The t-statistic value is 2.263 and the p-value is 0.024. These results show that the more tall level data accuracy in system payments , the more increase effectiveness payment bills to the company manufacturing . In a way theoretical , findings This support (McLean, 2003) explain that accurate , relevant , and accessible information reliable will increase effectiveness use system Information . In the payment process digital- based , data accuracy plays a role important in ensure nominal suitability , purpose payment , and completeness administration so that can reduce transfer error , revision payments , as well as potential complaint .

Research result This in line with study previously stated that good data quality capable increase effectiveness operational through subtraction error administration and improvement accuracy of the transaction process . Influence positive the supported by indicators Data Accuracy , namely lack of data errors , billing data accuracy , and validation automatic system . Third indicator the help ensure payment done in a way appropriate so that the payment process become more accurate and appropriate procedure . In a way practical , company need guard data quality through improvement validation automatic ,

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SAP/ERP integration , and monitoring of data input and verification processes for minimize error payment . Based on results Therefore , hypothesis H6 is accepted , which means Data Accuracy (X3) has an effect positive and significant to Effectiveness Payment Bill (Y).

g. Hypothesis 7

H7: Payment Process Efficiency (Z) has an effect positive and significant to Effectiveness Payment Bill (Y).

Test results show that Payment Process Efficiency (Z) has an effect positive and significant to Effectiveness Payment Bill (Y), with The t-statistic value is 6.803 and the p-value is 0.000. These results show that the more tall efficiency of the payment process , increasingly high effectiveness payment bills to the company manufacturing . In addition that , Payment Process Efficiency is variables that have the strongest influence to Effectiveness Payment Bill compared to variables independent other . In a way theoretical , findings This support draft efficiency operational aspects put forward by (Barry, 2017) , that efficient work processes through subtraction time , errors , and usage source Power can increase effectiveness organization . In study this , the efficiency of the payment process allows transaction completed with more fast , accurate , and appropriate procedure so that payment bill can done appropriate time and according to nominal.

Research result This in line with study previously stated that improvement payment process efficiency capable increase effectiveness operational through acceleration settlement transactions , reductions error administration , and improvement accuracy time payment . Influence positive the supported by indicators Payment Process Efficiency , namely speed settlement transactions , minimum input errors , and minimal error system . Third indicator the support creating a more efficient payment process effective , accurate and precise time . In a way practical , company need Keep going increase payment process efficiency through optimization SAP/ERP system , simplification channel work , and strengthening payment process control for effectiveness payment bill can Keep going increase . Based on results Therefore , hypothesis H7 is accepted , which means Payment Process Efficiency (Z) has an effect positive and significant to Effectiveness Payment Bill (Y).

2. Discussion Influence No Direct (Bootstrapping)

Discussion influence No direct done for explain role Payment Process Efficiency (Z) as variables mediation in connection between E-Billing System (X1), Speed Transactions (X2), and Data Accuracy (X3) against Effectiveness Payment Bill (Y). Testing mediation done use bootstrapping results of the indirect effect for know whether influence variables independent to variables dependent happen through improvement Payment Process Efficiency .

a. Hypothesis 8

H8: The E-Billing System (X1) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z).

Test results show that The E-Billing System (X1) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z), with The t-statistic value is 6.005 and the p-value is 0.000. These results show that Payment Process Efficiency play a role as variables strong mediation in connection between E-Billing System and Effectiveness Payment Bill . In a way theoretical , findings This supports (Davis, 1989) Technology Acceptance Model (TAM) which explains that easy technology used and provide benefit can increase performance through work process improvement . In study this , the implementation The E-Billing system does not only give influence direct to effectiveness payments , but also increases efficiency of the payment process which ultimately impact on increasing effectiveness payment bill .

Research result This in line with study previously stated that implementation system digital payments are possible increase effectiveness operational through improvement efficiency of the work process . This reinforced by values influence No direct of 0.310, which is more big compared to influence direct of 0.263. With Thus , Payment Process Efficiency own more roles dominant in mediate influence E-Billing System for Effectiveness Payment Bill . Connection the supported by convenience use system , speed delivery information billing , and integration system capable payment speed up the payment process as well as reduce error administration . In a way practical , company need Keep going optimize implementation E-Billing System and improve payment process efficiency through SAP/ERP integration , data validation , and improvement competence users for effectiveness payment bill can Keep going increase . Based on results Therefore , hypothesis H8 is accepted , which means Payment Process Efficiency capable mediate in a way positive and significant influence E-Billing System for Effectiveness Payment Bill .

b. Hypothesis 9

H9: Speed Transaction (X2) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z).

