Evaluation of the Efficiency and Effectiveness of Working Capital Management Before and During the Implementation of Digital Invoicing: Evidence from PT XYZ

THESIS

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We hereby declare that this Thesis is from student's own work, has been read and presented to Institut IPMI Board of Examiners, and has been accepted as part of the requirements needed to obtain a Master of Business Administration Degree and has been found to be satisfactory.

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NON-PLAGIARISM DECLARATION FORM

This Thesis is a presentation of our original research work. Wherever contribution of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions.

Also, this work is being submitted in partial fulfillment of the requirements for the Master of Business Administration degree and has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Jakarta, 16 October 2026



Rahayu Eko Tintriyaningsih

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ABSTRACT

Digital Invoicing (DI) has become an important component of digital transformation aimed at improving working capital management (WCM) in manufacturing companies. By digitalizing invoicing processes, companies can accelerate billing, improve receivables collection, and strengthen cash flow. This study analyzes and evaluates the association between DI implementation and the efficiency and effectiveness of WCM at PT XYZ, an Indonesian flour manufacturing company. Before DI implementation, the company faced liquidity constraints, with a Current Ratio (CR) of 0.81 and a Quick Ratio (QR) of 0.38 at the end of 2024. Approximately 83% of sales were conducted on credit, while the manual invoicing process required an average of 5.0 days from invoice creation to delivery. Monthly secondary financial data covering 11 months before DI implementation (February–December 2024) and 11 months during the DI implementation period (February–December 2025) were analyzed using the Shapiro–Wilk test, paired-sample t-test, and Wilcoxon signed-rank test, as appropriate. Effect sizes and 95% confidence intervals were also assessed to evaluate practical significance. The results show significant reductions in Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), and Average Collection Period (ACP), indicating improvements across several WCM components. ACP decreased from 38.73 to 34.18 days ($p = 0.005$; $r = 0.849$), representing a large effect and the improvement most closely associated with DI through faster invoicing and receivables collection. RMCP decreased from 63.82 to 38.82 days ($p = 0.035$; $d = 0.736$), WPCP from 5.91 to 4.18 days ($p = 0.004$; $d = 1.111$), and FGCP from 3.91 to 3.00 days ($p = 0.024$; $d = 0.800$). PDP also decreased from 92.45 to 63.27 days ($p = 0.026$; $d = 0.789$), which may reduce cash-flow flexibility and partly offset improvements in other WCM components. CR improved significantly ($p = 0.003$; $|d| = 1.169$), while QR increased descriptively from 0.374 to 0.410 but did not improve significantly ($p = 0.166$; $|d| = 0.451$). The Cash Conversion Cycle (CCC) decreased from 19.91 to 16.91 days, but the change was not statistically significant ($p = 0.638$; $d = 0.146$). Overall, the findings indicate that DI was most closely associated with improvements in receivables collection, while broader WCM improvements were supported by complementary operational and financial practices. The absence of a significant CCC improvement demonstrates that gains in individual WCM components can be offset by changes in other components. Therefore, maximizing the benefits of DI requires integrated management of receivables, inventory, procurement, payables, and cash flow, supported by adequate cash-based liquidity buffers.

Keywords: Digital Transformation, Digital Invoicing; Working Capital Management, Cash Conversion Cycle

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CHAPTER I
INTRODUCTION

1.1. Background

In today's increasingly competitive and dynamic business environment, efficient working capital management (WCM) has become a fundamental element in sustaining business operations and ensuring long-term profitability. WCM involves the control and optimization of a company's current assets and liabilities, including inventory, accounts receivable, accounts payable, and cash balances. It plays a vital role in maintaining liquidity, enhancing operational efficiency, and ensuring overall financial stability (Mere, 2025).

Effective WCM is fundamental to the operational sustainability and financial stability of manufacturing firms. Working capital functions as the operational driving force of a firm, as its adequacy and circulation determine the continuity of production and day-to-day business activities. Inefficiencies in working capital circulation can directly disrupt operational performance and weaken financial stability (Soeprihanto, 1996).

Furthermore, effective WCM encompasses several aspects of short-term financial management, including maintaining adequate cash levels, converting short-term assets such as accounts receivable and inventory into cash, and controlling outgoing payments to vendors and other stakeholders. This requires coordinated management of credit policies, receivable collection, inventory control, and payable obligations (Clayman et al., 2012).

In recent years, digital transformation (DT) has emerged as a strategic necessity across industries to enhance operational efficiency, improve service quality, and strengthen financial performance. Empirical evidence suggests that DT improves operational effectiveness, transaction reliability, and financial resilience (Budiyatno, 2022). Moreover, DT tends to have a more immediate and sustained impact on operating performance than on financial performance, as improvements in operational processes are generlly easier to achieve than financial outcomes (Guo & Xu, 2021).

These findings provide a conceptual foundation for examining DT initiatives in manufacturing firms, particularly those aimed at improving efficiency and effectiveness WCM.

Background PT XYZ

PT XYZ, established in 2011, has evolved from a flour mill into a food ingredient manufacturer, becoming one of the five largest flour producers in Indonesia and a leader in innovation for specialty flour products.

PT XYZ is serving industrial and retail customers through integrated production and distribution activities. The company is a pioneer in high-nutrition flour products in Indonesia and operates within a complex supply chain involving raw material procurement, processing, packaging, warehousing, and nationwide distribution.

As a manufacturing firm with high operational intensity, PT XYZ relies heavily on the efficient and effective coordination of inventory, receivables, payables, and logistics to maintain operational continuity and financial stability. In 2024, approximately 83% of the company's revenue was generated from credit sales, highlighting the critical importance of effective receivables management in supporting cash flow and working capital performance.

At the end of December 2024, PT XYZ recorded a current ratio of 0.8, as illustrated in Figure 1.1, indicating a liquidity-constrained financial structure.

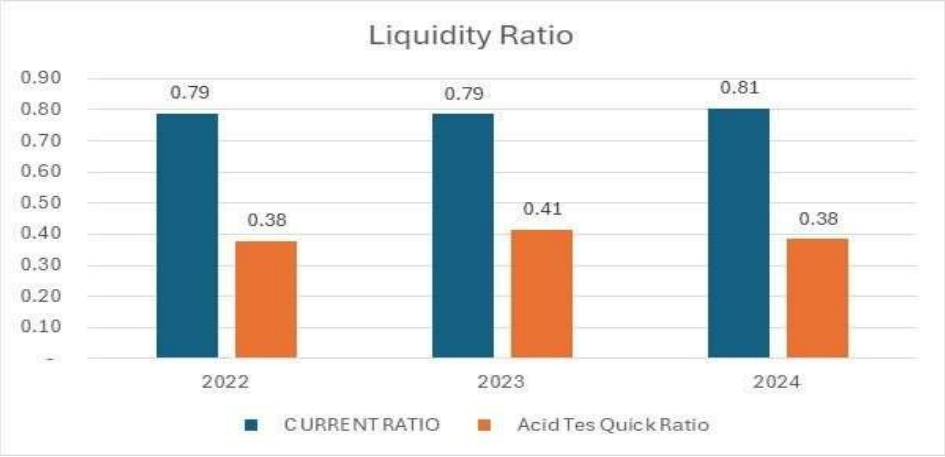

Figure 1.1. Liquidity Ratio

Source : Management Report 2023 to 2024

Liquidity remained relatively stable but below the ideal benchmark. The current ratio ranged from 0.79 to 0.81 during the period 2022–2024, with a slight increase to 0.81 in 2024; however, it remained below the generally accepted benchmark of 1.0. The quick ratio further reflects liquidity constraints, with values of 0.38 in 2022, 0.41 in 2023, and 0.38 in 2024. These figures indicate limited availability of highly liquid assets to meet short-term obligations.

Overall, this condition exposes the firm to elevated liquidity risk, as its ability to convert assets into cash in a timely manner remains limited. This increases the company's dependence on efficient WCM to sustain operations.

Prior to 2025, PT XYZ relied on manual invoicing processes, including printed invoices and physically delivered tax documents.

Table 1.1. Invoice processing flow

Process	2024 Distributor (59%)	Industry (41%	Average
Invoice Creation das	2.0	4.9	3.2
Invoice Delivery days	1.8	1.8	1.8
Total	3.8	6.7	5.0

Table 1.1. Presents the invoice processing flow at PT XYZ. Prior to the implementation of Digital Invoicing, PT XYZ the manual invoicing process required an average of 5.0 days from invoice creation to invoice delivery, comprising 3.8 days for distributor customers (59% of sales) and 6.7 days for industrial customers (41% of sales). These delays postponed customer billing, extended the Average Collection Period (ACP), slowed cash inflows, and increased working capital requirements. This condition also increases the firm's vulnerability to an extended cash conversion cycle (CCC).

Figure 1.3. The circulation of working capital in PT XYZ begins with cash used to purchase raw materials, which are then converted into work-in-process and finished goods through production. These goods are sold—often on credit—resulting in accounts receivable rather than immediate cash inflows. The cycle is completed when receivables are collected and converted back into cash (Soeprihanto, 1996).

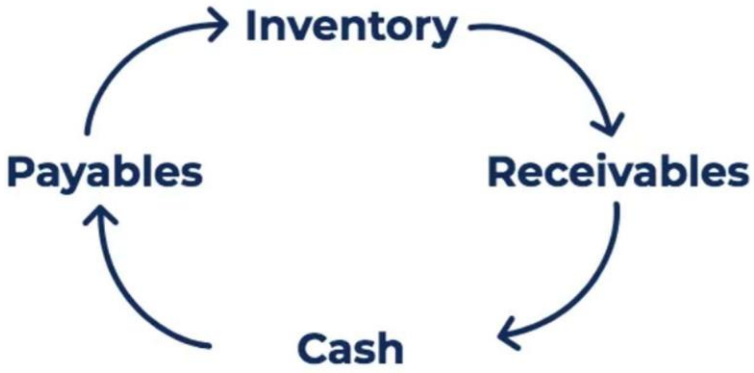

Figure 1.2. The Circulation of Working Capital in Manufacturing Firm

Source : CFI, 2019

This process underscores the critical role of accounts receivable management in achieving working capital efficiency. Delays in receivable collection prolong the operating cycle and extend the CCC, increasing reliance on external financing and heightening liquidity risk.

Within this framework, PT XYZ, in 2025, focused on optimizing the key components of WCM, including inventory conversion efficiency across raw materials, work-in-process, and finished goods; receivables collection efficiency, as measured by the Average Collection Period (ACP); payables management efficiency, as reflected by the Payable Deferral Period (PDP); and overall working capital effectiveness, as monitored through liquidity ratios. To achieve these objectives, the company implemented Digital Invoicing (DI) in January 2025. In parallel, management introduced improvements to its collection and payment policies to strengthen receivable collection discipline and optimize supplier payment practices.

1.2. Previous Studies

Previous studies have examined the impact of DT on firm performance from different perspectives. Arfian (2024) analyzed financial performance before and during DT in the healthcare sector and found that liquidity ratios, such as the cash ratio and current ratio, improved significantly during implementation (p-value < 0.05). However, activity ratios, including total asset turnover and inventory turnover, did not show

significant improvement (p-value > 0.05). These findings suggest that while DT may enhance liquidity conditions, it does not necessarily lead to improvements in operational efficiency.

Similarly, Guo and Xu (2021) investigated the effect of DT on firm performance using panel data from manufacturing firms and found that DT significantly improves operating performance, while its impact on financial performance follows a U-shaped relationship due to initial implementation costs. This indicates that DT tends to deliver immediate operational efficiency gains, whereas financial performance improvements are realized over a longer period.

While these studies provide important insights, they remain limited in explaining the specific mechanisms through which DT affects short-term financial efficiency and liquidity risk. In particular, prior research predominantly focuses on aggregate financial ratios or overall firm performance, without examining the detailed components of WCM that directly drive cash flow dynamics.

Therefore, there is a research gap in understanding how DT—specifically DI as a financial process innovation—affects key working capital components, including inventory conversion period (ICP), average collection period (ACP), payable deferral period (PDP), and the cash conversion cycle (CCC). Addressing this gap is particularly important for firms operating under liquidity constraints, where improvements in cash flow timing and working capital efficiency are critical for financial sustainability.

This study aims to fill this gap by providing a more granular and empirical analysis of the efficiency and effectiveness of WCM before and during the implementation of DI at PT XYZ.

1.3. Problem Identification

PT XYZ operates under a liquidity-constrained financial structure, as reflected in its current ratio below 1.0 and consistently low quick ratio over the period 2022–2024. This condition indicates limited availability of liquid assets to meet short-term obligations and increases the firm’s dependence on efficient WCM to sustain daily operations. Under such conditions, inefficiencies in the cash conversion cycle (CCC),

particularly in accounts receivable collection, can significantly disrupt cash flow stability and heighten liquidity risk.

Prior to 2025, the company relied on manual invoicing processes, including printed invoices and physically delivered tax documents. These practices contributed to delays in invoice receipt, prolonged accounts receivable collection periods, frequent disputes, and limited transparency in billing processes. As a result, the receivable conversion process became inefficient, extending the CCC and weakening overall working capital performance.

To address these challenges, PT XYZ implemented a Digital Invoicing (DI) system in January 2025, integrated with its B2B Online Ordering System. This initiative supports the company's objective of improving its Current Ratio (CR) to 1.0 by the end of 2025 through accelerating invoice delivery, improving billing accuracy, enhancing transaction transparency, and ultimately shortening the Average Collection Period (ACP). These improvements are expected to enhance cash flow, shorten the Cash Conversion Cycle (CCC), and strengthen overall working capital management.

From an operational efficiency perspective, Digital Invoicing is expected to streamline invoice processing and receivable collection activities, thereby reducing the ACP and improving the efficiency of the CCC. Through greater information availability and process integration, the system may also indirectly improve inventory management and payment cycles. However, the extent to which these operational improvements have been achieved has not yet been empirically evaluated.

The effectiveness of working capital management should be assessed by its ability to maintain adequate liquidity for meeting the company's short-term financial obligations. Accordingly, the success of Digital Invoicing should be evaluated not only through improvements in operational cycle indicators but also through its contribution to liquidity performance, as reflected in the Current Ratio and Quick Ratio. Because these liquidity measures may also be affected by other operational and financial policies, empirical analysis is required to determine whether the implementation of Digital Invoicing has contributed to improving the overall effectiveness of working capital management.

Therefore, this study seeks to evaluate whether the implementation of Digital Invoicing at PT XYZ has improved both the efficiency of working capital management—through reductions in the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Average Collection Period (ACP), Payable Deferral Period (PDP), and Cash Conversion Cycle (CCC)—and the effectiveness of working capital management, as reflected by improvements in the company's liquidity performance, particularly the Current Ratio and Quick Ratio.

1.4. Research Question

Based on the problem identification described above, this study addresses the following research question:

1. How is the efficiency level of managing Raw Material before and during DI implementations?
2. How is the efficiency level of managing Work in Process before and during DI implementations?
3. How is the efficiency level of managing Finished Goods before and during DI implementations?
4. How is the efficiency level of managing Accounts Receivable before and during DI implementations?
5. How is the efficiency level of managing Accounts payable before and during DI implementations?
6. How is the efficiency level of managing CCC before and during DI implementations?
7. How is the effectiveness level of WCM before and during DI implementations reflected by the company's current ratio?
8. How is the effectiveness level of WCM before and during DI implementations reflected by the company's quick ratio?

1.5. Research Objectives

Based on the formulation of the research question that has been mentioned, the objectives of this study are:

1. To evaluate the efficiency level of managing raw material before and during DI implementations?
2. To evaluate the efficiency level of managing work in process before and during DI implementations?
3. To evaluate the efficiency level of managing finished goods before and during DI implementations?
4. To evaluate the efficiency level of managing Accounts Receivable before and during DI implementations?
5. To evaluate the efficiency level of managing Accounts payable before and during DI implementations?
6. To evaluate the efficiency level of managing CCC before and during DI implementations?
7. To evaluate the effectiveness level of WCM before and during DI implementations reflected by the company's current ratio?
8. To evaluate the effectiveness level of WCM before and during DI implementations reflected by the company's quick ratio?

1.6. Research Benefit

This study provides both theoretical and practical contributions.

1. Theoretical Contribution

   From a theoretical perspective, this study reinforces the relevance of working capital management theory by empirically examining the relationship between Digital Invoicing (DI) implementation and improvements in both the efficiency and effectiveness of working capital management. Regarding efficiency, the study evaluates the impact of DI on the Cash Conversion Cycle (CCC) and its key components, including inventory management, accounts receivable management, and accounts payable management. Regarding effectiveness, it

extends the literature by examining whether improvements in operational efficiency are reflected in enhanced liquidity performance, as measured by the Current Ratio and Quick Ratio. In doing so, the study contributes to the digital transformation literature by demonstrating how targeted digital interventions in financial operations can improve not only operational processes but also broader financial outcomes within manufacturing firms.

2. Practical Contribution

   From a practical standpoint, the findings provide valuable insights for manufacturing firms operating under conditions of liquidity constraints and high leverage. The study demonstrates that Digital Invoicing can serve not only as an operational efficiency tool by accelerating invoice processing, improving receivable collection, and optimizing the cash conversion cycle, but also as a strategic mechanism for enhancing the effectiveness of working capital management through stronger liquidity performance. These findings provide managerial implications for improving billing processes, accelerating cash inflows, maintaining adequate liquidity to meet short-term obligations, and strengthening overall working capital performance and financial resilience.

1.7. Scope and Limitations of the Study

This study focuses on a single manufacturing firm, PT XYZ, and evaluates the efficiency and effectiveness of working capital management before and during the implementation of the digital invoicing (DI) system. The year 2024 is defined as the before-implementation period, while 2025 represents the during-implementation period.

The evaluation of efficiency is limited to changes in the cash conversion process, as measured by the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Average Collection Period (ACP), Payable Deferral Period (PDP), and the overall Cash Conversion Cycle (CCC). Meanwhile, the evaluation of effectiveness is limited to the

achievement of the company's liquidity objectives, as reflected by the Current Ratio (CR) and Quick Ratio (QR).

The study examines whether the implementation of DI is associated with improvements in these efficiency and effectiveness indicators but does not attempt to isolate the effects of other operational or financial policies that may also influence working capital performance and liquidity.

1.8. Structure of the Thesis

This thesis consists of five chapters and references.

Chapter I – INTRODUCTION

This chapter presents the background of the study, problem identification, research questions, research objectives, research scope, significance of the study, and the structure of the thesis. It explains the importance of Digital Invoicing as a digital transformation initiative for improving the efficiency and effectiveness of working capital management at PT XYZ.

Chapter II – LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This chapter reviews the theoretical foundations related to working capital management, Digital Invoicing, digital transformation, the Cash Conversion Cycle (CCC), liquidity management, and the efficiency and effectiveness of working capital management. It also presents relevant empirical studies, develops the conceptual framework, and formulates the research hypotheses.

Chapter III – RESEARCH METHODOLOGY

This chapter describes the research design, research object, data sources, population and sample, operational definitions of variables, data collection methods, and statistical analysis techniques. The analysis includes descriptive statistics, the Shapiro–Wilk normality test, paired t-tests, and the Wilcoxon signed-rank test to evaluate differences in working capital management before and during the implementation of Digital Invoicing.

Chapter IV – RESULT AND DISCUSSION

This chapter presents the descriptive analysis and statistical findings regarding the efficiency and effectiveness of working capital management before and during the implementation of Digital Invoicing. The analysis covers the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Average Collection Period (ACP), Payable Deferral Period (PDP), Cash Conversion Cycle (CCC), Current Ratio (CR), and Quick Ratio (QR). The findings are interpreted and discussed by comparing them with relevant theories and previous studies to evaluate the contribution of Digital Invoicing to working capital management.

Chapter V – CONCLUSION AND RECOMMENDATION

This chapter summarizes the research findings and presents conclusions corresponding to each research objective. It also discusses the theoretical and managerial implications of the study, identifies the limitations of the research, and provides recommendations for PT XYZ and future research on Digital Invoicing and working capital management.

References

This section contains all references cited throughout the thesis, presented in accordance with the required academic citation style.

CHAPTER II
LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Introduction

This chapter presents the theoretical and empirical foundations underlying this research framework. Its primary objective is to support the analysis and evaluation of the efficiency and effectiveness of working capital management before and during the implementation of Digital Invoicing (DI) at PT XYZ. The discussion integrates relevant theories, conceptual models, and prior empirical studies that explain the relationships among the key variables within the context of working capital management.

This chapter has three main objectives. First, it establishes a theoretical foundation by reviewing key concepts related to working capital management, the Cash Conversion Cycle (CCC) and its core components—the Inventory Conversion Period (ICP), Average Collection Period (ACP), and Payable Deferral Period (PDP), accounts receivable management, financial and liquidity risk, and digital transformation (DT). Second, it synthesizes findings from previous empirical studies to identify consistencies, differences, and research gaps that justify the need for this study. Third, it develops a conceptual framework and research hypotheses to be tested through quantitative analysis.

The discussion begins with an overview of working capital management, emphasizing its role in ensuring operational continuity, maintaining adequate liquidity, and supporting financial stability. It then examines the Cash Conversion Cycle as a comprehensive measure of working capital efficiency, highlighting how inventory management, receivables collection, and payables management jointly influence cash flow performance. In addition, the chapter discusses the Current Ratio and Quick Ratio as indicators of the effectiveness of working capital management in meeting the company's short-term financial obligations. Furthermore, the chapter explores liquidity risk, financial risk, and Digital Transformation (DT), particularly Digital Invoicing

(DI), as a targeted operational intervention that enhances billing efficiency, improves cash flow visibility, and potentially strengthens both the efficiency and effectiveness of working capital management.