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Test results show that Speed Transaction (X2) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z), with The t-statistic value is 5.753 and the p-value is 0.000. These results show that Payment Process Efficiency play a role as variables strong mediation in connection between Speed Transactions and Effectiveness Payment Bill . In a way theoretical , findings This support draft efficiency operationally as stated by (Barry, 2017) , that improvement speed of work process can increase performance organization through process efficiency . In study this , speed transaction speed up settlement payment , reduce delay administration , as well as expedite channel payment so that increase efficiency of the payment process and ultimately impact on effectiveness payment bill .

Research result This in line with study previously stated that speed digital transactions are capable increase effectiveness operational through improvement efficiency of the payment process . This reinforced by values influence No direct of 0.281, which is more big compared to influence direct of 0.135. Condition the show that Payment Process Efficiency is mechanism main in mediate influence Speed Transaction to Effectiveness Payment Bill . Connection the supported by speed settlement transactions , minimum process delays , and accuracy time confirmation capable transactions speed up settlement payment as well as reduce obstacle administration . In a way practical , company need increase speed transaction through optimization system payments , business process integration , and monitoring channel transaction in a way periodically to ensure efficiency of the payment process Keep going increase and provide impact to effectiveness payment bill . Based on results Therefore , hypothesis H9 is accepted , which means Payment Process Efficiency capable mediate in a way positive and significant influence Speed Transaction to Effectiveness Payment Bill .

c. Hypothesis 10

H10: Data Accuracy (X3) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z).

Test results show that Data Accuracy (X3) has an effect positive and significant to Effectiveness Payment Bill (Y) via Payment Process Efficiency (Z), with The t-statistic value is 5.347 and the p-value is 0.000. These results show that Payment Process Efficiency play a role as variables strong mediation in connection between Data Accuracy and Effectiveness Payment Bill . In a way theoretical , findings This support (McLean, 2003) explain that quality accurate and reliable information reliable capable increase performance system through operational process improvements . In study This , data accuracy helps minimize input errors , nominal discrepancies , and errors administration so that the verification and payment process become more efficient and ultimately increase effectiveness payment bill .

Research result This in line with study previously stated that good data quality capable increase effectiveness operational through improvement efficiency of the payment process . This reinforced by values influence No direct of 0.236, which is more big compared to influence direct of 0.167. With Thus , Payment Process Efficiency is mechanism main in mediate influence Data Accuracy against Effectiveness Payment Bill . Connection the supported by the lack of data errors , billing data accuracy , and validation automatic in capable system speed up the payment process as well as reduce error administration . In a way practical , company need guard data quality through optimization validation automatic , SAP/ERP integration , and supervision regarding the data input and verification process to ensure efficient payment processes the more increase and provide impact positive to effectiveness payment bill . Based on results Therefore , the hypothesis H10 is accepted , which means Payment Process Efficiency capable mediate in a way positive and significant influence Data Accuracy against Effectiveness Payment Bill .

CONCLUSIONS

Based on the results of the direct and indirect effect tests, this study concludes that the e-billing system, transaction speed, and data accuracy play important roles in improving payment process efficiency and bill payment effectiveness in the manufacturing companies examined. The findings show that all direct relationships proposed in the research model are positive and statistically significant. The e-billing system has a significant positive effect on payment process efficiency, indicating that the implementation of an integrated digital billing system can support a more efficient payment workflow. Transaction speed and data accuracy also contribute significantly to payment process efficiency, showing that timely transaction processing and reliable financial information are important elements in completing payment activities effectively. The study also finds that the e-billing system, transaction speed, and data accuracy have significant positive direct effects on bill payment effectiveness. Among the direct relationships, payment process efficiency demonstrates the strongest effect on bill payment effectiveness. This finding indicates that the effectiveness of payment activities is closely related to how efficiently the payment process is managed, rather than being determined only by the availability of digital technology. Therefore, improvements in payment procedures, verification, transaction processing, and information management are important for achieving better payment outcomes.

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The indirect-effect analysis further demonstrates that payment process efficiency significantly mediates the relationships between the e-billing system, transaction speed, data accuracy, and bill payment effectiveness. The significant indirect effects indicate that the benefits of digital billing technology and operational improvements can be realized more effectively when they are translated into an efficient payment process. This finding supports the view that information technology can create organizational value through improvements in business processes (Jianping, 2016); (Aydiner, 2019). Overall, the findings indicate that improving bill payment effectiveness requires an integrated approach. Manufacturing companies should not focus solely on adopting an e-billing system, but should also pay attention to transaction processing speed, data accuracy, and the efficiency of the payment workflow. The results provide empirical support for the importance of business process efficiency as a mechanism connecting information technology and operational factors with payment effectiveness. This conclusion is also consistent with previous studies showing that information technology capabilities can contribute to organizational performance when they are supported by effective and agile business processes.

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