Following the theoretical review, each key construct—including working capital management, the Cash Conversion Cycle and its components, liquidity performance, accounts receivable management, liquidity and financial risk, and Digital Invoicing—is discussed in detail and supported by relevant empirical evidence. This synthesis clarifies the interrelationships among the variables and positions Digital Invoicing as a mechanism that may directly and indirectly improve both operational efficiency and liquidity effectiveness.

The chapter concludes with the development of a conceptual framework and the formulation of research hypotheses, which together provide the foundation for the empirical analysis presented in Chapter III.

2.2. Definition Efficiency and Effectiveness

Peter F. Drucker emphasizes that management performance depends not only on efficiency but primarily on effectiveness. Efficiency refers to doing things right—optimizing processes and resource use—whereas effectiveness refers to doing the right things, that is, choosing goals and activities that genuinely contribute to organizational results. In this sense, effectiveness is outcome-oriented—ensuring that decisions lead to meaningful results—whereas efficiency is process-oriented—ensuring that activities are carried out with optimal use of resources. An executive may be highly efficient, but without focusing on the right priorities, such efficiency does not necessarily translate into organizational success. (Drucker, 1985)

In the context of working capital management, efficiency is reflected in indicators such as inventory turnover, receivables collection period, and payables deferral, which show how economically resources are utilized. Effectiveness, however, is evaluated through the degree to which these policies support broader objectives like liquidity, profitability, and risk reduction. Thus, this study uses Drucker's efficiency–effectiveness distinction as a conceptual basis for assessing whether operational

improvements in working capital processes translate into meaningful financial performance.

In the context of educational management, Husman distinguishes clearly between efficiency and effectiveness. **Efficiency** refers to the degree of resource optimization, where inputs are utilized to generate maximum output with minimum cost and time. This is reflected in the acceleration and streamlining of operational processes, such as improved cycle time in delivering educational programs. **Effectiveness**, on the other hand, relates to the extent to which intended outcomes and long-term impacts are achieved. It focuses on whether educational outputs translate into meaningful results, such as positive changes in student behavior, enhanced competencies, and improved quality of graduates who can contribute to society. (Husman, 2011)

Thus, while efficiency emphasizes *how well processes are executed*, effectiveness emphasizes *whether the desired goals and impacts are ultimately achieved*.

2.3. Working Capital

Every company always needs working capital to finance its daily operations, for example, to provide advances for purchases, pay labor wages, employee salaries, etc., where the money or funds that have been spent are expected to return relatively quickly through the sale of its products.

The definition of working capital can be presented through several concepts (Soeprihanto, 1996; Kasmir, 2010; Surindra et al., 2020):

1. Quantitative concept: This refers to the amount of funds invested in current assets such as cash, receivables, inventory, and prepaid expenses.
2. Qualitative concept: This refers to the amount of funds invested in current assets that can actually be used to finance the company's operations or after deducting current liabilities.
3. Functional concept: This refers to the amount of capital based on the function of the funds to generate income. Therefore, the amount of working capital includes:

a. The amount of cash

b. The amount of inventory

c. The amounts of receivables (less profits)

d. The amount of funds invested in fixed assets

The goal of effectively working capital management is to ensure that company has adequate ready access to the funds necessary for day-to-day operating expenses, while at the same time making sure the company assets are invested in the most productive way (Clayman et al., 2012).

Working capital management involves finding the optimal levels for cash, marketable securities, accounts receivable, and inventory, and then financing that working capital management can generate considerable amount of cash. (Brigham & Houston, 2019)

In manufacturing firms, where the operating cycle involves substantial investment in inventories and trade receivables, the effectiveness of working capital management becomes a critical determinant of both operational sustainability and financial resilience.

The circulation of working capital follows a continuous process can be illustrated in Figure 2.1.

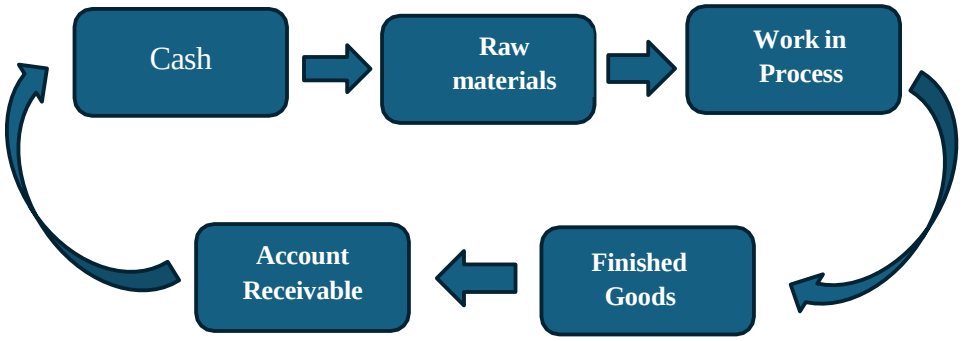

Figure 2.1. The circulation of working capital follows a continuous process

Source : Brigham & Houston (2019)

The speed of this circulation determines the firm's ability to internally finance its operations without excessive reliance on external funding (Ross et al., 2022).

The purpose of working capital management is to ensure a company has sufficient liquidity to meet short-term obligations and operate efficiently, while optimally utilizing working capital to support profitability. (Brigham & Houston, 2019)

2.4. Cash Conversion Cycle

The cash conversion cycle (CCC) or Cash Cycle (CC) is a comprehensive measure of working capital performance because it captures the time required to convert operational investment into cash (Richards & Laughlin, 1980).

The cash Conversion Cycle is calculated as:

Cash Conversion Cycle	=	**Inventory Conversion Period**	+	**Average Collection Period**	-	**Payable Deferral Period**

(Brigham & Houston, 2019)

Where:

- Inventory Conversion Period (ICP) measures inventory utilization efficiency
- Average Collection Period (ACP) measures receivable collection efficiency
- Payable Deferral Period (PDP) measures the firm's payment deferral period

A shorter CCC indicates faster internal cash generation, lower external financing requirements, and stronger liquidity (Deloof, 2003). Moreover, the impact of CCC on firm performance varies across business cycles, show that the significance of efficient inventory management and accounts receivables conversion periods increase during periods of economic downturns, resulting that active working capital management matters and, thus, should be included in firms' financial planning. (Enqvist et al., 2014).

According to Riyanto, B. (2016) in manufacturing companies (factories), inventories are generally classified into three main categories:

1. Raw Material Inventory
2. Work in process Inventory
3. Finished Goods Inventory

Brigham and Houston (2018) explain that the inventory conversion period represents the average number of days required for inventory to be converted into sales. In manufacturing firms, this period reflects how efficiently materials are transformed through production stages until they become finished products ready for sale. In line with Riyanto (2016), inventory within the production cycle can be classified into three main categories: raw materials, work in process, and finished goods. Therefore, the

inventory conversion period may be decomposed into three sequential components, namely the raw material conversion period, work-in-process conversion period, and finished goods conversion period, each representing a specific operational stage before cash inflow is generated.

Inventory Conversion Period	=	**Raw material Conversion Period**	+	**Work in process Conversion Period**	+	**Finished Goods Conversion period**

(Brigham & Houston, 2019), (Riyanto, 2016)

The raw material conversion period (RMCP) indicates the average time raw materials remain in storage before entering production. The work-in-process conversion period (WPCP) reflects the production time required to transform raw materials into semi-finished products. Meanwhile, the finished goods conversion period (FGCP) measures the average time finished products remain in inventory before being sold to customers. (Riyanto, 2016). Together, these three components form the inventory cycle, which significantly affects the length of the cash conversion cycle and ultimately influences working capital efficiency.

Defining the operating and cash cycle

- The ***operating cycle*** is the time we acquire some inventory to the time we collect the cash. Based on the definition, the operating cycle is the sum of inventory and accounts receivable period (Ross et al., 2022).

Operating cycle = Inventory Period (ICP) + Accounts Receivable Period (ACP)

- The ***cash cycle*** is the number of days that pass before we collect the cash from a sale, measure from when we pay for the inventory (Ross et al., 2022).

Cash cycle (CCC) = Operating cycle - Accounts Payable Period (PDP)

Figure 2.2 illustrates Operating and cash cycle. The operating cycle is the period from inventory purchase until the receipt of cash. (Operating cycle may not include the time from placement of the order until arrival of the stock). The cash cycle is the period from when cash is paid out to when cash is received (Ross et al., 2022).

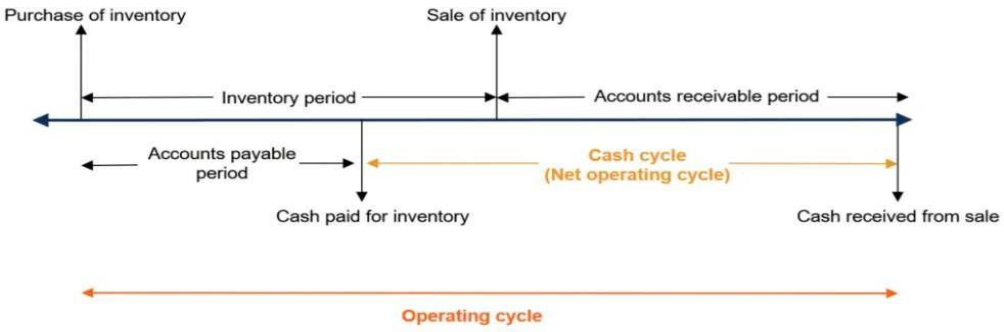

Figure 2.2. Operating and cash cycle in manufacturing company
Source : Ross et al. (2022)

Building on this concept, the cash cycle (CCC) integrates both cycles by capturing the net time interval between cash outflows and cash inflows, after considering payable deferral. It therefore serves as a key indicator of working capital management efficiency.

In the context of PT XYZ, a shorter CCC indicates that the company requires less time to convert its investment in inventory and receivables into cash inflows, thereby enhancing liquidity and reducing dependence on external financing.

2.5. Financial Risk and Liquidity Risk

Financial risk in short-term corporate finance primarily arises from a firm's inability to meet its current obligations when they fall due. This condition, commonly referred to as **liquidity risk**, becomes more critical in firms with high leverage and low current ratios because delayed cash inflows immediately increase dependence on external financing (Brigham & Ehrhardt, 2017).

Liquidity is the extent to which a company can meet its short-term obligations using assets that can be readily transformed into cash. When we evaluate the liquidity of an asset, we focus on two dimensions: the type of asset and the speed at which the asset can be converted to cash, by sale of financing. For companies that have the luxury of large excesses of cash, liquidity is typically taken for granted, and the focus is on putting the excess liquidity to its most productive use. On the other hand, when a company faces tighter financial situation, it is important to have effective liquidity management to ensure solvency (Clayman et al., 2012).

Liquidity management refers to the ability of an organization to generate cash when and where it is needed. The challenge of managing liquidity includes developing, implementing, and maintaining liquidity policy. To do this effectively, a company manages all its key resources of liquidity efficiently. These key resources generally include the primary sources of liquidity, such as cash balance, and secondary sources of liquidity, such as selling assets (Clayman et al., 2012).

The implementation of DI at PT XYZ introduces a process innovation that can improve working capital efficiency without increasing financial risk. By accelerating billing processes, improving accuracy, and enhancing receivable monitoring, DI supports faster cash collection and reduces reliance on external financing. This is particularly important for PT XYZ, as faster cash recovery can lower liquidity pressure, reduce refinancing risk, and strengthen overall financial stability.

2.6. Digital Transformation

Business process digitalization (BPD) enhances Working Capital Management (WCM) by improving data accuracy, automating routine tasks, and fostering operational synergy (Wang & Nie, 2025).

For manufacturing firms operating under credit sales, accounts receivable represents a dominant component of working capital. The efficiency of receivable management is influenced by invoice accuracy, billing cycle speed, transaction transparency, dispute frequency, and monitoring capability. Manual billing processes are associated with delivery delays, document mismatches, and reconciliation problems, which prolong the collection period and increase average collection period (ACP). (Budiyatno, 2022)

DI platforms are transforming payment collection processes for businesses across industries. Traditional invoicing methods have long created significant delays between service delivery and payment receipt, placing substantial strain on business cash flow and operations. The evolution from paper-based systems to sophisticated cloud platforms represents a fundamental shift in how companies manage their financial transactions. These platforms significantly compress payment timelines by

implementing features such as automated reminders, multi-channel delivery options, embedded payment processing, and real-time tracking capabilities. (Shah, 2025)

The implementation of DI in PT XYZ marks a critical transformation in the company's billing and cash collection cycle. By enabling a faster, standardized, and real-time invoicing process, the time required for invoices to be generated, delivered, and received by customers is significantly reduced. This acceleration in the billing stage directly enhances the efficiency and controllability of the collection process.

2.7. Research Framework

Based on the literature review, this study proposes a conceptual framework that analyzes and evaluates the impact of DI implementation on working capital management performance. Figure 2.2. represent the research framework applied in this study.

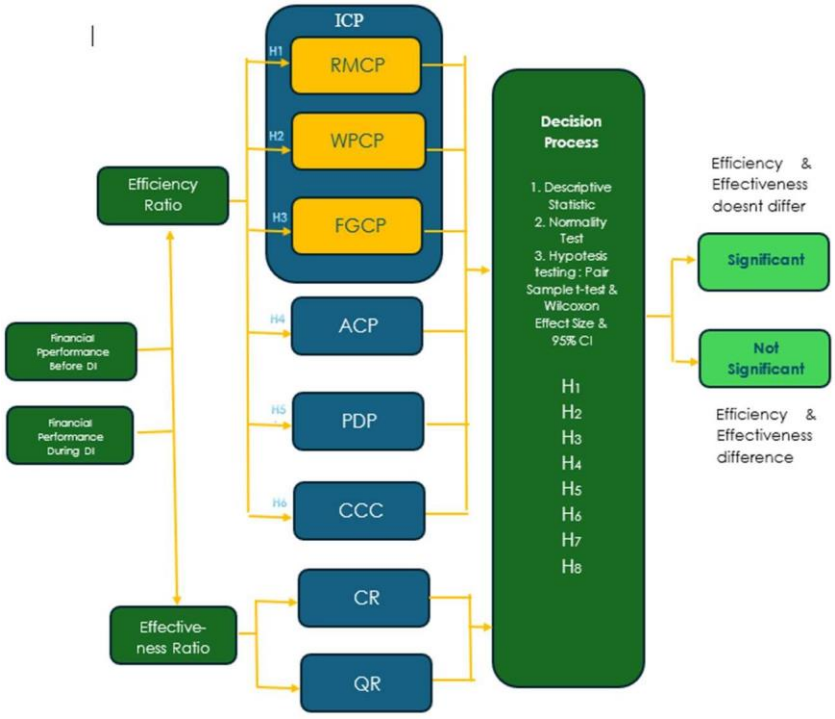

Figure 2.3 Research Framework

In this framework, DI is treated as the independent variable, representing a initiative that is expected to accelerate working capital circulation and mitigate liquidity risk.

The dependent variables in this study comprise efficiency and effectiveness indicators of working capital management. The efficiency variables are the ratios associated with the components of the cash conversion cycle (CCC), namely the raw material conversion period (RMCP), work-in-process conversion period (WPCP), finished goods conversion period (FGCP), average collection period (ACP), payable deferral period (PDP), and the overall cash conversion cycle (CCC). The effectiveness variables are represented by the current ratio (CR) and quick ratio (QR). Together, these measures are employed to assess how efficiently and effectively the firm's working capital is managed.

Hypothesis testing is conducted using a paired t-test/ Wilcoxon range test, which compares two related samples — namely, the periods before and during the implementation of DI. This method is employed to determine whether there are statistically significant differences in working capital efficiency and effectiveness between the two periods. In addition to statistical significance, effect size analysis is incorporated to evaluate the practical magnitude of the observed differences, ensuring that the findings reflect not only statistical detectability but also material business meaning.

The analysis aims to assess whether the implementation of DI leads to improvements in working capital performance, as reflected in shorter conversion periods and a more efficient and effective cash conversion cycle — with effect size estimates (Cohen's d and confidence intervals) providing a measure of how substantial these improvements are in practical terms.

2.8. Hypotheses Definition

Referring to the research framework, there are 8 hypotheses that will be tested as follows:

2.7.1. Raw material

$H_{1,0}$: The RMCP of PT XYZ during DI implementation does not differ from the RMCP before DI implementation.

$H_{1,1}$: The RMCP of PT XYZ during DI implementation differs from the RMCP before DI implementation.

2.7.2. Work in process

$H_{2,0}$: The WPCP of PT XYZ during DI implementation does not differ from the WPCP before DI implementation.

$H_{2,1}$: The WPCP of PT XYZ during DI implementation differs from the WPCP before DI implementation.

2.7.3. Finish goods

$H_{3,0}$: The FGCP of PT XYZ during DI implementation does not differ from the FGCP before DI implementation.

$H_{3,1}$: The FGCP of PT XYZ during DI implementation differs from the FGCP before DI implementation.

2.7.4. Accounts Receivable

$H_{4,0}$: The ACP of PT XYZ during DI implementation does not differ from the ACP before DI implementation.

$H_{4,1}$: The ACP of PT XYZ during DI implementation differs from the ACP before DI implementation.

2.7.5. Accounts Payable

$H_{5,0}$: The PDP of PT XYZ during DI implementation does not differ from the PDP before DI implementation.

$H_{5,1}$: The PDP of PT XYZ during DI implementation differs from the PDP before DI implementation.

2.7.6. Cash Conversion Cycle

$H_{6,0}$: The CCC of PT XYZ during DI implementation does not differ from the CCC before DI implementation.

$H_{6,1}$: The CCC of PT XYZ during DI implementation differs from the CCC before DI implementation.

2.7.7. Current Ratio

$H_{7,0}$: The CR of PT XYZ during DI implementation does not differ from the CR before DI implementation.

$H_{7,1}$: The CR of PT XYZ during DI implementation differs from the CR before DI implementation.

2.7.8. Quick Ratio

$H_{8,0}$: The QR of PT XYZ during DI implementation does not differ from the QR before DI implementation.

$H_{8,1}$: The QR of PT XYZ during DI implementation differs from the QR before DI implementation.

Eight statistical hypothesis tests were conducted to examine differences in working capital management efficiency and liquidity between the periods before and during the implementation of Digital Invoicing (DI). The significance level was set at $\alpha = 0.05$, and two-tailed p-values were used for all hypothesis tests. In addition to statistical significance, effect size estimates are incorporated to assess the practical magnitude of the differences observed, ensuring that the findings reflect not only statistical detectability but also material business meaning. This framework provides the theoretical foundation for the quantitative analysis presented in Chapter III, where the proposed relationships will be empirically examined using a paired t-test — complemented by effect size analysis (Cohen's d and 95% confidence intervals) — to compare working capital efficiency and effectiveness before and during the implementation of DI.

CHAPTER III
RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes the research methodology used to achieve the objectives of the study. It presents the research design, data collection sources and methods, population and sampling procedures, variable measurement, and data analysis techniques used to evaluate the efficiency and effectiveness of working capital management (WCM) before and during the implementation of Digital Invoicing (DI) at PT XYZ.

The analysis examines whether statistically significant differences exist in selected WCM efficiency and liquidity indicators between the pre-DI period and the period during DI implementation at PT XYZ. The monthly observations are paired by the same calendar month across the two periods to improve comparability and, to the extent possible, account for recurring seasonal patterns.

Statistical analysis was performed using IBM SPSS Statistics version 29.0. Paired-samples t-tests and Wilcoxon signed-rank tests were employed to examine the proposed hypotheses, depending on the distribution of the paired differences. Statistical significance was assessed using two-tailed tests at a 5% significance level. In addition to p-values, effect sizes and 95% confidence intervals were considered to assess the magnitude and precision of the observed changes.

As eight hypotheses are tested without formal adjustment for multiple testing, the statistical findings are interpreted as exploratory rather than confirmatory. Furthermore, the study recognizes potential limitations associated with seasonality and autocorrelation in monthly observations. Therefore, the findings are interpreted as evidence of differences between the pre-DI and during-DI periods rather than as definitive evidence that DI alone caused the observed changes.

3.2. Research Design

This study employs a quantitative approach using a quasi-experimental research design with a before-and-during comparison. The design compares selected working capital management (WCM) efficiency and liquidity indicators of PT XYZ across two periods: (1) the before-implementation period, when the invoicing process was predominantly manual, and (2) the period during Digital Invoicing (DI) implementation.

The quasi-experimental design is appropriate because the study examines the same organizational unit under different process conditions without random assignment or a separate control group. The comparison is conducted at the firm level using monthly aggregated financial data, particularly credit sales and related working capital accounts and activities.

To improve comparability between the two periods, monthly observations are paired by the same calendar month. Accordingly, each month in the before-DI period is compared with the corresponding month during the DI implementation period. This approach helps account, to the extent possible, for recurring calendar-month and seasonal effects. However, because the study includes only one year of observations in each period, it cannot fully isolate seasonal effects or year-specific factors. In addition, the monthly observations may exhibit autocorrelation, which is not explicitly modeled in the statistical tests applied in this study.

The design enables the study to identify and evaluate changes in WCM efficiency and liquidity indicators between the before-DI and during-DI periods while maintaining the same company, business environment, and organizational context. However, because the study does not employ randomization or a control group, and other operational, financial, and policy changes may have occurred during the study period, the observed differences cannot be attributed solely to the implementation of DI. Therefore, the findings are interpreted as evidence of changes occurring during the DI implementation period rather than definitive causal effects of DI.

3.3. Source of data

This study utilizes secondary data obtained from the financial reports and internal records of PT XYZ. The data sources include:

- Accounts receivable subsidiary ledger
- Sales transaction records
- Inventory records (raw materials, work-in-process, and finished goods)
- Accounts payable records
- Digital invoicing system database
- Financial management reports

The data was collected monthly for two observation periods: the before-DI period, covering February to December 2024, and the during-DI period, covering February to December 2025. This resulted in 11 monthly observations for each period and 22 monthly observations in total.

The monthly data were used to calculate the key working capital management and liquidity indicators examined in this study, including the Raw Material Conversion Period (RMCP), Work in Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Accounts Collection Period (ACP), Payable Deferral Period (PDP), Cash Conversion Cycle (CCC), Current Ratio (CR), and Quick Ratio (QR).

To facilitate comparison between the two periods, observations were paired by the same calendar month. For example, February 2024 was paired with February 2025, and the same approach was applied through December. This pairing was intended to improve comparability between the before-DI and during-DI periods and, to the extent possible, account for recurring monthly or seasonal patterns.

3.4. Data Collection Technique

This study employs a document analysis approach as the primary data collection technique. Relevant financial and operational data were extracted from the internal systems, financial records, and management reports of PT XYZ. The data collection

process was conducted systematically to ensure consistency and comparability between the before-DI and during-DI observation periods.

- The data used in this study consists of the following sources:
- Inventory records, including raw materials, work-in-process, and finished goods
- Accounts receivable (AR) records
- Sales transaction records
- Accounts payable (AP) records
- Digital Invoicing (DI) system database
- Financial management reports

The collected data were reviewed, organized, and processed to calculate the working capital management and liquidity indicators examined in this study, including the Raw Material Conversion Period (RMCP), Work in Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Accounts Collection Period (ACP), Payable Deferral Period (PDP), Cash Conversion Cycle (CCC), Current Ratio (CR), and Quick Ratio (QR).

Data validation was performed by cross-checking the extracted data against relevant financial management reports and supporting records. Any discrepancies identified during the validation process were reviewed and reconciled with the underlying source records before the data were included in the analysis. The same data extraction and validation procedures were applied to both observation periods to maintain consistency and comparability.

The use of document analysis is appropriate because this study relies on objective, historical financial and operational data rather than perception-based or self-reported measures. The use of actual company records enables the study to evaluate observed changes in working capital efficiency and liquidity between the before-DI and during-DI periods based on PT XYZ's recorded financial and operational performance.

Data Cleaning Procedures

The data cleaning procedure employed to ensure data reliability includes: (i) exclusion of cancelled and reversed invoices; (ii) adjustment incomplete transactions; (iii)

reconciliation of beginning and ending balances with corresponding monthly financial statements; and (iv) identification of anomalous values for sensitivity analysis.

3.5. Population and Sample

3.5.1 Population

The population of this study consists of all monthly financial and operational observations of PT XYZ that are relevant to working capital management (WCM) efficiency and liquidity. These observations encompass financial and operational activities related to inventory management, accounts receivable, accounts payable, sales, and liquidity — the data required to measure the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Accounts Collection Period (ACP), Payable Deferral Period (PDP), Cash Conversion Cycle (CCC), Current Ratio (CR), and Quick Ratio (QR). The study focuses on firm-level aggregated monthly data rather than customer- or transaction-level observations, as the objective is to evaluate changes in PT XYZ's overall working capital efficiency and liquidity between the before-DI and during-DI periods..

3.5.2 Sample

From this population, the study selected a sample of 22 monthly observations: 11 months before DI implementation (February–December 2024) and 11 months during DI implementation (February–December 2025). The same calendar months were used in both periods to control seasonality, and the equal number of observations ensures a balanced paired comparison. Monthly firm-level aggregates were used because the objective is to assess changes in overall WCM performance between the two periods, which requires comparable, equally spaced observations rather than transaction-level data.

3.6. Measurement Variables

This study consists of one independent variable and eight dependent variables.

3.6.1 Independent Variable

The independent variable in this study is the implementation of Digital Invoicing (DI) at PT XYZ, operationalized as a dummy variable representing the billing system in use during each monthly observation period:

- 0 = Manual invoicing period (before DI implementation)
- 1 = Digital invoicing period (during DI implementation)

This dummy variable serves as the grouping factor in the paired comparison, distinguishing observations before DI implementation (February–December 2024) from those during DI implementation (February–December 2025)

3.6.2 Dependent Variables

3.6.2.1. Inventory Conversion Period

According to Riyanto (2016) in manufacturing companies (factories), inventories are generally classified into three main categories: raw material inventory, work in process/ goods in process inventory and finished goods inventory.

Inventory utilization efficiency, per Brigham and Houston (2019), is measured by the **Inventory Conversion Period** (ICP):

$$ICP = \frac{Inventory}{Cost\ of\ goods\ sold\ per\ day}$$

Following Riyanto (2016), this inventory utilization efficiency can be decomposed into the following factors:

a. Raw Material Conversion Period

Efficiency Raw material measured by **Raw material conversion period** (RMCP):

$$RMCP = \frac{Raw\ material\ inventory}{Cost\ of\ goods\ sold\ per\ day}$$

(Brigham & Houston, 2019), (Riyanto, 2016)

b. Work in Process Conversion Period

Efficiency work in process measured by **Work in process conversion period** (WPCP)

$$WPCP = \frac{\text{Work in process inventory}}{\text{Cost of goods sold per day}}$$

(Brigham & Houston, 2019), (Riyanto, 2016)

c. Finished Goods Conversion Period

Efficiency finished goods measured by **Finished Goods conversion period** (FGCP)

$$FGCP = \frac{\text{Finished goods inventory}}{\text{Cost of goods sold per day}}$$

(Brigham & Houston, 2019)**,** (Riyanto, 2016)

3.6.2.2. Average Collection Period

Account receivable efficiency measured by **Average Collection Period (ACP).**

$$ACP = \frac{\text{Account Receivable}}{\text{Sales per day}}$$

(Brigham & Houston, 2019)

3.6.2.3. Payable Deferral Period

Account payable efficiency measured by **Payable Deferral Period (PDP).**

$$PDP = \frac{\text{Account Payable}}{\text{Cost of goods sold per day}}$$

(Brigham & Houston, 2019)

3.6.2.4. Cash Conversion Cycle

Cash Cycle measured by **Cash Conversion Cycle (CCC).**

$$\text{Cash Conversion Cycle} = \text{Inventory Conversion Period} + \text{Average Collection Period} - \text{Payable Deferral Period}$$

(Brigham & Houston, 2019)

Where : CCC = Cash Conversion Cycle

ICP = Inventory conversion period

ACP = Average collection period

PDP = Payable deferral period

3.6.2.5. Current ratio

Current Ratio (CR) measures the extent to which current liabilities are covered by assets expected to be converted into cash in the near future.

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liability}}$$

(Brigham & Houston, 2019)

3.6.2.6. *Quick ratio*

Quick Ratio is a stricter measure of liquidity because it excludes inventory, which may be more difficult or take longer to sell.

$$\text{Quick Ratio} = \frac{\text{Current Assets - Inventories}}{\text{Current Liability}}$$

(Brigham & Houston, 2019)

3.7. Data Analysis Method

The data analysis was performed using IBM SPSS Statistics version 29.0. The analysis employed paired-samples t-tests and Wilcoxon signed-rank tests to examine differences in the selected working capital management and liquidity indicators between the before-DI and during-DI periods. Two-tailed tests were conducted at a 5% significance level. In addition to p-values, effect sizes and 95% confidence intervals were considered to assess the magnitude and precision of the observed changes. As eight hypotheses were tested without formal adjustment for multiple testing, the statistical findings are interpreted as exploratory rather than confirmatory. The data analysis conducted through several stages:

3.7.1. Descriptive Statistics

Descriptive analysis is employed to present summary statistics, including the mean, median, minimum, maximum, and standard deviation for all variables across the before and during implementation periods. This analysis provides an initial overview of the changes in working capital performance following the implementation of DI.

3.7.2. Normality Test

Normality is assessed using the Shapiro–Wilk test applied to the paired differences between during-implementation and before-implementation values for each variable. The decision criteria are as follows:

- **p-value > 0.05** indicates that the data are normally distributed, and a paired t-test is applied.
- **p-value ≤ 0.05** indicates that the data are not normally distributed, and the Wilcoxon signed-rank test is used.

3.7.3. Hypothesis Testing

To examine whether there are significant differences between the two periods, this study employs a paired t-test for variables that meet the normality assumption, and a Wilcoxon signed-rank test for variables that do not. The paired design is appropriate because the observations are matched — the same indicators are measured across two periods (before and during DI implementation) and the objective is to compare the differences in means (or ranks) between the paired observations.

In addition to statistical significance, effect sizes are reported to assess the practical magnitude of the observed differences. For variables analyzed using the paired t-test, effect size is measured using Cohen's d, complemented by 95% confidence intervals. For variables analyzed using the Wilcoxon signed-rank test, effect size is measured using the rank-biserial correlation coefficient (r).

The decision criteria are as follows:

- **p-value < 0.05** indicates a statistically significant difference between the two periods.
- **p-value ≥ 0.05** indicates no statistically significant difference.

The paired t-test is conducted for the following variables:

- Inventory Conversion Period (ICP), decomposed into:
  - Raw material conversion period (RMCP)
  - Work in Process conversion period (WPCP)
  - Finished good conversion period (FGCP)
- Average Collection Period (ACP)
- Payable Deferral Period (PDP)
- Cash Conversion Cycle (CCC)
- Current Ratio
- Quick Ratio

3.8. Analysis and Interpretation

The statistical results are interpreted in relation to the theoretical framework and hypotheses developed in this study, by comparing the empirical findings with the theories and prior studies discussed in Chapter II. The interpretation focuses on the direction, magnitude, and statistical significance of the differences in WCM and liquidity indicators — RMCP, WPCP, FGCP, ACP, PDP, CCC, CR, and QR — between the before-DI and during-DI periods. Statistical significance is assessed using two-tailed tests at $\alpha = 0.05$, while effect sizes and 95% confidence intervals are used to evaluate the practical magnitude and precision of the observed changes.

The findings are evaluated against the theoretical expectations of working capital management, the cash conversion cycle framework, and financial risk theory. Importantly, interpretation also considers interactions among WCM components — changes in inventory conversion, receivables collection, and payable deferral jointly shape the CCC, so improvements in individual components do not necessarily translate into a significant CCC improvement. Likewise, changes in CR and QR are interpreted alongside the underlying movements in current assets and liabilities.

Because the study employs an observational before–during comparison without randomization or a control group, the observed differences are not interpreted as definitive causal effects of DI; other operational, financial, and business factors may have contributed. The findings are therefore treated as exploratory evidence of changes occurring during the DI implementation period.

Finally, the results are discussed in terms of their managerial implications for PT XYZ — including billing and collection processes, inventory management, supplier payment practices, and liquidity planning — with emphasis on the practical magnitude of changes (effect sizes and confidence intervals) rather than statistical significance alone, while acknowledging the study's methodological limitations.

3.9. Research Work Flow

Based on the theoretical framework and methodological approach outlined in the previous sections, this research workflow is designed to provide a systematic overview of the entire research process. Figure 3.1. The overall workflow of this research is illustrated in this study.

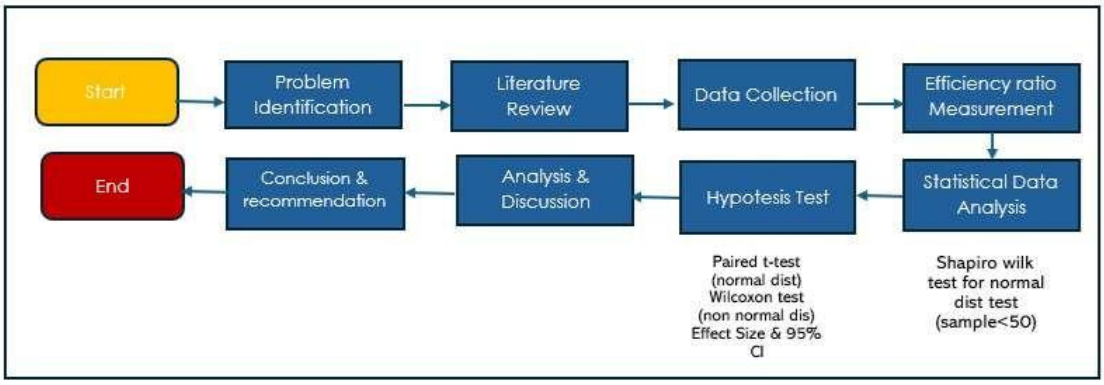

Figure 3.1. Research Workflow

Figure 3.1. The study begins with Problem Identification, followed by a Literature Review to establish the theoretical and empirical foundation. Data Collection is then conducted using relevant financial and operational records from PT XYZ, followed by the calculation of the selected WCM and liquidity indicators.

The Data Analysis stage consists of descriptive analysis and normality testing using the Shapiro–Wilk test. Based on the distribution of the paired differences, hypothesis testing is conducted using either the paired-samples t-test for normally distributed data or the Wilcoxon signed-rank test when the normality assumption is not satisfied. The analysis also considers effect sizes and 95% confidence intervals to assess the magnitude and precision of the observed changes.

The findings are subsequently interpreted through Analysis and Discussion in relation to the research hypotheses, theoretical framework, and previous studies. Given the exploratory nature of the analysis and the limitations associated with the monthly before-DI and during-DI comparison, including potential seasonality and autocorrelation, the findings are interpreted cautiously. Finally, Conclusions and Managerial Recommendations are developed based on the research findings and their implications for WCM and liquidity management at PT XYZ.

CHAPTER IV
FINDING, ANALYSIS AND DISCUSSION

4.1. Findings

This section outlines the key findings from the analysis of the company's working capital management practices. The results are organized by the specific metrics used to evaluate performance, beginning with the efficiency of working capital utilization, followed by the effectiveness of WCM strategies.

4.1.1. WCM Efficiency Ratio Result

The WCM efficiency ratio results for PT XYZ during the 11-month periods in 2024 and 2025 are presented in Tables 4.1. and 4.2.

Table 4.1. WCM Efficiency Ratio Before DI Implementation

Month	Before Digital Invoicing										
	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
RMCP	23	38	71	63	106	97	99	50	49	58	48
WPCP	4	5	9	6	5	6	7	6	7	6	4
FGCP	3	3	5	4	5	5	4	4	4	3	3
ACP	35	38	56	35	41	40	37	37	35	34	38
PDP	66	58	112	102	130	125	115	93	68	64	84
CCC	(1)	26	29	6	27	23	32	4	27	37	9

Source : Monthly Management Report calculated by Excel, 2024

Table 4.2. WCM Efficiency Ratio During DI Implementation

Month	After Digital Invoicing										
	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25
RMCP	49	54	46	38	34	23	29	35	41	45	33
WPCP	4	4	4	3	5	4	4	4	5	5	4
FGCP	3	4	3	3	3	2	3	3	3	3	3
ACP	33	36	36	34	37	32	35	34	33	35	31
PDP	51	81	91	60	52	41	45	54	69	82	70
CCC	38	17	(2)	18	27	20	26	22	13	6	1

Source : Monthly Management Report calculated by Excel, 2025

The trends in WCM efficiency ratios for PT XYZ over the 11-month periods in 2024 and 2025 are presented in Figures 4.1–4.6.

4.1.1.1. Raw Material Conversion Period (RMCP)

Based on Figure 4.1. The Raw Material Conversion Period (RMCP) exhibited substantial fluctuations during the observation period. In the period 2024, RMCP

increased sharply from 23 days in February to a peak of 106 days in June, before declining and stabilizing between 48 and 58 days toward the end of the year. These fluctuations indicate that raw materials were held in inventory for longer periods during the first half of 2024, resulting in lower inventory turnover efficiency and greater working capital tied up in raw material stocks.

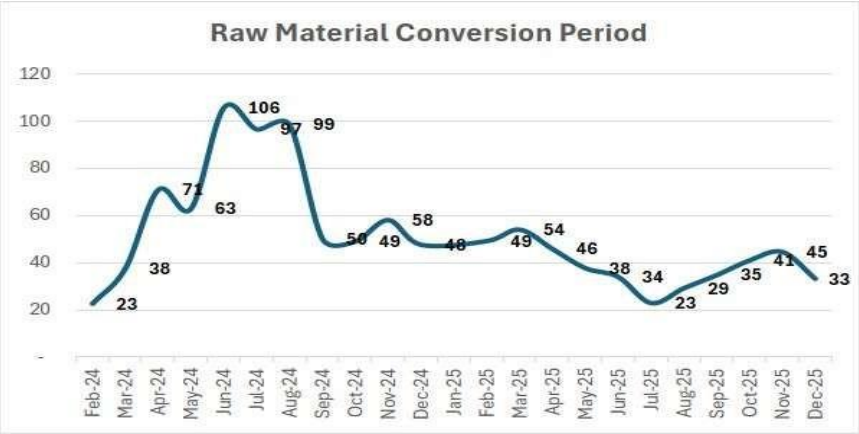

Figure 4.1. RMCP Before and During Digital Invoicing Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the period 2025, RMCP generally showed a downward trend, decreasing from 48 days in January to a low of 23 days in August, before ending the year at 33 days. Overall, the lower RMCP values in 2025 suggest improved efficiency in raw material inventory management and reduced working capital investment in inventory. However, because Digital Invoicing primarily affects the invoicing and collection process rather than inventory operations, these improvements are more likely associated with enhanced inventory planning and production management than with the implementation of the Digital Invoicing system alone.

4.1.1.2. Work-in-Process Conversion Period (WPCP)

Based on Figure 4.2. The Work-in-Process Conversion Period (WPCP) showed medium fluctuations during the period 2024. WPCP increased from 4 days in February to a peak of 9 days in April, before gradually declining and fluctuating between 5 and 7 days for the remainder of 2024. These results indicate that the time required to convert raw materials into finished products was relatively stable, although temporary increases suggest periods of lower production efficiency or higher work-in-process inventory.

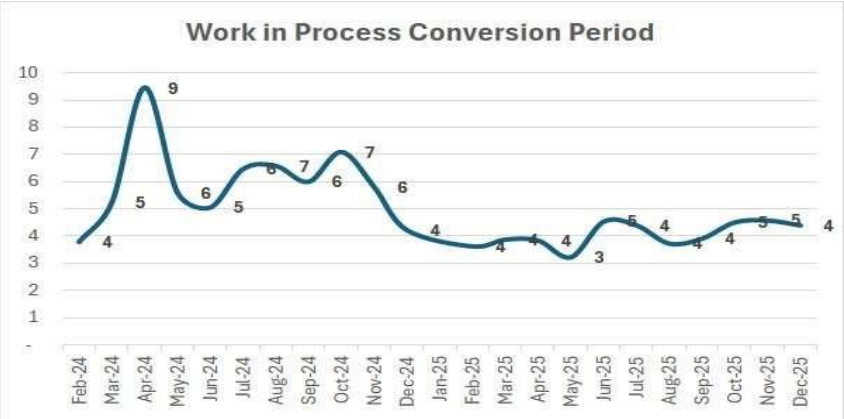

Figure 4.2. WPCP Before and During Digital Invoicing Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the period 2025, WPCP remained consistently lower, fluctuating between 3 and 5 days throughout the year. The shortest conversion period of 3 days was recorded in June 2025, while the year ended at 4 days in December. Overall, the lower and more stable WPCP in 2025 indicates improved production efficiency and faster processing of work-in-process inventory. However, since Digital Invoicing primarily affects the invoicing and accounts receivable process rather than production activities, these improvements are more likely attributable to enhanced production planning and operational management than to the Digital Invoicing implementation itself.

4.1.1.3. Finished Goods Conversion Period (FGCP)

Based on Figure 4.3. The Finished Goods Conversion Period (FGCP) exhibited relatively low and stable values throughout the observation period. During the period (2024), FGCP increased from 3 days in February to a peak of 5 days in April, before gradually declining and fluctuating between 3 and 5 days for the remainder of the year. These results indicate that finished goods were generally converted into sales within a short period, although temporary increases suggest slower inventory turnover during certain months.

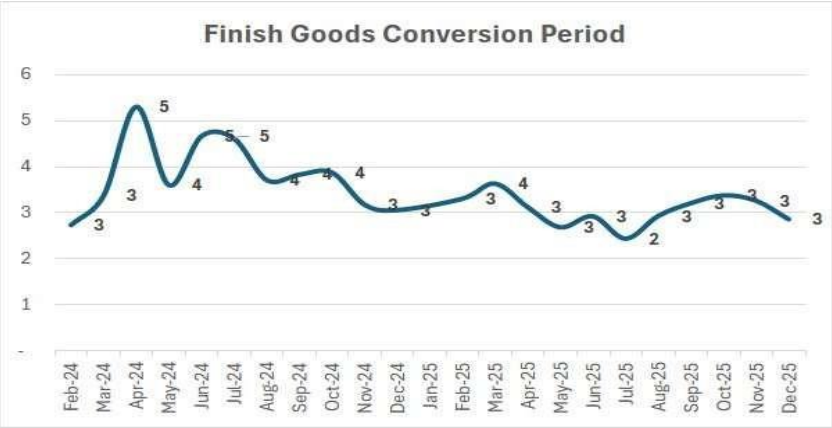

Fig 4.3. FGCM Before and During Digital Invoicing Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the period 2025, FGCP remained stable, fluctuating between 2 and 4 days, with the lowest value of 2 days recorded in August 2025 and ending the year at 3 days in December. Overall, the consistently lower FGCP values in 2025 indicate improved efficiency in managing finished goods inventory and faster conversion of products into sales. However, because Digital Invoicing primarily influences the invoicing and collection process rather than inventory management, these improvements are more likely associated with enhanced inventory control and demand planning than with the implementation of the Digital Invoicing system alone.

4.1.1.4. Average Collection Period (ACP)

Figure 4.4. illustrates the monthly trend of the Average Collection Period (ACP) from February 2024 to December 2025. Prior to the implementation of Digital Invoicing (DI), the ACP fluctuated considerably, ranging from 35 to 56 days. A notable spike occurred in April 2024, when the ACP reached 56 days, indicating a temporary slowdown in receivable collection. Following this peak, the ACP gradually declined but continued to exhibit fluctuations between 35 and 41 days throughout the remainder of 2024. These variations suggest that the manual invoicing process was associated with inconsistent collection performance, likely due to delays in invoice preparation, delivery, verification, and customer payment processing.

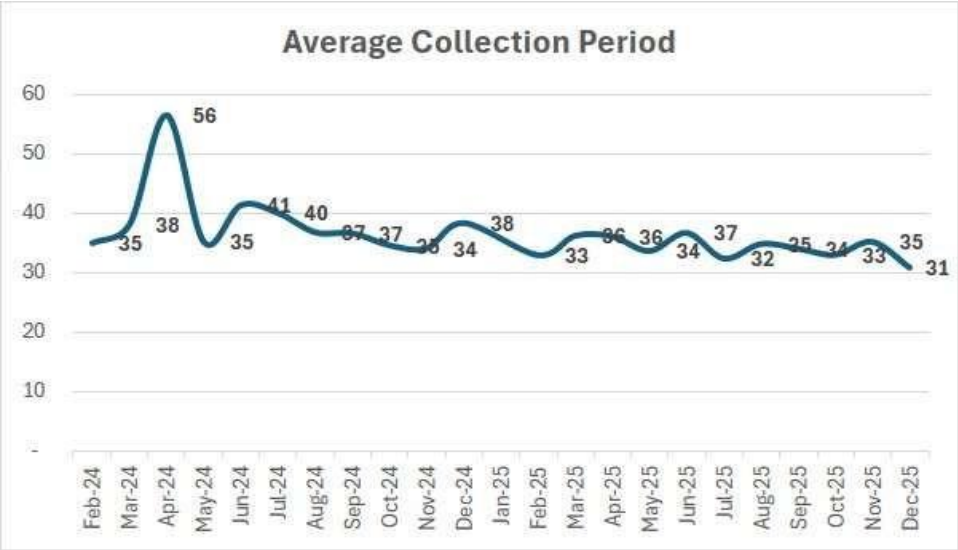

Fig 4.4. ACP Before and During Digital Invoicing Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the implementation period in 2025, the ACP showed a more stable and consistently lower pattern, generally ranging between 31 and 38 days. Although minor month-to-month fluctuations remained, the overall trend demonstrates improved collection efficiency compared with the implementation period before. The ACP gradually decreased from 38 days in January 2025 to 31 days in December 2025, representing the lowest value observed during the study period. This downward trend indicates that the implementation of Digital Invoicing, together with improvements in collection practices, enabled faster invoice processing and accelerated customer payments. Consequently, the company was able to convert accounts receivable into cash more quickly, thereby strengthening cash flow and contributing to improved working capital management.

4.1.1.5. Payable Deferral Period (PDP)

Figure 4.5 illustrates the monthly trend of the Payable Deferral Period (PDP) from February 2024 to December 2025. Prior to the implementation of Digital Invoicing (DI), the PDP exhibited substantial fluctuations, ranging from 58 to 130 days. The payment period increased sharply during the first half of 2024, reaching its highest value of 130 days in June 2024, before gradually declining during the second half of

the year. Despite this downward trend, supplier payment periods remained relatively high and volatile throughout 2024, reflecting inconsistencies in payment timing. These fluctuations suggest that supplier payment decisions were largely influenced by the company's cash flow management, procurement activities, and contractual payment arrangements.

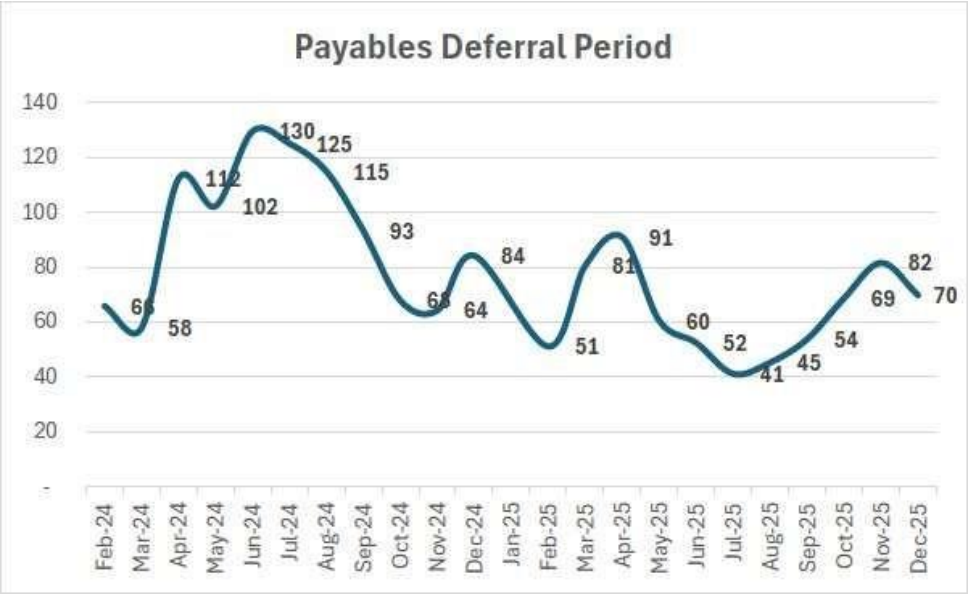

Figure 4.5. PDP Before and During Digital Invoicing Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the implementation period in 2025, the PDP generally exhibited a lower and more stable pattern than in the before-implementation period, fluctuating between 41 and 91 days. The payment period declined to its lowest value of 41 days in August 2025, before increasing mediumly during the final quarter and ending at 70 days in December 2025. Compared with 2024, the company consistently maintained shorter payment periods throughout most months, indicating that supplier obligations were settled more promptly.

4.1.1.6 Cash Conversion Cycle (CCC)

Figure 4.6 illustrates the monthly trend of the Cash Conversion Cycle (CCC) from February 2024 to December 2025. Prior to the implementation of Digital Invoicing (DI), the CCC exhibited considerable month-to-month fluctuations, ranging from approximately −1 to 37 days. The CCC reached several relatively high levels, with the

highest value of 37 days, indicating that the company required a relatively long period to convert its investments in inventory and receivables into cash. Conversely, negative CCC values were observed in some months, indicating that the company was able to collect cash from customers before settling its obligations to suppliers. Overall, the substantial fluctuations during the before-implementation period reflect variations in inventory turnover, accounts receivable collection, and supplier payment timing, resulting in inconsistent working capital performance.

Figure 4.6. CCC Before and During Digital Invoicing Implementation



Source: Monthly Management Report calculated by Excel, 2024 - 2025

During the implementation period in 2025, the CCC continued to fluctuate but generally showed a more medium and declining pattern toward the end of the observation period. The CCC reached a high of approximately 38 days before subsequently declining, reaching 1 day at the end of the period. Compared with the before implementation period, the latter part of 2025 shows a narrower and more stable CCC range, suggesting improved coordination of inventory, receivables, and payables. However, the remaining monthly fluctuations indicate that CCC performance continued to be influenced by the combined effects of inventory management, customer collection, and supplier payment practices.

4.1.2. WCM Effectiveness Ratio Result

Tables 4.3. and 4.4. present the WCM effectiveness ratios of PT XYZ, comprising the Current Ratio (CR) and Quick Ratio (QR), during the 11-month periods in 2024 and 2025.

Table 4.3. The CR & QR Before DI Implementation

Month	Before Digital Invoicing										
	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
CR	0.78	0.81	0.81	0.82	0.83	0.82	0.84	0.82	0.80	0.80	0.82
QR	0.44	0.41	0.35	0.33	0.31	0.26	0.25	0.33	0.34	0.36	0.38

Source: Monthly Management Report calculated by Excel, 2024

Table 4.4. The CR & QR During DI Implementation

Month	After Digital Invoicing										
	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25
CR	0.85	0.82	0.81	0.82	0.86	0.87	0.88	0.91	0.94	0.94	0.95
QR	0.35	0.41	0.36	0.41	0.36	0.41	0.44	0.40	0.37	0.47	0.53

Source: Monthly Management Report calculated by Excel, 2025

Figure 4.7 presents the WCM effectiveness ratios of PT XYZ, comprising the Current Ratio (CR) and Quick Ratio (QR), for the 11-month periods in 2024 and 2025.



Figure 4.7. CQ & QR Before and During DI Implementation

Source: Monthly Management Report calculated by Excel, 2024 - 2025

Figure 4.7. Presents the trend of the Current Ratio (CR) and Quick Ratio (QR) of PT XYZ from February 2024 to December 2025, illustrating the company's short-term liquidity position before and during the implementation of Digital Invoicing (DI).

4.1.2.1. Current Ratio (CR)

The Current Ratio (CR) remained below the conventional benchmark of 1.0 throughout the observation period, indicating that current assets were not yet sufficient to fully cover current liabilities. During 2024, prior to the implementation of Digital Invoicing (DI), the CR remained relatively stable, ranging from 0.78 to 0.84, with only minor month-to-month fluctuations. Following the implementation of DI in 2025, the CR initially fluctuated within the range of 0.81 to 0.85 before showing a gradual upward trend from June onward. The CR increased to 0.91 in September 2025 and remained at 0.94 in October and November, before reaching 0.95 in December 2025, the highest level during the observation period. This upward trend indicates an improvement in the company's liquidity position and a gradual movement toward the target CR of 1.0.

4.1.2.2. Quick Ratio (QR)

Quick Ratio declined from 0.44 in February to a low of 0.29 in August, before gradually recovering to 0.38 by December. In 2025, the ratio fluctuated between 0.35 and 0.44 during the first three quarters and then increased more noticeably in the final quarter, reaching 0.47 in November and 0.53 in December, the highest value recorded over the study period. Although both liquidity indicators remained below the ideal benchmark of 1.0, the upward trend observed during the implementation period suggests that the company's ability to meet short-term obligations improved over time. This improvement is consistent with enhanced working capital management and may reflect the positive contribution of Digital Invoicing in accelerating cash collection and strengthening liquidity, although other operational improvements may also have influenced the observed results.

4.2. Analysis

4.2.1. Analysis Descriptive

4.2.1.1. Analysis for Efficiency Ratio Result

4.2.1.1.1. Raw Material Conversion Period (RMCP)

Table 4.5. indicate a substantial reduction in the Raw Material Conversion Period (RMCP) following the implementation of Digital Invoicing (DI). Before

implementation (RMCP_B), the mean RMCP was 63.82 days, with monthly values ranging from 23 to 106 days. During the implementation period (RMCP_D), the mean decreased to 38.82 days, while the range narrowed to 23 to 54 days, representing an average reduction of approximately 25.00 days. This finding suggests that raw materials were converted into the production process much more quickly during the implementation of DI, indicating improved efficiency in raw material inventory management.

Table 4.5. Descriptive Statistic RMCP Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data RMCP_B	11	23.00	106.00	63.8182	26.82841
Data RMCP_D	11	23.00	54.00	38.8182	9.20672
Valid N (listwise)	11				

Resource: SPSS Output, 2026

Furthermore, the variability of the RMCP decreased substantially during the implementation period. The standard deviation declined from 26.83 days before implementation to 9.21 days during implementation, indicating that monthly r;.aw material conversion periods became significantly more consistent and predictable. The maximum RMCP also decreased markedly from 106 days to 54 days, reflecting the elimination of extreme delays in raw material utilization. Overall, these descriptive statistics provide strong preliminary evidence that the implementation of DI was associated with a shorter and more stable raw material conversion period, contributing to improved inventory management and enhanced working capital efficiency.

4.2.1.1.2. Work-in-Process Conversion Period (WPCP)

Table 4.6. indicate a reduction in the Work-in-Process Conversion Period (WPCP) following the implementation of Digital Invoicing (DI). Before implementation (WPCP_B), the mean WPCP was 5.91 days, with monthly values ranging from 4 to 9 days. During the implementation period (WPCP_D), the mean decreased to 4.18 days, with a narrower range of 3 to 5 days, representing an average reduction of approximately 1.73 days. This finding suggests that products progressed through the

production process more quickly during the implementation of DI, reflecting improved efficiency in managing work-in-process inventory.

Table 4.6. Descriptive Statistic WPCP Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data WPCP_B	11	4.00	9.00	5.9091	1.44600
Data WPCP_D	11	3.00	5.00	4.1818	.60302
Valid N (listwise)	11				

Resource: SPSS Output, 2026

In addition, the variability of the WPCP declined considerably during the implementation period. The standard deviation decreased from 1.45 days before implementation to 0.60 days during implementation, indicating that monthly production conversion periods became more consistent and predictable. The narrower minimum and maximum values during implementation further demonstrate greater stability in the production process. Overall, these descriptive statistics provide preliminary evidence that the implementation of DI was associated with a shorter and more consistent work-in-process conversion period, contributing to improved inventory management and overall working capital efficiency.

4.2.1.1.3. Finished Goods Conversion Period (FGCP)

Table 4.7. indicate a reduction in the Finished Goods Conversion Period (FGCP) following the implementation of Digital Invoicing (DI).

Table 4.7. Descriptive Statistic FGCP Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data FGCP_B	11	3.00	5.00	3.9091	.83121
Data FGCP_D	11	2.00	4.00	3.0000	.44721
Valid N (listwise)	11				

Resource: SPSS Output, 2026

Before implementation (FGCP_B), the mean FGCP was 3.91 days, with monthly values ranging from 3 to 5 days. During the implementation period (FGCP_D), the mean decreased to 3.00 days, with a narrower range of 2 to 4 days, representing an average reduction of approximately 0.91 days. This finding suggests that finished

goods were converted into sales more quickly during the implementation of DI, reflecting improved efficiency in finished goods inventory management and the overall order fulfillment process.

Furthermore, the variability of the FGCP decreased during the implementation period. The standard deviation declined from 0.83 days before implementation to 0.45 days during implementation, indicating that monthly finished goods conversion periods became more consistent and predictable. The lower minimum and maximum values observed during implementation further demonstrate greater stability in the movement of finished goods from storage to customers. Overall, these descriptive statistics provide preliminary evidence that the implementation of DI was associated with a shorter and more stable finished goods conversion period, contributing to improved inventory management and enhanced working capital efficiency.

4.2.1.1.4. Average Collection Period (ACP)

Table 4.8. indicate a noticeable improvement in the Average Collection Period (ACP) following the implementation of Digital Invoicing (DI). Before implementation (ACP_B), the mean ACP was 38.73 days, with monthly collection periods ranging from 34 to 56 days. During the implementation period (ACP_D), the mean ACP decreased to 34.18 days, with a narrower range of 31 to 37 days, representing an average reduction of approximately 4.54 days. This finding suggests that the company was able to collect receivables more quickly during implementing DI, thereby improving the efficiency of accounts receivable management and accelerating cash inflows.

Table 4.8. Descriptive Statistic ACP Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data ACP_B	11	34.00	56.00	38.7273	6.13337
Data ACP_D	11	31.00	37.00	34.1818	1.83402
Valid N (listwise)	11				

Resource: SPSS Output, 2026

In addition, the variability of the ACP declined substantially during implementation. The standard deviation decreased from 6.13 days before implementation to 1.83 days during implementation, indicating that monthly collection periods became more consistent and predictable. The narrower minimum and maximum values during the implementation period further support this observation, suggesting greater stability in the receivables collection process. Overall, these descriptive statistics provide preliminary evidence that the implementation of DI was associated with faster and more consistent accounts receivable collection. However, the statistical significance of this improvement should be confirmed through the paired t-test or Wilcoxon signed-rank test, depending on the normality of the paired differences.

4.2.1.1.5. Payable Deferral Period (PDP)

Table 4.9. presents the descriptive statistics of the Payable Deferral Period (PDP) before and during the implementation of Digital Invoicing (DI). The analysis is based on 11 paired monthly observations for each period. Before the implementation of DI, the PDP ranged from 58 to 130 days, with an average of 92.45 days and a standard deviation of 26.11 days. The relatively high mean indicates that the company generally took more than three months to settle its accounts payable, while the large standard deviation suggests substantial variation in payment practices across the observation period.

Table 4.9. Descriptive Statistic PDP Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data PDP_B	11	58.00	130.00	92.4545	26.10886
Data PDP_D	11	41.00	91.00	63.2727	16.48084
Valid N (listwise)	11				

Resource: SPSS Output, 2026

During the implementation period, the PDP decreased to an average of 63.27 days, with values ranging from 41 to 91 days. In addition, the standard deviation declined markedly from 26.11 days to 16.48 days, indicating that supplier payment periods became more consistent and less dispersed than before the implementation. Although

these descriptive statistics suggest an improvement in accounts payable management, the reduction in the average PDP should be interpreted cautiously.

4.2.1.1.6. Cash Conversion Cycle

Table 4.10. indicate that the Cash Conversion Cycle (CCC) averaged 19.91 days before the implementation of Digital Invoicing and 16.91 days during the implementation period. This represents an average reduction of approximately 3 days, suggesting a modest improvement in the efficiency of working capital management During the implementation of Digital Invoicing.

Table 4.10. Descriptive Statistic CCC Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data CCC_B	11	-1.00	37.00	19.9091	12.92636
Data CCC_D	11	-2.00	38.00	16.9091	11.87817
Valid N (listwise)	11				

Resource: SPSS Output, 2026

The CCC before implementation ranged from -1.00 to 37.00 days, while during implementation it ranged from -2.00 to 38.00 days. The standard deviation decreased from 12.93 days before implementation to 11.87 days during implementation, indicating that the monthly CCC became slightly more consistent during the implementation of Digital Invoicing. Overall, the descriptive statistics suggest a slight improvement in the company's ability to convert invested working capital into cash, although further statistical testing is required to determine whether the observed difference is statistically significant.

4.2.1.2. Analysis for Effectiveness Ratio Result

4.2.1.2.1. Current Ratio (CR)

Table 4.11. indicate that the Current Ratio (CR) improved following the implementation of Digital Invoicing (DI). During the implementation period (Data_CR_B), based on 11 monthly observations, the current ratio ranged from 0.78 to 0.84, with a mean of 0.8136 and a standard deviation of 0.01629. The relatively low standard deviation indicates that the company's liquidity position was stable, with only

minor month-to-month fluctuations. However, the average current ratio remained below the recommended benchmark of 1.0, suggesting that current assets were insufficient to fully cover current liabilities.

Table 4.11. Descriptive Statistic CR Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data_CR_B	11	.78	.84	.8136	.01629
Data_CR_D	11	.81	.95	.8773	.05140
Valid N (listwise)	11				

Resource: SPSS Output, 2026

In the during-implementation period (Data_CR_D), the current ratio increased, with values ranging from 0.81 to 0.95 and a mean of 0.8773, representing an improvement of approximately 0.0637 points (7.8%) compared with the before-implementation period. The higher standard deviation of 0.05140 indicates greater monthly variation during the implementation period, reflecting the company's ongoing adjustments during adopting Digital Invoicing. Despite this increased variability, the higher average current ratio suggests an overall improvement in short-term liquidity and working capital management. Nevertheless, since the mean current ratio remained below 1.0, PT XYZ had not yet achieved the ideal level of liquidity, indicating that further improvements in current asset management are still necessary.

4.2.1.2.2. Quick Ratio (QR)

Table 4.12. indicate an improvement in the company's Quick Ratio (QR) following the implementation of Digital Invoicing (DI). Before implementation (QR_B), the mean Quick Ratio was 0.374, with values ranging from 0.29 to 0.47. During the implementation period (QR_D), the mean Quick Ratio increased to 0.4100, with a range of 0.35 to 0.53, representing an average increase of approximately 0.036. This improvement suggests that the company's ability to meet its short-term obligations using its most liquid assets, excluding inventories, strengthened during the implementation of DI.

Table 4.12. Descriptive Statistic QR Before & During DI Implementation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data QR_B	11	.29	.47	.3736	.05240
Data QR_D	11	.35	.53	.4100	.05404
Valid N (listwise)	11				

Resource: SPSS Output, 2026

Furthermore, the variability of the Quick Ratio remained relatively low in both periods. The standard deviation decreased slightly from 0.0524 before implementation to 0.0540 during implementation, indicating that the company's liquidity position became marginally more consistent over time. The higher minimum and maximum values observed during the implementation period also demonstrate an overall upward shift in liquidity performance rather than isolated improvements in specific months. Although the mean Quick Ratio remained below the conventional benchmark of 1.0, the descriptive statistics suggest that Digital Invoicing contributed to enhancing the company's short-term liquidity by improving cash availability through more efficient working capital management.

4.2.2. Normality Test

The normality of the paired differences was examined using the Shapiro–Wilk test because the number of observations was less than 50 (n = 11). A significance value (Sig.) greater than 0.05 indicates that the data are normally distributed, while a significance value less than 0.05 indicates non-normal distribution.

Based on Table 4.13, the summary of the Normality Test Results is derived from the appendix data obtained through the normality test using SPSS. The results show that the differences in RMCP (p = 0.170), WPCP (p = 0.081), FGCP (p = 0.134), PDP (p = 0.564), CCC (p = 0.585), CR (p=0.121) and QR (p=0.827) are normally distributed because their significance values exceed 0.05. Therefore, the differences in these variables can be analyzed using the paired t-test. In contrast, the difference in ACP has a significance value of 0.003, which is below 0.05, indicating that the data are not normally distributed. Consequently, the difference in ACP (p=0.003) should be

analyzed using the Wilcoxon signed-rank test, a non-parametric alternative to the paired t-test.

Table 4.13. Summary The Normality Test Result

		Test of normality					
		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statisti	df	Sig.	Statistic	df	Sig.
Efficiency	Raw Material Conversion Period (RMCP)	0.224	11	0.129	0.897	11	0.170
	Work-in-Process Conversion Period	0.206	11	0.200*	0.872	11	0.081
	Finished Goods Conversion Period	0.219	11	0.146	0.889	11	0.134
	Average Collection Period (ACP)	0.254	11	0.046	0.76	11	0.003
	Payable Deferral Period (PDP)	0.139	11	0.200*	0.944	11	0.564
	Cash Conversion Cycle (CCC)	0.187	11	0.200*	0.945	11	0.585
Effective	Current Ratio (CR)	0.165	11	0.200*	0.885	11	0.121
	Quick Ratio (QR)	0.11	11	0.200*	0.965	11	0.827

Resource: SPSS Output, 2026

Based on Table 4.14. Summary normality test indicates that seven variables (RMCP, WPCP, FGCP, PDP, CCC, CR and QR) satisfy the assumption of normality and are suitable for parametric analysis or **Paired t-test**, whereas ACP does not satisfy the normality assumption and requires non-parametric testing using **Wilcoxon signed-ranked test**.

Table 4.14. Summary Interpretation Normality Test Result

Variable S	hapiro–Wil Sig.	k Distribution	Statistical Test
Raw Material Conversion Period (RMCP)	0.170	Normal	Paired sample t-test
Work-in-Process Conversion Period (WPCP)	0.081	Normal	Paired sample t-test
Finished Goods Conversion Period (FGCP)	0.134	Normal	Paired sample t-test
Average Collection Period (ACP)	0.003	Not normal	Wilcoxon signed-rank test
Payable Deferral Period (PDP)	0.564	Normal	Paired sample t-test
Cash Conversion Cycle (CCC)	0.585	Normal	Paired sample t-test
Current Ratio (CR)	0.121	Normal	Paired sample t-test
Quick Ratio (QR)	0.827	Normal	Paired sample t-test

Resource: SPSS Output, 2026

4.2.3. Analysis Hypothesis

The data for RMCP, WPCP, FGCP, PDP, CCC, CR, and QR were parametric and normally distributed, so the paired t-test was used for these variables; effect sizes were measured using Cohen's d, complemented by 95% confidence intervals. However, the data for ACP were not normally distributed, so the Wilcoxon signed-rank test was used instead, with the effect size measured using the rank-biserial correlation coefficient (r). The results of the statistical measurements used to test the hypotheses — employing the efficiency ratio and effectiveness ratio — are presented in Tables 4.15 through 4.21.

4.2.3.1. Hypothesis testing for Efficiency Ratio Result

□□,□: The RMCP of PT XYZ during DI implementation differs from the RMCP before DI implementation.

4.2.3.1.1. Raw Material Conversion Period (RMCP) - Paired t-test

Table 4.15. indicates a statistically significant difference in the Raw Material Conversion Period (RMCP) before and during the implementation of the Digital Invoicing (DI) system. The mean difference between the two periods is 25.00 days, indicating that the RMCP during the DI implementation period was, on average, 25 days shorter than before implementation. The test produced a t-value of 2.440 with 10 degrees of freedom and a two-tailed significance value of 0.035, which is below the 0.05 significance level. Therefore, the null hypothesis (H_0) is rejected, indicating a significant reduction in RMCP following the implementation period.

Table 4.15. Paired T Test RMCP before and during DI

		Mea	Std. Deviatio	Std. Error Mean	G5% Confidence of the Difference		t	df	Significanc	
					Lowe	Uppe			One-sided p	Two-sided
Pair 1	RMCP_Before – RMCP_During	25.00	33.98529	10.24695	2.16837	47.83163	2.440	10	0.017	0.035

Resource: SPSS Output, 2026

Table 4.16. the effect size analysis indicates a medium effect of the difference in Raw Material Conversion Period (RMCP) between the before-DI and during-DI periods, with a Cohen's *d* of 0.736 (95% CI: 0.050 to 1.393). The positive effect size indicates that RMCP was higher before DI than during the DI implementation period, consistent

with the observed reduction in RMCP. Hedges' correction also indicated a medium effect size (g = 0.679; 95% CI: 0.047 to 1.285), supporting the practical magnitude of the observed change. The confidence intervals are relatively wide, indicating some uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.16. Paired Sample effect Size RMCP before and during DI

		Confidence Estimate	Std. Deviation	Point	G5% Standardizer[a] Interval	
					Lower	Upper
RMCP_Before – RMCP_During	Cohen's d		33.98529	0.736	0.050	1.393
	Hedges' correction		36.83062	0.679	0.047	1.285

Resource: SPSS Output, 2026

□□,□: The WPCP of PT XYZ during DI implementation differs from the WPCP before DI implementation.

4.2.3.1.2. Work-in-Process Conversion Period (WPCP) – Paired t-test

Table 4.17. reveal a statistically significant difference in the Work-in-Process Conversion Period (WPCP) before and during the implementation of the DI system. The average reduction in WPCP is 1.73 days, with a t-value of 3.684 and a two-tailed p-value of 0.004, indicating significance at the 5% level. Accordingly, the null hypothesis is rejected, confirming that the time required to convert work-in-process inventory into finished goods decreased significantly during implementation.

Table 4.17. Paired t-Test WPCP before and during DI

		Mean	Std. Deviation	Std. Error Mean	G5% Confidence Interval of the Difference		t	df	Significance	
					Lower	Upper			One-sided p	Two-sided p
Pair 1	WPCP_Before – WPCP_During	1.73	1.55505	0.46887	0.68258	2.77197	3.684	10	0.002	0.004

Resource: SPSS Output, 2026

Table 4.18. The effect size analysis indicates a large effect of the difference in Working Process Conversion Period (WPCP) between the before-DI and during-DI periods, with a Cohen's d of 1.111 (95% CI: 0.333 to 1.856). The positive effect size indicates that WPCP was higher before DI than during the DI implementation period, consistent with the observed reduction in WPCP. Hedges' correction also indicated a large effect (g = 1.025; 95% CI: 0.307 to 1.712), supporting the practical magnitude of the observed

change. The confidence intervals are relatively wide, indicating some uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.18. Paired Sample effect Size WPCP before and during DI

		Confidence Estimate	Std. Deviation	Point	G5% Standardizer[a] Interval	
					Lower	Upper
Pair 1	WPCP_Before – WPCP_During	Cohen's d	1.55505	1.111	0.333	1.856
		Hedges' correction	1.68524	1.025	0.307	1.712

Resource: SPSS Output, 2026

□□,□: The FGCP of PT XYZ during DI implementation differs from the FGCP before DI implementation.

4.2.3.1.3. Finished Goods Conversion Period (FGCP) – Paired t-test

Table 4.19. demonstrates a statistically significant difference in the Finished Goods Conversion Period (FGCP) before and during Digital Invoicing implementation. The average reduction is 0.91 days, with a t-value of 2.654 and a two-tailed p-value of 0.024. Since the significance value is below 0.05, the null hypothesis is rejected, indicating that finished goods were converted into sales significantly faster during the implementation period.

Table 4.19. Paired t-Test FGCP before and during DI

		Mean	Std. Deviation	Std. Error Mean	G5% Confidence Interval of the Difference		t	df	Significance	
					Lower	Upper			One-sided p	Two-sided p
Pair 1	FGCP_Before – FGCP_During	0.91	1.13618	0.34257	0.14579	1.67239	2.654	10	0.012	0.024

Resource: SPSS Output, 2026

Table 4.20. The effect size analysis indicates a large effect of the difference in FGCP between the before-DI and during-DI periods, with a Cohen's d of 0.800 (95% CI: 0.101 to 1.470). The positive effect size indicates that FGCP was higher before DI than during the DI implementation period, consistent with the observed reduction in FGCP. Hedges' correction also indicated a large effect (g = 0.738; 95% CI: 0.093 to 1.357), supporting the practical magnitude of the observed change. The confidence intervals are relatively wide, indicating some uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.20. Paired Sample effect Size FGCP before and during DI

			Std. Deviation	Standardizer[a]	Point Estimate	G5% Confidence Interval	
						Lower	Upper
Pair 1	FGCP_Before – FGCP_During	Cohen's d	1.13618	0.8	0.101	1.470
		Hedges' correction	1.23131	0.738	0.093	1.357

Resource: SPSS Output, 2026

□□,□: The ACP of PT XYZ during DI implementation differs from the ACP before DI implementation.

4.2.3.1.4. Average Collection Period (ACP) - Wilcoxon Signed-Rank Test

Table 4.21. indicates a statistically significant reduction in the Average Collection Period (ACP) during the implementation of the Digital Invoicing (DI) system.

Table 4.21. Rank ACP Before and During DI

		N	Mean	Sum of
ACP_During – Data ACP_Before	Negative Ranks	10[a]	6.45	64.5
	Positive Ranks	1[b]	1.5	1.5
	Ties	0[c]		
	Total	11		

a. Data ACP_D < Data ACP_B
b. Data ACP_D > Data ACP_B
c. Data ACP_D = Data ACP_B

Resource: SPSS Output, 2026

The results show 10 negative ranks, 1 positive ranks, and 0 ties. The negative ranks indicate that the ACP during the implementation period was lower than the ACP before implementation for 10 out of 11 paired observations, while no observations showed an increase in ACP. The remaining 2 observations had no change between the two periods. This pattern demonstrates that the reduction in ACP occurred consistently across most of the observation months.

Table 4.22. Test Statistic ACP Before and During DI

	ACP_During – ACP_Before
Z	-2.816[b]
Asymp. Sig. (2-tailed)	0.005

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.

Resource: SPSS Output, 2026

Based on table 4.22. The Wilcoxon Signed-Rank Test produced a Z-value of -2.816 with a two-tailed p-value of 0.005, which is below the 0.05 significance level. Therefore, the null hypothesis is rejected, indicating a statistically significant reduction in the Average Collection Period following the implementation of Digital Invoicing. The effect size was calculated using the standardized test statistic, (r = |Z|/\sqrt{N}), where (Z = -2.816) and (N = 11) paired observations.

$$r = \frac{|Z|}{\sqrt{N}} = \frac{2.816}{\sqrt{11}} = 0.849$$

The resulting effect size was (r = 0.849), indicating a **large effect** based on the conventional interpretation of effect size ((r > 0.50)). This result suggests that the reduction in the Average Collection Period was not only statistically significant but also substantively meaningful. Therefore, the implementation period of Digital Invoicing was associated with a strong improvement in collection efficiency, indicating that invoices and related billing information were processed and delivered more efficiently, potentially supporting faster customer payment and reducing the time required to convert receivables into cash.

□□,□: The PDP of PT XYZ during DI implementation differs from the PDP before DI implementation.

4.2.3.1.5. Payable Deferral Period (PDP)- Paired t-test

Table 4.23. indicates a statistically significant reduction in the Payable Deferral Period (PDP) following the implementation of Digital Invoicing. The mean difference between the periods before and during implementation was 29.18 days, indicating that the company shortened its average supplier payment period by approximately 29 days during implementation. The standard deviation of 36.98 days suggests medium variability in the monthly differences, while the standard error of 11.15 days indicates an acceptable level of precision in estimating the mean difference.

Table 4.23. Paired t-Test PDP Before and During DI

	Mea	Std. Deviatio	Std. Error Mean	G5% Confidence of the Difference		t	df	Significanc	
				Lowe	Uppe			One-sided p	Two-sided
Pair 1 PDP_Before – PDP_During	29.1818	36.97788	11.14925	4.33974	54.0239	2.617	10	0.013	0.026

Resource: SPSS Output, 2026

The 95% confidence interval, ranging from 4.34 to 54.02 days, does not include zero, providing further evidence that the observed difference is statistically significant. The paired t-test produced a t-value of 2.617 with 10 degrees of freedom and a two-tailed p-value of 0.026, which is below the 0.05 significance level. Therefore, the null hypothesis is rejected, and it can be concluded that there was a significant difference in the Payable Deferral Period before and during the implementation of Digital Invoicing. Table 4.24. The effect size analysis indicates a medium-to-large effect of the difference in PDP between the before-DI and during-DI periods, with a Cohen's d of 0.789 (95% CI: 0.092 to 1.457). The positive effect size indicates that PDP was higher before DI than during the DI implementation period, consistent with the observed reduction in PDP. Hedges' correction also indicated a medium-to-large effect (g = 0.728; 95% CI: 0.085 to 1.344), supporting the practical magnitude of the observed change. The confidence intervals are relatively wide, indicating some uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.24. Paired Sample effect Size PDP before and during DI

		Std. Deviation	Standardizer[a]	Point Estimate	G5% Confidence Interval	
					Lower	Upper
Pair 1 PDP_Before – PDP_During	Cohen's d	36.97788		0.789	0.092	1.457
	Hedges' correction	40.07375		0.728	0.085	1.344

Resource: SPSS Output, 2026

□□,□: The CCC of PT XYZ during DI implementation differs from the CCC before DI implementation.

4.2.3.1.6. Cash Conversion Cycle (CCC) - Paired t-test

Table 4.25. shows mean difference of 3 days between the CCC before and during Digital Invoicing implementation. This indicates that, on average, the Cash Conversion Cycle decreased by approximately 3 days during implementation. However, the

standard deviation of 20.49 days suggests considerable variation among the monthly observations, indicating that the changes in CCC were inconsistent throughout the study period.

Table 4.25. Paired t-test CCC Before and During DI

	Mean	Std. Deviation	Std. Error Mean	G5% Confidence Interval of the Difference		t	df	Significance	
				Lower	Upper		One-sided p		Two-sided p
Pair 1 CCC_Before – CCC_During	3.0000	20.48902	6.17767 10.76471	-	16.76471	0.486	10	0.319	0.638

Resource: SPSS Output, 2026

The 95% confidence interval, ranging from −10.76 to 16.76 days, includes zero, indicating that the true mean difference may be positive, negative, or negligible. This finding is supported by the statistical test result, which produced a t-value of 0.486 with 10 degrees of freedom and a two-tailed p-value of 0.638. Since the p-value is greater than the 0.05 significance level, the null hypothesis cannot be rejected. Therefore, there is no statistically significant difference in the Cash Conversion Cycle before and during the implementation of Digital Invoicing.

Table 4.26. The effect size analysis indicates a negligible effect of the difference in CCC between the before-DI and during-DI periods, with a Cohen's d of 0.146 (95% CI: −0.451 to 0.737). The positive point estimate suggests CCC was marginally higher before DI, but the magnitude is trivial. The confidence interval includes zero, so the effect is not statistically distinguishable from no difference. Hedges' correction showed a similarly negligible effect (g = 0.135; 95% CI: −0.417 to 0.680). The wide confidence interval, which crosses zero, indicates substantial uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.26. Paired Sample effect Size CCC before and during DI

		Standardizer[a]	Point Estimate	G5% Confidence Interval	
	Std. Deviation			Lower	Upper
Pair 1 CCC_Before – CCC_During	Cohen's d	20.48902	0.146	−0.451	0.737
	Hedges' correction	22.20441	0.135	−0.417	0.680

Resource: SPSS Output, 2026

4.2.3.2. Hypothesis testing for Effectiveness Ratio

□□,□: The CR of PT XYZ during DI implementation differs from the CR before DI implementation.

4.2.3.2.1. Current Ratio – paired t-test

Table 4.27. indicates a statistically significant difference in the Current Ratio (CR) before and during the implementation period. The mean difference was -0.0364, indicating that the Current Ratio increased during the implementation period (the negative value results from the calculation being CR_Before − CR_During). The standard deviation of 0.05446 suggests relatively low variability in the monthly differences, while the standard error of 0.01642 indicates that the estimated mean difference was measured with reasonable precision.

Table 4.27. Paired t-Test CR Before and During DI

		Mea	Std. Deviatio	Std. Error Mean	G5% Confidence of the Difference		t	df		
					Lowe	Uppe			One-sided p	Two-sided
Pair 1	CR_Before - CR_During	-0.06364	0.05446	0.01642	-0.10022	-0.02705	-3.876	10	0.002	0.003

Resource: SPSS Output, 2026

The 95% confidence interval for the mean difference ranges from -0.10022 to -0.02705, which does not include zero, providing additional evidence of a significant difference between the two periods. The statistical test produced a t-value of -3.876 with 10 degrees of freedom, and a two-tailed p-value of 0.003 (one-tailed p = 0.002), which is below the 0.05 significance level. Therefore, the null hypothesis is rejected, indicating that the implementation period was associated with a significant improvement in the company's Current Ratio compared to the period before implementation.

Table 4.28. The effect size analysis indicates a large effect of the difference in CR between the before-DI and during-DI periods, with a Cohen's d of −1.169 (95% CI: −1.929 to −0.375). The negative effect size indicates that CR was lower before DI than during the DI implementation period—i.e., the direction of change runs opposite to that of the conversion-period measures (RMCP, WPCP, FGCP, PDP). Hedges' correction also indicated a large effect (g = −1.078; 95% CI: −1.780 to −0.346), supporting the practical magnitude of the observed change. The confidence intervals are relatively

wide, indicating some uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.28. Paired Sample effect Size CR before and during DI

		Std. Deviation	Standardizer[a]	Point Estimate	G5% Confidence Interval	
					Lower	Upper
Pair 1 CR_Before - CR_During	Cohen's d	0.05446	−1.169	−1.929	−0.375	
	Hedges' correction	0.05902	−1.078	−1.780	−0.346	

Resource: SPSS Output, 2026

□ □,□: The QR of PT XYZ during DI implementation differs from the QR before DI implementation.

4.2.3.2.2. Quick ratio – paired t-Test

Table 4.29. shows a mean difference of −0.03636 between QR before and during Digital Invoicing implementation. This indicates that, on average, the Quick Ratio increased by approximately 0.036 during implementation. However, the standard deviation of 0.08066 suggests considerable variation among the monthly observations, indicating that the changes in QR were inconsistent throughout the study period.

Table 4.29. Paired t-Test QR Before and During DI

	Mean	Std. Deviation	Std. Error Mean	G5% Confidence Interval of the Difference		t	df	Significance	
				Lower	Upper			One-sided p	Two-sided p
Pair 1 QR_Before - QR_During	-0.03636	0.08066	0.0243	-0.09055	-0.01782	-1.495	10	0.083	0.166

Resource: SPSS Output, 2026

The 95% confidence interval, ranging from −0.09055 to 0.01782, includes zero, indicating that the true mean difference may be positive, negative, or negligible. This finding is supported by the statistical test result, which produced a t-value of −1.495 with 10 degrees of freedom and a two-tailed p-value of 0.166. Since the p-value is greater than the 0.05 significance level, the null hypothesis cannot be rejected. Therefore, there is no statistically significant difference in the Quick Ratio before and during the implementation of Digital Invoicing.

Table 4.230. The effect size analysis indicates a small-to-medium effect of the difference in QR between the before-DI and during-DI periods, with a Cohen's d of −0.451 (95% CI: −1.063 to 0.181). The negative effect size suggests that QR was lower

before DI than during the DI implementation period. However, the confidence interval includes zero, so the effect is not statistically distinguishable from no difference. Hedges' correction showed a similar small-to-medium effect (g = −0.416; 95% CI: −0.981 to 0.167), also spanning zero. The wide confidence interval, which crosses zero, indicates substantial uncertainty in the estimated effect due to the limited number of monthly observations.

Table 4.30. Paired Sample effect Size QR before and during DI

		Std. Deviation	Standardizer[a]	Point Estimate	G5% Confidence Interval	
					Lower	Upper
Pair 1 QR_Before - QR_During	Cohen's d	0.08066	−0.451	−1.063	0.181	
	Hedges' correction	0.08741	−0.416	−0.981	0.167	

Resource: SPSS Output, 2026

4.3. Discussion

This study aimed to evaluate whether the implementation of the Digital Invoicing (DI) system improved the efficiency and effectiveness of working capital management at PT XYZ.

The overall statistical results, summarized in Table 4.31, indicate that the DI implementation period was associated with statistically significant changes in the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), Finished Goods Conversion Period (FGCP), Average Collection Period (ACP), Payable Deferral Period (PDP), and Current Ratio (CR). These changes were consistent with the expected direction of working capital improvement, namely shorter conversion and collection periods and a stronger liquidity position.

However, the Cash Conversion Cycle (CCC) and Quick Ratio (QR) did not show statistically significant changes, indicating that the effects of the DI implementation period were not uniform across all working capital indicators.

Table 4.31 Summary Statistic Result

	Variable	Direction of Change After DI	Statistical Result	Effect size test	Decision	Interpretation
Efficiency	**Raw Material Conversion Period (RMCP)**	↓	Significant (p = 0.035)	Medium to large (d = 0.736)	H_1 accepted	Raw materials moved into production faster, reflecting improved production planning and ROP policies as an indirect operational improvement.
	Work-in-Process Conversion Period (WPCP)	↓	Significant (p = 0.004)	Largest (d = 1.111)	H_2 accepted	Products moved through the production process more efficiently, reflecting improved production operations. This is the strongest result in the study, with the largest effect size.
	Finished Goods Conversion Period (FGCP)	↓	Significant (p = 0.024)	Large (d = 0.800)	H_3 accepted	Finished goods were sold and delivered more quickly, indicating improved inventory turnover.
	Average Collection Period (ACP)	↓	Significant (p = 0.005)	Large (d = 0.849)	H_4 accepted	Receivables were collected faster, converting sales into cash more quickly. This is the clearest direct improvement linked to DI through faster invoicing and automated follow-up.
	Payable Deferral Period (PDP)	↓	Significant (p =0.026)	Medium to large (d = 0.789)	H_5 accepted	A shorter PDP can reduce cash-flow flexibility because it means the company pays suppliers sooner, partly offsetting improvements in other components.
	Cash Conversion Cycle (CCC)	↓	**Not Significant** (p = 0.638)	**Negligible, < 0.20 (d = 0.146)**	**H_6 rejected**	Improvements in inventory and receivables were partly offset by the shorter PDP, so overall cash conversion efficiency did not improve significantly.
Effectiveness	**Current Ratio (CR)**	↑	Significant (p = 0.008)	Large (d = −1.169).	H_7 accepted	A materially stronger short-term financial position. However, since CR remains below 1.0, further improvement is still needed.
	Quick Ratio (QR)	↑	**Not Significant** (p = 0.166)	**Small to medium (d = −0.451)**	**H_8 rejected**	Liquidity improvement was driven by inventory and receivables rather than highly liquid assets.

Resource: SPSS Output, 2026

Footnote tabel effect size test: small $|d| \approx 0.2$, medium $|d| \approx 0.5$, large $|d| \approx 0.8$ (Cohen, 1988).

4.3.1. Raw Material Conversion Period (RMCP)

The results indicate that RMCP decreased significantly during the implementation period, suggesting that raw materials were converted into the production process more quickly. A shorter RMCP reflects improved inventory turnover and reduced capital tied up in raw material inventories, thereby enhancing working capital efficiency. Although Digital Invoicing does not directly affect inventory management, the implementation coincided with broader operational improvements, including enhanced inventory planning, procurement coordination, and production scheduling. These operational improvements have likely contributed to the reduction in RMCP.

This finding is consistent with Brigham and Houston (2018), who argue that efficient inventory management reduces the amount of capital invested in current assets and improves liquidity. Similarly, Riyanto (2016) states that reducing inventory holding periods contributes to more efficient utilization of working capital. Therefore, the

observed improvement in RMCP should be interpreted as an indirect outcome of

broader operational improvements rather than the direct effect of the Digital Invoicing system.

Based on the effect size test, a *d* value of 0.736 was obtained. This demonstrates that the DI implementation period was associated with a medium to large effect ($d > 0.5$) on the reduction of the Raw Material Conversion Period at PT XYZ. The fact that the 95% confidence interval did not include zero confirms that this reduction was not only statistically detectable but also materially important, indicating that raw materials were converted into the production process substantially faster during the DI period than before.

4.3.2. Work-in-Process Conversion Period (WPCP)

The study also found a significant reduction in WPCP, indicating that products moved through the production process more efficiently during the implementation period. A shorter production cycle enables the company to reduce work-in-process inventory and accelerate the conversion of production costs into finished goods, thereby improving overall operational efficiency.

Although Digital Invoicing primarily focuses on financial transaction processing, the implementation period coincided with improvements in production planning and workflow management. Better coordination among departments may have contributed to smoother production scheduling and reduced production delays. Consequently, the improvement in WPCP is more likely associated with enhanced operational management rather than the direct implementation of Digital Invoicing.

Based on the effect size test, a *d* value of 1.111 was obtained. This demonstrates that the DI implementation period was associated with a large effect ($d > 0.8$) on the reduction of the Work-in-Process Conversion Period at PT XYZ. The confidence interval excluding zero indicates that the acceleration of production flow during the DI period was a materially meaningful improvement, not a marginal statistical artifact. However, because the confidence interval includes zero, the practical magnitude of this improvement remains uncertain and should be interpreted with caution.

4.3.3. Finished Goods Conversion Period (FGCP)

The Finished Goods Conversion Period also decreased significantly following the implementation period. This finding indicates that finished goods were sold more quickly, reducing inventory holding costs and minimizing the amount of working capital tied up in completed products.

The improvement may reflect better inventory control, more accurate demand forecasting, and closer coordination between production and sales functions. According to Brigham and Houston 2019, efficient finished goods management improves inventory turnover and contributes positively to working capital efficiency. Since Digital Invoicing does not directly influence warehouse operations or sales planning, the improvement in FGCP should also be interpreted as an indirect benefit resulting from broader operational improvements implemented alongside the DI project.

Based on the effect size test, a *d* value of 0.800 was obtained. This demonstrates that the DI implementation period was associated with a large effect ($d > 0.8$) on the reduction of the Finished Goods Conversion Period at PT XYZ. This indicates that finished goods were sold and delivered faster during the DI period, reducing capital tied up in finished goods inventory and the associated storage and obsolescence costs.

4.3.4. Average Collection Period (ACP)

Among all working capital components, ACP represents the most directly influenced by the implementation of Digital Invoicing. The study found a statistically significant reduction in ACP, indicating that the company collected receivables more quickly during implementing the DI system.

This finding is consistent with the primary objective of Digital Invoicing, which is to automate invoice generation, reduce manual processing time, improve invoice accuracy, and accelerate invoice delivery to customers. Before implementation, invoice distribution relied heavily on manual processes, which increased the risk of delays and billing errors. Following implementation, invoices were generated electronically and transmitted more efficiently through the company's B2B Online Ordering System and

email platform. These improvements enabled customers to receive invoices more promptly, reducing administrative delays and accelerating payment processing.

The findings support previous studies suggesting that digital transformation in financial processes improves receivables management by shortening collection periods and enhancing cash flow. Faster receivable collection increases liquidity and reduces the amount of working capital tied up in accounts receivable, enabling firms to finance daily operations more efficiently.

Based on the effect size test, a *r* value of 0.849 was obtained. Following Cohen (1988), effect sizes of 0.10, 0.30, and 0.50 may be interpreted as small, medium, and large effects, respectively. This demonstrates that the DI implementation period was associated with a large effect ($d > 0.5$) on the reduction of the Average Collection Period at PT XYZ. This finding suggests that customers settled their outstanding invoices slightly faster during the DI period, improving receivables collection efficiency and accelerating cash inflows — an outcome consistent with the faster invoice delivery and automated follow-up mechanisms enabled by Digital Invoicing.

4.3.5. Payable Deferral Period (PDP)

The Payable Deferral Period (PDP) also decreased significantly during the implementation period, indicating that the company settled its obligations to suppliers more quickly, resulting in a shorter average payment period. While a shorter PDP reduces the period over which the company can defer cash outflows and may therefore partially offset improvements in other working capital components at the CCC level, the earlier settlement of supplier obligations may provide a financial benefit through supplier payment refunds. Therefore, the reduction in PDP should not necessarily be interpreted as a deterioration in payables management, but rather as a payment-timing decision involving a trade-off between preserving the financing benefit of trade credit and obtaining financial benefits from earlier supplier payments.

The improvement in payment performance may reflect enhanced payment scheduling, improved cash flow planning, and better coordination between the finance and procurement functions during the implementation period. According to Brigham and Houston (2019), accounts payables management involves balancing the benefits of

maintaining available trade credit with the costs and benefits associated with payment timing.

Since Digital Invoicing primarily improves invoice processing, information visibility, and transaction efficiency rather than directly determining supplier payment policies, the significant reduction in PDP should be interpreted as the combined outcome of Digital Invoicing and broader financial management initiatives implemented alongside the DI project. Thus, the PDP result highlights that improvements in working capital efficiency should be evaluated not only based on the duration of the payment period, but also in relation to the financial benefits and strategic considerations associated with supplier payment practices.

Based on the effect size test, a *d* value of 0.789 was obtained. This demonstrates that the DI implementation period was associated with a medium to large effect ($d > 5$) on the change in the Payable Deferral Period at PT XYZ. This indicates that the company was able to defer supplier payments for a longer period. This indicates that the company settled supplier obligations more quickly during the DI period, which may reflect either improved payment discipline or a deliberate policy to maintain supplier relationships; the effect on working capital depends on whether the faster payment was offset by improvements in collections

4.3.6 Cash Conversion Cycle (CCC)

The Cash Conversion Cycle (CCC) decreased slightly following the implementation period; however, the reduction was not statistically significant. This finding indicates that, although the company converted its investment in working capital into cash within a slightly shorter period, the overall improvement in cash conversion efficiency was not sufficient to demonstrate a statistically significant change.

The non-significant improvement in CCC may partly reflect a trade-off among its underlying components. Significant improvements in inventory conversion, reflected in the Raw Material Conversion Period (RMCP), Work-in-Process Conversion Period (WPCP), and Finished Goods Conversion Period (FGCP), as well as the reduction in the Average Collection Period (ACP), contributed to faster working capital conversion.

However, these benefits were partly offset by the significant reduction in the Payable Deferral Period (PDP), as the company settled supplier obligations more quickly. This illustrates that an improvement in individual working capital components does not necessarily translate proportionally into an improvement in the overall CCC.

According to Ross et al. (2022), the Cash Conversion Cycle represents an integrated measure of working capital efficiency because it captures the interaction among inventory conversion, receivables collection, and payable deferral. Therefore, the non-significant change in CCC should be understood in the context of the trade-offs among these components rather than as an indication that the improvements in individual working capital processes were ineffective. While Digital Invoicing was associated with improvements in several operational processes, further optimization requires an integrated approach to inventory planning, procurement management, receivables collection, supplier payment scheduling, and cash flow management, while considering the financial benefits obtained from supplier payment refunds.

Based on the effect size test, a *d* value of 0.146 was obtained. This demonstrates that the DI implementation period was associated with only a negligible effect on the Cash Conversion Cycle at PT XYZ, as the value did not exceed even the small-effect threshold ($d < 0.2$). This indicates that although several components of the cycle moved in a favorable direction, their effects largely offset one another, such that the overall speed of cash conversion did not change in a materially meaningful way during the DI period.

4.3.7. Current Ratio (CR)

The Current Ratio (CR) increased significantly following the implementation period. This finding indicates that the company's ability to meet its short-term obligations using current assets improved during the implementation of Digital Invoicing. A higher Current Ratio reflects stronger short-term liquidity and suggests that the company became better positioned to cover its current liabilities as they became due.

The improvement may reflect faster accounts receivable collection, more efficient inventory management, and improved working capital control during the implementation period. Although the overall Cash Conversion Cycle did not improve

significantly, significant improvements in individual components, particularly inventory conversion and receivable collection, contributed to strengthening the company's liquidity position. According to Brigham and Houston (2018), the Current Ratio is one of the primary indicators of short-term financial health because it measures the firm's ability to satisfy current obligations using current assets. Therefore, the significant increase in the Current Ratio suggests that Digital Invoicing, together with complementary operational and financial management improvements, enhanced the company's overall liquidity performance.

Based on the effect size test, a d value of −1.169 was obtained. Because the effect size was computed as Before minus During, the negative sign indicates an **increase** in the Current Ratio. This demonstrates that the DI implementation period was associated with a large effect ($|d| > 0.8$) on the improvement of the Current Ratio at PT XYZ. The magnitude of this effect indicates that the strengthening of the company's short-term liquidity position during the DI period was not marginal but materially substantial.

4.3.8. Quick Ratio (QR)

The Quick Ratio (QR) increased during the Digital Invoicing (DI) implementation period; however, the increase was not statistically significant. The paired t-test produced a t-value of −1.495 with 10 degrees of freedom and a two-tailed p-value of 0.166. Therefore, there is insufficient statistical evidence to conclude that the company's immediate liquidity position, as measured by the QR, differed significantly between the before-DI and during-DI periods.

Because the Quick Ratio excludes inventories from current assets, changes in QR provide an indication of the company's ability to meet short-term obligations using its more liquid assets. Although the observed increase may be consistent with improvements in cash and accounts receivable management, the non-significant result indicates that such an improvement cannot be established statistically during the observation period. The observed change may also have been influenced by other financial and operational factors occurring during the same period. According to Brigham and Houston (2018), the Quick Ratio provides a more conservative measure of short-term liquidity because it excludes inventory from current assets.

Based on the effect size test, a *d* value of −0.451 was obtained. The negative sign reflects an **increase** in the Quick Ratio when computed as Before minus During. This demonstrates that the DI implementation period was associated with a small to medium effect ($d > 0.2$) on the improvement of the Quick Ratio at PT XYZ. Although the effect did not reach statistical significance, its medium magnitude suggests that the improvement in immediate liquidity was not entirely trivial; however, because the confidence interval included zero, the evidence remains insufficient to conclude a materially reliable change.

Overall, the statistical analysis indicates significant differences in several individual WCM and liquidity indicators, including RMCP, WPCP, FGCP, ACP, PDP, and CR, while CCC and QR did not show statistically significant differences between the before-DI and during-DI periods. More importantly, the effect size estimates indicate that these significant findings were not merely statistical artifacts. The reductions in RMCP (d = 0.736), [WPCP (d = 1.111), FGCP (d = 0.800), ACP (r = 0.849), and PDP (d = 0.789)] represent medium to large effects, while the improvement in CR represents the largest effect observed in this study (d = −1.169, indicating an increase in the current ratio). In contrast, the non-significant findings were accompanied by negligible or small effect sizes — CCC (d = 0.146) and QR (d = −0.451, with a confidence interval including zero) — confirming that the absence of significance reflected the absence of a materially meaningful change rather than a mere limitation of statistical power. These findings suggest that the most evident and material changes occurred in inventory conversion, receivables collection, payable management, and current liquidity, whereas improvements in the overall cash conversion cycle and more liquid short-term solvency were not materially established during the observation period.

Because the analysis involves eight hypothesis tests without formal multiple-testing adjustment, the findings are interpreted as exploratory rather than confirmatory. The reliance on effect size and confidence intervals, rather than p-values alone, strengthens this exploratory interpretation: conclusions regarding materiality are based on the magnitude and precision of the estimated effects, not solely on statistical significance. Moreover, the before-DI and during-DI comparison does not include a control group,

and other operational, financial, and policy changes may have occurred concurrently with DI implementation. Therefore, the observed differences should not be interpreted as definitive causal effects of Digital Invoicing. Instead, they provide exploratory evidence of changes in WCM efficiency and liquidity occurring during the DI implementation period at PT XYZ.

In summary, the implementation of Digital Invoicing marked an important step toward improving working capital management at PT XYZ. DI was associated with practically meaningful improvements in several components — particularly faster receivables collection and more efficient inventory management, reflected in medium-to-large effect sizes (RMCP, WPCP, FGCP, ACP) and a shorter Operating Cycle Period. Liquidity also strengthened, as the Current Ratio increased significantly with the largest effect size in the study (d = 1.169); however, the Quick Ratio showed no significant change (p = 0.166), indicating that this improvement was carried by inventory and receivables rather than immediately liquid assets.

However, these gains did not translate into a significant improvement in the Cash Conversion Cycle (p = 0.638; d = 0.146), as the reduction in the Payables Deferral Period partially offset the shorter operating cycle. This offsetting mechanism left virtually no net change in cash conversion speed.

Description	Before DI	During DI	Increase (Decr)
Operation Cycle	112.36	80.18	-32.18
PDP	92.45	63.27	-29.18
CCC	19.91	16.91	-3.00

Therefore, Digital Invoicing alone is insufficient to optimize overall cash conversion efficiency. It should be integrated with broader strategies — inventory optimization, procurement and payment coordination, production planning, and cash flow forecasting — while building cash-based liquidity buffers, so that gains in one component are not offset by another and short-term solvency does not depend solely on operating-cycle assets.

CHAPTER V
CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1. Conclusions

Chapter 4 presented the findings, analysis, and discussion of this study, which evaluated the efficiency and effectiveness of working capital management (WCM) before and during the implementation of Digital Invoicing (DI) at PT XYZ.

The findings indicate that during the 2025 Digital Invoicing implementation period, PT XYZ recorded a statistically significant reduction in ACP and improvements in several working capital indicators. The overall CCC declined from 19.91 to 16.91 days, but the change was not statistically significant. Because the study uses uncontrolled before-and-during design and several operational and financial initiatives were implemented concurrently, the findings show temporal association rather than a causal effect of Digital Invoicing. The strongest process-level evidence concerns receivables collection, while changes in inventory, payables, and liquidity require cautious interpretation. By analyzing changes in the CCC, its components, and liquidity ratios — with conclusions based on statistical significance, effect magnitude, and confidence intervals — this study successfully addressed its research objectives. Based on these findings, the study concludes the following:

1. **To evaluate the efficiency level of managing raw materials before and during Digital Invoicing (DI) implementation**.

   RMCP decreased significantly from 63.82 to 38.82 days ($p = 0.035$; $d = 0.736$, medium–large; 95% CI excluding zero), indicating that raw materials moved into production more quickly during the DI period. Since DI does not directly influence procurement or inventory decisions, this reduction more likely reflects improvements in production planning, reorder point policies, and procurement practices. It should therefore be interpreted as an indirect outcome of broader operational improvements, not a direct causal effect of DI..

2. **To evaluate the efficiency level of managing work-in-process before and during DI implementation**.

   WPCP decreased significantly from 5.91 to 4.18 days ($p = 0.004$; $d = 1.111$ — the largest effect observed, exceeding the large-effect threshold; CI entirely above zero), reflecting a meaningful reduction in WIP accumulation. As DI does not directly affect production activities, the improvement was more likely associated with enhanced production planning, process coordination, and reduced bottlenecks — again an indirect outcome of concurrent operational improvements.

3. **To evaluate the efficiency level of managing finished goods before and during DI implementation.**

   FGCP decreased significantly from 3.91 to 3.00 days ($p = 0.024$; $d = 0.800$, reaching the large-effect threshold; CI excluding zero), indicating faster finished goods turnover. Since FGCP is primarily driven by demand and inventory policies, DI contributed indirectly through improved order processing, billing efficiency, and information flow — functioning as an enabling factor rather than a direct driver.

4. **To evaluate the efficiency level of managing accounts receivable before and during DI implementation**.

   ACP decreased significantly from 38.73 to 34.18 days ($p = 0.005$; $r = 0.849$, large; CI excluding zero), meaning receivables were collected faster and sales converted into cash more quickly. This is the strongest evidence of a direct DI-related improvement, as faster invoice delivery, clearer due dates, and automated follow-up are DI's primary operating mechanisms. Nevertheless, the before–during design precludes definitive causal attribution, as credit policy enforcement and collection efforts may also have contributed.

5. **To evaluate the efficiency level of managing accounts payable before and during DI implementation**.

   PDP decreased significantly from 92.45 to 63.27 days ($p = 0.026$; $d = 0.789$, medium–large; CI excluding zero), indicating substantially earlier settlement of supplier obligations. However, a shorter PDP is not necessarily an efficiency gain:

since CCC = ICP + ACP − PDP, it reduces the period for deferring cash outflows and, all else equal, increases the CCC. It may reflect faster invoice verification enabled by DI, improved payment discipline, or deliberate supplier relationship policy — but its cash-flow effect is unfavorable, partly offsetting the gains in other components.

6. **To evaluate the efficiency level of managing the Cash Conversion Cycle (CCC) before and during DI implementation**.

   CCC decreased by 3 days (19.91 → 16.91) but the reduction was not statistically significant (p = 0.638), as the improvements in inventory conversion and receivables collection were partly offset by the shorter PDP. There was therefore insufficient evidence that overall cash conversion efficiency significantly improved — highlighting that gains in individual WCM components do not necessarily translate into CCC improvement.

7. **To evaluate the effectiveness level of working capital management before and during DI implementation as reflected by the Current Ratio.**

   CR increased significantly from 0.814 to 0.877 (p = [verify: 0.003 or 0.008]; d = 1.169 — the largest effect in the study; CI excluding zero), indicating a materially stronger short-term financial position consistent with efficiency gains in collections and inventory conversion. However, as CR remains below the benchmark of 1.0, current assets still do not fully cover current liabilities, warranting continued attention to collection, inventory discipline, and payment-term coordination.

8. **To evaluate the effectiveness level of working capital management before and during DI implementation as reflected by the Quick Ratio**.

   QR increased only descriptively from 0.374 to 0.410 and was not statistically significant (p = 0.166; d = −0.451, small–medium; CI including zero), meaning the improvement in immediate liquidity was not statistically reliable. The divergence between CR and QR suggests that the liquidity improvement was driven mainly by operating-cycle assets (inventory and receivables) rather than

immediately liquid resources — leaving short-term solvency dependent on the least liquid components of working capital.

Overall, the findings indicate that working capital management at PT XYZ showed improvements in efficiency and effectiveness during the DI implementation period. Significant reductions were observed in RMCP (63.82 to 38.82 days, d = 0.736), WPCP (5.91 to 4.18 days, d = 1.111), FGCP (3.91 to 3.00 days, d = 0.800), ACP (38.73 to 34.18 days, r = 0.849), and PDP (92.45 to 63.27 days, d = 0.789), all with medium-to-large effect sizes, alongside a significant improvement in the Current Ratio (0.814 to 0.877, d = −1.169, the largest effect observed). These results indicate that the DI period was associated with faster inventory conversion, accelerated receivables collection, and strengthened short-term liquidity.

However, the Cash Conversion Cycle decreased only slightly (19.91 to 16.91 days) and was not statistically significant (p = 0.638), with a negligible effect size (d = 0.146). This indicates that the efficiency gains in inventory and receivables were largely offset by the shorter PDP, which reduced the period available to defer supplier payments. Similarly, the Quick Ratio improved descriptively (0.374 to 0.410) but not significantly (p = 0.166), suggesting that the improvement of liquidity was driven primarily by operating-cycle assets rather than immediately liquid resources.

Therefore, while DI implementation, together with complementary operational and financial initiatives, was associated with meaningful improvements across individual working capital components and strengthened current liquidity, it was not sufficient to produce a significant improvement in overall cash conversion efficiency. Achieving this requires an integrated approach encompassing inventory management, receivables collection, supplier payment scheduling, and cash flow management, with careful attention to the trade-off between cash conversion speed and the financial benefits of early supplier payments.

5.2 Limitations

First, the study was conducted using data from a single manufacturing company, PT XYZ. Therefore, the findings may not be generalizable to companies operating in different industries or with different working capital structures.

Second, the observation period covers 11 months before the implementation of Digital Invoicing (February–December 2024) and 11 months during its implementation (February–December 2025). As Digital Invoicing was implemented relatively recently, the 11-month observation period may not fully capture its longer-term impact on working capital performance. In addition, the comparison between the two periods may be influenced by monthly variations and other operational and financial management initiatives implemented during the same period.

Third, the paired design matches the same calendar months across the two years (e.g., February 2024 with February 2025) in order to control for recurring monthly patterns such as seasonal demand, production cycles, and year-end activity. However, this matching cannot fully eliminate seasonality, and the monthly observations may still be subject to autocorrelation, in which performance in one month is correlated with the previous month. Both factors may affect the independence assumption underlying the paired t-test and could influence the precision of the estimated differences.

Fourth, the analysis involved eight hypothesis tests conducted at a 5% significance level without formal multiple-testing adjustment. As a result, the familywise error rate across the eight tests may exceed 5%, and some marginally significant findings — such as RMCP ($p = 0.035$), FGCP ($p = 0.024$), and PDP ($p = 0.026$) — could lose statistical significance if a correction procedure such as the Holm–Bonferroni method were applied. The highly significant findings (WPCP, ACP, and CR, all $p < 0.01$) would remain significant under such correction. To address this concern, the findings of this study are interpreted as exploratory rather than confirmatory, and conclusions regarding the materiality of changes are based not solely on p-values but also on effect sizes and their confidence intervals.

Fifth, the implementation of Digital Invoicing coincided with several business process improvements, including enhancements in collection procedures and payment

management. Consequently, the improvements observed cannot be attributed solely to Digital Invoicing, as these complementary initiatives may also have contributed to the changes in working capital performance.

Finally, customer adoption of the Digital Invoicing system was not yet complete during the study period, with approximately 59% of customers actively using the integrated B2B Online Ordering System. As a result, the full benefits of Digital Invoicing may not yet have been realized.

5.3 Research Implications

5.3.1. Theoretical Implications

This study contributes to the working capital management literature in three ways.

First, it integrates operational WCM indicators with liquidity ratios and effect sizes, providing a broader assessment of WCM performance beyond statistical significance alone.

Second, the findings suggest that the impact of Digital Invoicing is strongest in the receivables cycle, as reflected by the large effect on ACP, while improvements in other WCM components are more closely related to operational and financial management decisions.

Third, the study shows that improvements in individual WCM components do not necessarily lead to overall cash conversion efficiency, as the CCC showed a negligible effect. This highlights the importance of assessing digitalization not only at the individual process level but also through its combined effect on the overall working capital cycle.

5.3.2. Managerial Implications

Overall, the findings indicate that the implementation of Digital Invoicing was accompanied by improvements in several working capital indicators. However, these improvements did not result in a significant improvement in the overall Cash Conversion Cycle. Based on these findings, management should consider the following actions:

1. Accelerate Digital Invoicing Adoption

   Management should continue increasing customer adoption of Digital Invoicing through the integrated B2B Online Ordering System and electronic invoice distribution. Wider adoption can further improve invoice delivery and receivables collection.

2. Strengthening Receivables Management

   The improvement in ACP indicates that receivables management is the area most closely linked to Digital Invoicing. Management should strengthen electronic payment confirmation, automated payment reminders, collection monitoring, and follow-up processes to support faster collections.

3. Integrate Digital Invoicing with Operational Planning

   Improvements in inventory, production, and payable management suggest the importance of integrating digital financial processes with production planning, inventory control, procurement, and payment scheduling. Management should strengthen cross-functional coordination and regularly review demand forecasts, inventory levels, supplier lead times, and payment schedules. The shorter PDP should also be managed carefully to balance supplier relationships, available trade credit, and cash flow.

4. Optimize Overall Working Capital Management

   Since improvements in individual components did not translate into a significant reduction in CCC, management should manage working capital as an integrated cycle. Greater attention should be given to inventory levels, collection timing, procurement lead times, supplier payment schedules, and alignment between cash inflows and outflows.

5. Strengthen Working Capital Monitoring

   Management should use integrated dashboards to monitor RMCP, WPCP, FGCP, ACP, PDP, CCC, CR, and QR regularly. Monitoring should focus not only on whether indicators improve, but also on whether the improvements support the company's overall cash flow and working capital objectives.

5.4. Recommendations

Based on the findings and limitations of this study, recommendations are proposed for future research, PT XYZ, and other manufacturing companies. The recommendations focus on strengthening working capital management, maximizing the benefits of Digital Invoicing, and addressing areas that require further investigation.

5.4.1. For Future Research

First, future studies should employ a longer observation period to evaluate the long-term impact of Digital Invoicing during implementation has fully matured, as digital transformation initiatives typically require time for process stabilization and user adaptation before their sustained effects on working capital performance become evident.

Second, future research should include companies across different industries and organizational settings to enhance the generalizability of the findings.

In addition, examining other factors that may influence working capital management — such as customer payment behavior, supplier relationship management, ERP integration, digital payment systems, demand forecasting, inventory planning, and procurement policies — may provide a more comprehensive understanding of how digital transformation affects both operational efficiency and financial performance.

1.4.2. For PT XYZ

Based on the findings of this study, the following recommendations are proposed to help PT XYZ sustain and improve its working capital management performance:

1. Expand Digital Invoicing Adoption and Receivables Management

   Management should continue expanding customer adoption of Digital Invoicing and maximize its features for billing, payment confirmation, reminders, and receivables monitoring. Greater adoption can further strengthen the order-to-cash process and collection efficiency.

2. Strengthen Cross-Functional Working Capital Management

   The improvements in inventory, production, receivables, and payables should be supported by stronger coordination among finance, sales, production, procurement,

and supply chain functions. Working capital decisions should be managed as an integrated process rather than through separate functional targets.

3. Optimize Payment Timing and Supplier Terms

   The shorter PDP should be managed carefully to balance supplier relationships, payment incentives, and cash-flow flexibility. Payment schedules should be aligned with expected customer collections and overall liquidity needs.

4. Focus on Overall Cash Conversion Efficiency

   Since improvements in individual WCM components did not result in a significant improvement in CCC, management should monitor CCC as an overall performance indicator while managing inventory, receivables, and payables together. Particular attention should be given to maintaining improvements in inventory and collection periods without unnecessarily reducing payment flexibility.

5. Strengthen Working Capital Monitoring

   Management should develop an integrated working capital dashboard covering RMCP, WPCP, FGCP, ACP, PDP, CCC, CR, and QR. Regular cross-functional reviews can help identify emerging risks and ensure that improvements in individual indicators translate into sustainable financial and operational benefits.

1.4.3. For Manufacturing Companies

The findings also provide broader recommendations for manufacturing companies implementing Digital Invoicing or similar digital financial processes:

1. Manage WCM as an Integrated System

   Companies should manage inventory, receivables, and payables as interconnected components rather than optimizing each component separately. Improvements in individual indicators may not necessarily improve overall cash conversion efficiency.

2. Position Digital Invoicing as a Process Enabler

   Digital Invoicing should be integrated with broader financial and operational processes, including order-to-cash, procure-to-pay, ERP, inventory planning, and

sales and operations planning. This can help translate digital process improvements into broader working capital benefits.

3. Manage Working Capital Trade-offs

   Companies should carefully balance collection speed, inventory levels, supplier payment timing, and liquidity. Payment decisions should consider supplier relationships, available trade credit, discounts, and overall cash-flow requirements.

4. Strengthening Liquidity Resilience

   Working capital improvements should be supported by adequate liquidity buffers. Companies should monitor both Current Ratio and Quick Ratio to ensure that liquidity is not overly dependent on inventory and receivables.

5. Establish Cross-Functional Monitoring and Accountability

   A working capital dashboard and regular cross-functional reviews can help management identify trade-offs, assign accountability, and sustain improvements over time.

Refference

Financial Report for PT XYZ, 2022, Indonesia

Financial Report for PT XYZ, 2023, Indonesia

Financial Report for PT XYZ, 2024, Indonesia

Management Report for PT XYZ, February 2024 to December 2024, Indonesia

Management Report for PT XYZ, February 2025 to December 2025, Indonesia

Anthony, R. N., Hawkins, D. F., Kenneth A. Merchant, & Singh., P. (2012). *Accounting: Text and Cases (The Financial Accounting Chapters)*. New York: McGraw-Hill.

Arfian Soffin (2024). FINANCIAL PERFORMANCE ANALYSIS, EVALUATION AND FINANCIAL HEALTH ASESSMENT OF PKU MUHAMMADIYAH SURAKARTA HOSPITAL, BEFORE AND DURING IMPLEMENTATION OF DIGITAL TRANSFORMATION. Jakarta. IPMI.

Barnet, A., Winning, M., Canaris, S., Michael Cleary, A. S., & Sullivan, C. (2019). Digital transformation of hospital quality and safety: real-time data for real-time action. *Australian Health Review 43 (6)*, pp 656-661.*2018, 361:k2014 doi:10.1136/bmj*.k2014.

Brigham, E. F., & Ehrhardt, M. C. (2017). *Financial management: Theory and Practice* (15th ed.), New York: Cengage Learning.

Brigham, E.F., and Houston, J.F. (2019), *Fundamentals of Financial Management*, 89 15th ed. New York: Cengage Learning.

Budiyatno, K.C. (2022). TRANSFORMASI DIGITAL SEBAGAI BAGIAN DARI STRATEGI PEMASARAN DI RUMAH SAKIT SILOAM PALANGKA RAYA TAHUN 2020. *Journal ARSI Juni 2022*, vol 8, no 2, hal 66-73.

Budiyatno, B. (2022). *Digital transformation and organizational performance: The mediating role of operational efficiency.*

Daryanto, C. (2019). FINANCIAL PERFORMANCE ANALYSIS OF PHARMACEUTICAL COMPANIES BEFORE AND AFTER THE IMPLEMENTATION OF BPJS KESEHATAN PROGRAM DURING THE

PERIOD OF 2010-2017. Jakarta : *SEKOLAH TINGGI MANAJEMEN IPMI JAKARTA.*

Clayman M.R., Fridson M.S., & Throughton H.G. (2012). *Corporate Finance A Practical Approach.* New Jersey. John Wiley & Sons, Inc.

Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business Finance & Accounting*, 30(3–4), 573–588. https://doi.org/10.1111/1468-5957.00008

Daryanto, W. M.; Samidi, S. (2018). A Financial Ratio Analysis of Oil and Gas Private Company in Indonesia: Before and After Declining the Oil Production. *International. Journal of Business Studies*, 74-83.

Daryanto, W.M; Dzikro, Shafa I; Fitri, Disyotani N. (2019). Financial Performance Analysis of Conventional Taxi in Indonesia: Before and After the Emergence of Ride-Hailing Company. *Southeast Asia Journal of Contemporary Business, Economics, and Law*, 19, 13-21.

Daryanto, W.M. (2018). A Financial Ratio Analysis of Oil and Gas Private Company in Indonesia: Before and After Declining the Oil Production. *International Journal of Business Studies*, 74-81.

Drucker, P.F. (1985). *The Effective Executive*. New York. Harper Collins Publishers.

Guo, L., Xu, L. (2021). The Effects of Digital Transformation on Firm Performance: Evidence from China's Manufacturing Sector. *Sustainability 13*. 12844. https://doi.org/10.3390/ su132212844

Hartono, J. (2021). *Metodologi Penelitian Bisnis, Salah Kaprah dan Pengalaman-pengalaman.* Yogyakarta: BPFE.

Mere, K. (2025). ANALYSIS OF WORKING CAPITAL MANAGEMEN AND ITS EFFECT ON FIRM PROFITABILITY. (2025). *COSTING: Journal of Economic, Business and Accounting Volume 8 Nomor 3, e-ISSN : 2597-5234.*

Peng, Y., & Tao, C. (2022). Can digital transformation promote enterprise performance? —From the perspective of public policy and innovation. *Journal of Innovation & Knowledge, 7*(3), 100198. Purwanto, H. (2020).

Purwanto, H., & Daryanto, W. M. (2020). Financial Performance Analysis of Pharmaceutical Listed Companies Four Years Before And After Universal Healthcare Coverage Initiation in Indonesia (2010-2018), 2020). Jakarta: IPMI.

Richards, V. D., & Laughlin, J. E. (1980). A cash conversion cycle approach to liquidity analysis. *Financial Management*, Vol. 9 No.1, pp.32–38. https://doi.org/10.2307/3665310

Riyanto, B. (2016). *Dasar-dasar Pembelanjaan Perusahaan*. Yogyakarta: BPFE

Soeprihanto, John. (1996). *Manajemen Modal Kerja*. Yogyakarta: BPFE

Shah G.S. (2025). Digital transformation in business finance: Accelerating cash flow through intelligent invoicing systems. *World Journal of Advanced Engineering Technology and Sciences*, 2025, 15(03), 068–076.

Wang, D., Nie, H. (2025). Business process digitalization and effciency of corporate working capital management. *International Review of Economics and Finance 104 (2025) 104606*, 1-23.

Appendix A. Data Calculation 2024

NO	KIND OF RASIO Overall Performance Measures	2024 Feb. 29	2024 Mar. 31	2024 Apr. 30	2024 May. 31	2024 Jun. 30	2024 Jul. 31	2024 Aug. 31	2024 Sep. 30	2024 Oct. 31	2024 Nov. 30	2024 Dec. 31
1	**Cost of Material Used**											
	Beginning Raw material	126,589,731,798	177,857,332,444	224,959,130,935	200,492,453,190	372,659,475,733	418,853,765,189	432,840,782,153	321,576,033,043	173,340,793,477	274,612,812,355	255,796,223,287
	Add. Pembelian Raw Material	239,593,992,479	213,252,453,741	65,438,664,316	313,110,598,869	158,287,841,004	150,522,557,927	7,404,972,157	- 86,897,355	242,754,614,540	118,012,163,308	100,710,675,351
	Less. Ending Raw material	177,857,332,444	224,959,130,935	200,492,453,190	372,659,475,733	418,853,765,189	432,840,782,153	321,576,033,043	173,340,793,477	274,612,812,355	255,796,223,287	206,192,163,651
	Cost of Material Used	188,326,391,833	166,150,655,250	89,905,342,062	140,943,576,326	112,093,551,548	136,535,540,962	118,669,721,267	148,148,342,211	141,482,595,662	136,828,752,376	150,314,734,986
	Raw material turnover											
	Cost of raw material Used	188,326,391,833	166,150,655,250	89,905,342,062	140,943,576,326	112,093,551,548	136,535,540,962	118,669,721,267	148,148,342,211	141,482,595,662	136,828,752,376	150,314,734,986
	Average Raw Material Inventory	152,223,532,121	201,408,231,689	212,725,792,062	286,575,964,461	395,756,620,461	425,847,273,671	377,208,407,598	247,458,413,260	223,976,802,916	265,204,517,821	230,994,193,469
	Raw material Turnover (x)	1	1	0	0	0	0	0	1	1	1	1
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Raw Material Conversion Period (days)	23.00	38.00	71.00	63.00	106.00	97.00	99.00	50.00	49.00	58.00	48.00
2	**Cost of Goods manufactured**											
	Beginning WIP	26,294,406,578	28,226,564,293	31,688,697,326	32,113,242,762	26,293,141,373	18,483,201,669	36,700,306,475	24,725,570,611	35,605,005,809	36,038,152,392	26,137,584,215
	Add. Cost of material Used	188,326,391,833	166,150,655,250	89,905,342,062	140,943,576,326	112,093,551,548	136,535,540,962	118,669,721,267	148,148,342,211	141,482,595,662	136,828,752,376	150,314,734,986
	Add. Other Material	5,938,450,000	5,314,740,475	3,799,157,309	5,239,650,699	4,174,315,337	4,484,042,706	4,697,770,340	4,832,979,303	5,209,907,229	4,195,609,483	4,536,703,789
	Add. Direct labor	684,062,200	694,863,400	730,574,157	740,806,331	653,181,190	633,245,311	623,508,480	609,306,881	637,317,448	620,247,478	619,309,952
	Add. Manufacturing Overhead	8,507,045,795	8,895,542,149	7,360,463,032	9,169,789,459	8,326,529,368	9,064,835,566	8,923,798,481	8,378,919,197	9,957,315,688	9,305,988,770	8,324,441,987
	Less. Ending WIP	28,226,564,293	31,688,697,326	32,113,242,762	26,293,141,373	18,483,201,669	36,700,306,475	24,725,570,611	35,605,005,809	36,038,152,392	26,137,584,215	20,081,802,033
	Cost of Goods manufactured	201,523,792,113	177,593,668,241	101,370,991,124	161,913,924,203	133,057,517,148	132,500,559,739	144,889,534,432	151,090,112,395	156,853,989,444	160,851,166,285	169,850,972,897
	Work In Process turnover											
	Cost of Goods manufactured	201,523,792,113	177,593,668,241	101,370,991,124	161,913,924,203	133,057,517,148	132,500,559,739	144,889,534,432	151,090,112,395	156,853,989,444	160,851,166,285	169,850,972,897
	Average WIP Inventory	27,260,485,435	29,957,630,810	31,900,970,044	29,203,192,068	22,388,171,521	27,591,754,072	30,712,938,543	30,165,288,210	35,821,579,100	31,087,868,303	23,109,693,124
	WIP Turnover (x)	7	6	3	6	6	5	5	5	4	5	7
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Work in Process Conversion Period (days)	4.00	5.00	9.00	6.00	5.00	6.00	7.00	6.00	7.00	6.00	4.00
3	**Cost of Good Sold**											
	Beginning Finished Goods	19,589,829,772	19,685,275,299	19,059,707,530	17,339,549,217	19,630,528,864	21,124,396,951	18,780,189,411	16,277,995,560	21,000,589,262	18,683,283,495	15,890,664,225
	Add. Cost of Goods manufactured	201,523,792,113	177,593,668,241	101,370,991,124	161,913,924,203	133,057,517,148	132,500,559,739	144,889,534,432	151,090,112,395	156,853,989,444	160,851,166,285	169,850,972,897
	Less. Ending Finished Good	19,685,275,299	19,059,707,530	17,339,549,217	19,630,528,864	21,124,396,951	18,780,189,411	16,277,995,560	21,000,589,262	18,683,283,495	15,890,664,225	17,252,315,108
	Less. Sample/Disposal	161,513,250	273,058,691	203,739,422	428,063,963	574,540,298	701,963,539	912,243,049	363,192,558	421,288,804	400,085,994	535,483,447
	Cost of Goods Sold	201,266,833,336	177,946,177,319	102,887,410,015	159,194,880,593	130,989,108,763	134,142,803,740	146,479,485,234	146,004,326,135	158,750,006,407	163,243,699,560	167,953,838,567
	Finished Goods turnover											
	Cost of goods Sold	201,266,833,336	177,946,177,319	102,887,410,015	159,194,880,593	130,989,108,763	134,142,803,740	146,479,485,234	146,004,326,135	158,750,006,407	163,243,699,560	167,953,838,567
	Average Finished Goods Inventory	19,637,552,535	19,372,491,415	18,199,628,374	18,485,039,041	20,377,462,908	19,952,293,181	17,529,092,485	18,639,292,411	19,841,936,378	17,286,973,860	16,571,489,667
	Finished Goods Turnover (x)	10	9	6	9	6	7	8	8	8	9	10
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Finished Goods Conversion Period (days)	3.00	3.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	3.00	3.00
	ICP (days)	30.0	46.0	85.0	73.0	116.0	108.0	110.0	60.0	60.0	67.0	55.0
4	Average Collection Period (days)											
	Average Accounts Receivable	214,990,670,910.34	222,288,354,892.80	192,940,562,530.49	171,919,100,262.67	171,255,860,181.00	169,797,688,584.19	167,081,099,598.68	169,016,446,772.90	177,642,508,020.22	192,751,118,276.97	195,912,936,176.37
	Revenue	172,509,924,720.00	181,177,980,748.80	102,466,621,754.20	152,072,257,032.00	124,411,824,826.34	131,712,260,996.34	141,146,187,434.30	138,707,784,220.22	159,545,484,698.00	170,071,344,072.12	158,640,184,224.40
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Average Collection Period (days)	35.00	38.00	56.00	35.00	41.00	40.00	37.00	37.00	35.00	34.00	38.00
5	**Payable Defferal Period (PDP)**											
	Average Account Payable	404,743,879,320.30	337,238,200,759.50	383,773,983,470.58	501,594,725,597.76	537,427,600,950.16	531,479,507,247.93	523,170,574,241.97	430,563,400,511.18	348,352,684,080.08	363,539,348,821.47	430,534,962,110.26
	Cost of Goods Sold	172,509,924,720.00	181,177,980,748.80	102,466,621,754.20	152,072,257,032.00	124,411,824,826.34	131,712,260,996.34	141,146,187,434.30	138,707,784,220.22	159,545,484,698.00	170,071,344,072.12	158,640,184,224.40
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Payable Defferal Period (PDP)	66.00	58.00	112.00	102.00	130.00	125.00	115.00	93.00	68.00	64.00	84.00
6	**CCC (1+2+3+4-5)**	(1.00)	26.00	29.00	6.00	27.00	23.00	32.00	4.00	27.00	37.00	9.00
7	**Current Ratio (Rasio Lancar)**											
	Current Asset	650,124,721,766.75	740,799,064,635.54	801,464,995,086.37	822,832,456,430.27	861,354,181,990.28	815,303,968,835.42	787,304,408,428.90	672,432,556,724.70	653,088,346,001.23	625,898,564,680.41	657,895,184,691.22
	Current Liabilities	830,813,552,075.50	912,911,923,684.85	985,418,328,524.44	1,001,511,476,377.29	1,039,791,104,112.97	993,899,592,656.92	937,673,807,752.91	823,243,878,745.37	811,339,021,079.31	778,541,785,674.23	805,656,342,507.27
	(Current Asset /Current Liabilities) x 100	0.78	0.81	0.81	0.82	0.83	0.82	0.84	0.82	0.80	0.80	0.82
8	**Acid Tes Quick Ratio**											
	Monetary Current Assets (Total current as	392,566,395,939.03	399,787,591,939.06	372,330,444,022.76	366,002,665,853.75	363,089,109,897.58	298,989,866,370.76	275,319,548,231.56	294,371,438,520.24	299,895,422,332.78	300,093,103,348.19	313,853,630,579.25
	Current Liabilities	830,813,552,075.50	912,911,923,684.85	985,418,328,524.44	1,001,511,476,377.29	1,039,791,104,112.97	993,899,592,656.92	937,673,807,752.91	823,243,878,745.37	811,339,021,079.31	778,541,785,674.23	805,656,342,507.27
	(Monetary Current Asset /Current Liabilit	0.47	0.44	0.38	0.37	0.35	0.30	0.29	0.36	0.37	0.39	0.39

Appendix B. Data Calculation 2025

NO	KIND OF RASIO Overall Performance Measures	2025 Feb. 28	2025 Mar. 31	2025 Apr. 30	2025 May. 31	2025 Jun. 30	2025 Jul. 31	2025 Aug. 31	2025 Sep. 30	2025 Oct. 31	2025 Nov. 30	2025 Dec. 31
1	**Cost of Material Used**											
	Beginning Raw material	232,014,739,221	292,917,805,214	211,412,222,176	199,983,227,280	182,534,781,247	159,160,016,756	104,629,350,075	212,076,336,229	206,096,897,275	244,742,461,994	250,551,553,296
	Add. Pembelian Raw Material	210,183,610,649	63,029,313,981	123,087,083,072	139,727,720,427	127,169,522,048	124,088,262,865	275,432,352,533	174,496,897,909	209,026,461,353	172,273,667,941	21,939,736,419
	Less. Ending Raw material	292,917,805,214	211,412,222,176	199,983,227,280	182,534,781,247	159,160,016,756	104,629,350,075	212,076,336,229	206,096,897,275	244,742,461,994	250,551,553,296	106,083,861,309
	Cost of Material Used	149,280,544,656	144,534,897,019	134,516,077,968	157,176,166,459	150,544,286,539	178,618,929,546	167,985,366,379	180,476,336,862	170,380,896,634	166,464,576,639	166,407,428,406
	Raw material turnover											
	Cost of raw material Used	149,280,544,656	144,534,897,019	134,516,077,968	157,176,166,459	150,544,286,539	178,618,929,546	167,985,366,379	180,476,336,862	170,380,896,634	166,464,576,639	166,407,428,406
	Average Raw Material Inventory	262,466,272,217	252,165,013,695	205,697,724,728	191,259,004,263	170,847,399,001	131,894,683,415	158,352,843,152	209,086,616,752	225,419,679,634	247,647,007,645	178,317,707,302
	Days	28	31	30	31	30	31	31	30	31	30	31
	Raw material Turnover (x)	0.57	0.57	0.65	0.82	0.88	1.35	1.06	0.86	0.76	0.67	0.93
	Raw Material Conversion Period (days)	49.00	54.00	46.00	38.00	34.00	23.00	29.00	35.00	41.00	45.00	33.00
2	**Cost of Goods manufactured**											
	Beginning WIP	21,188,051,992	21,313,785,162	19,061,619,823	18,990,940,172	17,428,171,712	29,077,975,431	27,005,770,099	19,059,931,901	29,556,811,423	26,082,351,094	28,657,530,625
	Add. Cost of material Used	149,280,544,656	144,534,897,019	134,516,077,968	157,176,166,459	150,544,286,539	178,618,929,546	167,985,366,379	180,476,336,862	170,380,896,634	166,464,576,639	166,407,428,406
	Add. Other Material	4,644,348,143	4,863,753,621	3,984,333,387	5,022,075,075	4,639,050,952	5,871,045,369	4,734,145,320	5,765,219,632	6,619,375,278	4,864,929,503	6,117,147,623
	Add. Direct labor	713,896,683	659,248,151	691,304,209	672,293,407	680,277,108	684,499,596	648,734,228	704,366,157	684,023,728	694,137,729	696,425,285
	Add. Manufacturing Overhead	9,714,749,660	9,314,631,717	9,347,784,165	10,499,598,178	9,752,403,744	10,487,273,088	10,327,160,370	10,262,140,360	10,398,305,843	10,190,523,697	10,933,067,684
	Less. Ending WIP	21,313,785,162	19,061,619,823	18,990,940,172	17,428,171,712	29,077,975,431	27,005,770,099	19,059,931,901	29,556,811,423	26,082,351,094	28,657,530,625	24,653,201,134
	Cost of Goods manufactured	164,227,805,972	161,624,695,847	148,610,179,379	174,932,901,579	153,966,214,622	197,733,952,932	191,641,244,494	186,711,183,490	191,557,061,812	179,638,988,037	188,158,398,488
	Work In Process turnover											
	Cost of Goods manufactured	164,227,805,972	161,624,695,847	148,610,179,379	174,932,901,579	153,966,214,622	197,733,952,932	191,641,244,494	186,711,183,490	191,557,061,812	179,638,988,037	188,158,398,488
	Average WIP Inventory	21,250,918,577	20,187,702,492	19,026,279,997	18,209,555,942	23,253,073,572	28,041,872,765	23,032,851,000	24,308,371,662	27,819,581,258	27,369,940,859	26,655,365,880
	Days	28	31	30	31	30	31	31	30	31	30	31
	WIP Turnover (x)	7.73	8.01	7.81	9.61	6.62	7.05	8.32	7.68	6.89	6.56	7.06
	Work in Process Conversion Period (days)	4.00	4.00	4.00	3.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00
3	**Cost of Good Sold**											
	Beginning Finished Goods	19,268,457,463	19,387,517,076	18,611,974,559	13,367,411,889	16,340,753,899	14,067,364,580	16,581,929,433	19,046,166,808	20,482,509,931	21,147,998,709	18,454,246,460
	Add. Cost of Goods manufactured	164,227,805,972	161,624,695,847	148,610,179,379	174,932,901,579	153,966,214,622	197,733,952,932	191,641,244,494	186,711,183,490	191,557,061,812	179,638,988,037	188,158,398,488
	Less. Ending Finished Good	19,387,517,076	18,611,974,559	13,367,411,889	16,340,753,899	14,067,364,580	16,581,929,433	19,046,166,808	20,482,509,931	21,147,998,709	18,454,246,460	16,563,533,668
	Less. Sample/Disposal	440,154,261	335,099,815	174,747,181	381,195,366	243,225,865	242,137,536	678,224,149	413,729,438	- 123,062,314	302,362,994	238,615,769
	Cost of Goods Sold	163,668,592,098	162,065,138,548	153,679,994,869	171,578,364,202	155,996,378,076	194,977,250,543	188,498,782,970	184,861,110,929	191,014,635,348	182,030,377,292	189,810,495,510
	Finished Goods turnover											
	Cost of goods Sold	163,668,592,098	162,065,138,548	153,679,994,869	171,578,364,202	155,996,378,076	194,977,250,543	188,498,782,970	184,861,110,929	191,014,635,348	182,030,377,292	189,810,495,510
	Average Finished Goods Inventory	19,327,987,269	18,999,745,817	15,989,693,224	14,854,082,894	15,204,059,240	15,324,647,007	17,814,048,121	19,764,338,370	20,815,254,320	19,801,122,584	17,508,890,064
	Days	28	31	30	31	30	31	31	30	31	30	31
	Finished Goods Turnover (x)	8.47	8.53	9.61	11.55	10.26	12.72	10.58	9.35	9.18	9.19	10.84
	Finished Goods Conversion Period (days)	3.00	4.00	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00
	ICP (days)	56.0	62.0	53.0	44.0	42.0	29.0	36.0	42.0	49.0	53.0	40.0
4	Average Collection Period (days)											
	Average Accounts Receivable	195,220,293,751.93	188,312,490,226.68	175,933,945,410.20	176,462,119,788.29	182,315,470,542.38	189,801,079,298.61	194,145,432,450.44	180,876,591,186.22	177,908,086,050.12	183,796,182,848.50	180,936,286,123.13
	Revenue	166,410,314,568.14	161,533,206,908.90	146,587,401,036.80	163,041,887,418.60	149,361,034,616.04	182,290,232,493.70	173,247,758,322.80	159,793,271,450.42	167,597,033,581.20	157,053,654,481.30	182,331,355,441.65
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Average Collection Period (days)	33.00	36.00	36.00	34.00	37.00	32.00	35.00	34.00	33.00	35.00	31.00
5	**Payable Defferal Period (PDP)**											
	Average Account Payable	297,469,092,012.99	421,263,679,154.61	465,888,491,125.97	334,132,660,616.18	271,927,453,391.34	257,587,576,697.95	274,173,112,579.58	330,186,782,713.36	422,790,452,358.46	494,752,013,359.04	426,775,553,222.87
	Cost of Goods Sold	163,626,621,619.48	162,099,364,227.31	153,679,994,869.09	171,578,364,202.36	155,996,378,075.89	194,977,407,591.14	188,498,688,932.52	184,861,204,966.76	191,014,635,348.31	182,038,071,120.92	189,818,079,192.14
	Days	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00
	Payable Defferal Period (PDP)	51.00	81.00	91.00	60.00	52.00	41.00	45.00	54.00	69.00	82.00	70.00
6	**CCC (1+2+3+4-5)**	38.00	17.00	(2.00)	18.00	27.00	20.00	26.00	22.00	13.00	6.00	1.00
7	**Current Ratio (Rasio Lancar)**											
	Current Asset	756,406,207,188.79	607,264,448,141.01	541,372,501,493.78	541,432,772,011.23	648,417,960,218.90	624,611,832,105.13	624,167,080,112.53	735,158,513,863.48	844,789,858,267.84	719,866,335,316.01	756,362,795,274.19
	Current Liabilities	893,946,373,295.19	740,816,437,398.06	668,236,727,940.38	658,894,139,679.01	758,196,387,472.18	721,623,513,214.24	706,856,590,351.64	807,449,414,689.95	902,180,758,650.88	765,554,352,640.33	794,188,835,773.89
	(Current Asset /Current Liabilities) x 100	0.85	0.82	0.81	0.82	0.86	0.87	0.88	0.91	0.94	0.94	0.95
8	**Acid Tes Quick Ratio**											
	Monetary Current Assets (Total current as	314,387,603,052.60	302,758,786,531.36	241,115,184,447.97	267,581,496,425.04	275,953,768,451.86	298,570,399,679.97	313,284,740,389.99	325,859,671,407.59	331,678,466,560.49	360,385,287,623.97	424,349,879,036.77
	Current Liabilities	893,946,373,295.19	740,816,437,398.06	668,236,727,940.38	658,894,139,679.01	758,196,387,472.18	721,623,513,214.24	706,856,590,351.64	807,449,414,689.95	902,180,758,650.88	765,554,352,640.33	794,188,835,773.89
	(Monetary Current Asset /Current Liabilit	0.35	0.41	0.36	0.41	0.36	0.41	0.44	0.40	0.37	0.47	0.53

Appendix C. Summary Data Calculation 2024 & 2025

Month	RMCP			WPCP			FGCP			ICP			ACP			OCP			PDP			CCC		
	Before	During	Diff	Before	During	Diff	Before	During	Diff	Before	During	Diff	Before	During	Diff	Before	During	Diff	Before	During	Diff	Before	During	Diff
Feb	23	49	26	4	4	0	3	3	0	30	56	26	35	33	-2	65	89	24	66	51	-15	-1	38	39
Mar	38	54	16	5	4	-1	3	4	1	46	62	16	38	36	-2	84	98	14	58	81	23	26	17	-9
Apr	71	46	-25	9	4	-5	5	3	-2	85	53	-32	56	36	-20	141	89	-52	112	91	-21	29	-2	-31
May	63	38	-25	6	3	-3	4	3	-1	73	44	-29	35	34	-1	108	78	-30	102	60	-42	6	18	12
Jun	106	34	-72	5	5	0	5	3	-2	116	42	-74	41	37	-4	157	79	-78	130	52	-78	27	27	0
Jul	97	23	-74	6	4	-2	5	2	-3	108	29	-79	40	32	-8	148	61	-87	125	41	-84	23	20	-3
Aug	99	29	-70	7	4	-3	4	3	-1	110	36	-74	37	35	-2	147	71	-76	115	45	-70	32	26	-6
Sep	50	35	-15	6	4	-2	4	3	-1	60	42	-18	37	34	-3	97	76	-21	93	54	-39	4	22	18
Oct	49	41	-8	7	5	-2	4	3	-1	60	49	-11	35	33	-2	95	82	-13	68	69	1	27	13	-14
Nov	58	45	-13	6	5	-1	3	3	0	67	53	-14	34	35	1	101	88	-13	64	82	18	37	6	-31
Dec	48	33	-15	4	4	0	3	3	0	55	40	-15	38	31	-7	93	71	-22	84	70	-14	9	1	-8

Remark :

RMCP Raw Material Conversion Period

WPCP Working in Process Conversion Period

FGCP Finish Goods Conversion Period

ICP Inventory Conversion Period (RMCP+WPCP+FGCP)

ACP Average Collection Period

OCP Operating Cycle Period (ICP+ACP)

PDP Payment Defferal period

CCC Cash Conversion Cycle (OCP-PDP)

0 = 2024
1 = 2025

Month	CR			QR		
	Before	During	Diff	Before	During	Diff
Feb	0.78	0.85	0.06	0.47	0.35	-0.12
Mar	0.81	0.82	0.01	0.44	0.41	-0.03
Apr	0.81	0.81	0.00	0.38	0.36	-0.02
May	0.82	0.82	0.00	0.37	0.41	0.04
Jun	0.83	0.86	0.03	0.35	0.36	0.01
Jul	0.82	0.87	0.05	0.30	0.41	0.11
Aug	0.84	0.88	0.04	0.29	0.44	0.15
Sep	0.82	0.91	0.09	0.36	0.40	0.05
Oct	0.80	0.94	0.13	0.37	0.37	0.00
Nov	0.80	0.94	0.14	0.39	0.47	0.09
Dec	0.82	0.95	0.14	0.39	0.53	0.14

Appendix D. SPSS Output Result

D.1. Descriptive Statistics

Below is the SPSS output for descriptive statistics of the variable; RMCP, WPCP, FGCP, ACP, PDP, CR & QR, Table A.1.1 to A.1.8

Table D.1.1 Descriptive Statistics RMCP_B and RMCP_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data RMCP_B	11	23.00	106.00	63.8182	26.82841
Data RMCP_D	11	23.00	54.00	38.8182	9.20672
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.2 Descriptive Statistics WPCP_B and WPCP_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data WPCP_B	11	4.00	9.00	5.9091	1.44600
Data WPCP_D	11	3.00	5.00	4.1818	.60302
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.3 Descriptive Statistics FGCP_B and FGCP_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data FGCP_B	11	3.00	5.00	3.9091	.83121
Data FGCP_D	11	2.00	4.00	3.0000	.44721
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.4 Descriptive Statistics ACP_B and ACP_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data ACP_B	11	34.00	56.00	38.7273	6.13337
Data ACP_D	11	31.00	37.00	34.1818	1.83402
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.5 Descriptive Statistics PDP_B and PDP_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data PDP_B	11	58.00	130.00	92.4545	26.10886
Data PDP_D	11	41.00	91.00	63.2727	16.48084
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.6 Descriptive Statistics CCC_B and CCC_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data CCC_B	11	-2.00	37.00	19.7273	13.35733
Data CCC_D	11	-2.00	38.00	16.9091	11.69149
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.7 Descriptive Statistics CR_B and CR_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data_CR_B	11	.78	.84	.8136	.01629
Data_CR_D	11	.81	.94	.8645	.04886
Valid N (listwise)	11				

Source: SPSS Output, 2026

Table D.1.8 Descriptive Statistics QR_B and QR_D

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Data QR_B	11	.25	.44	.3418	.05706
Data QR_D	11	.35	.53	.4100	.05404
Valid N (listwise)	11				

Source: SPSS Output, 2026

D.2 Normality Test

Below is the SPSS output for Test of Normality variables; RMCP, WPCP, FGCP, ACP, PDP, CR & QR, Table D.2.1 to D.2.8.

Table D.2.1 Test of Normality CR_B and CR_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_RMCP	.224	11	.129	.897	11	.170

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.2 Test of Normality WPCP_B and WPCP_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_WPCP	.206	11	.200*	.872	11	.081

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.3 Test of Normality FGCP_B and FGCP_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_FGCP	.219	11	.146	.889	11	.134

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.4 Test of Normality ACP_B and ACP_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_ACP	.254	11	.046	.760	11	.003

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.5 Test of Normality PDP_B and PDP_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_PDP	.139	11	.200*	.944	11	.564

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.6 Test of Normality CCC_B and CCC_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_CCC	.187	11	.200*	.945	11	.585

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_CCC	.187	11	.200*	.945	11	.585

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.7 Test of Normality CR_B and CR_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_CR	.165	11	.200*	.885	11	.121

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

Table D.2.8 Test of Normality QR_B and QR_D

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_QR	.110	11	.200*	.965	11	.827

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: SPSS Output, 2026

D.3. Hypothesis Test (Paired t-test)

Below is the SPSS output for Paired t-Test of the RMCP, WPCP, FGCP, PDP, CCC, C & QR, Table C.3.1 to C.3.7.

Table D.3.1 Paired t-Test Output RMCP_B and RMCP_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data RMCP_B	63.8182	11	26.82841	8.08907
	Data RMCP_D	38.8182	11	9.20672	2.77593

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data RMCP_B & Data RMCP_D	11	-.709	.007	.014

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	Data RMCP_B - Data RMCP_D	25.00000	33.98529	10.24695	2.16837	47.83163	2.440	10	.017	.035

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	Data RMCP_B - Data RMCP_D	Cohen's d	33.98529	.736	.050	1.393
		Hedges' correction	36.83062	.679	.047	1.285

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.2 Paired t-Test Output WPCP_B and WPCP_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data WPCP_B	5.9091	11	1.44600	.43598
	Data WPCP_D	4.1818	11	.60302	.18182

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data WPCP_B & Data WPCP_D	11	.021	.476	.951

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	Data WPCP_B - Data WPCP_D	1.72727	1.55505	.46887	.68258	2.77197	3.684	10	.002	.004

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	Data WPCP_B - Data WPCP_D	Cohen's d	1.55505	1.111	.333	1.856
		Hedges' correction	1.68524	1.025	.307	1.712

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.3 Paired t-Test Output FGCP_B and FGCP_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data FGCP_B	3.9091	11	.83121	.25062
	Data FGCP_D	3.0000	11	.44721	.13484

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data FGCP_B & Data FGCP_D	11	-.538	.044	.088

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	Data FGCP_B - Data FGCP_D	.90909	1.13618	.34257	.14579	1.67239	2.654	10	.012	.024

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardizer[a]	Point Estimate	Lower	Upper
Pair 1	Data FGCP_B - Data FGCP_D	Cohen's d	1.13618	.800	.101	1.470
		Hedges' correction	1.23131	.738	.093	1.357

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.4 Paired t-Test Output PDP_B and PDP_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data PDP_B	92.4545	11	26.10886	7.87212
	Data PDP_D	63.2727	11	16.48084	4.96916

Paired Samples Correlations

				Significance	
		N	Correlation	One-Sided p	Two-Sided p
Pair 1	Data PDP_B & Data PDP_D	11	-.481	.067	.134

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Data PDP_B - Data PDP_D	29.18182	36.97788	11.14925	4.33974	54.02390	2.617	10	.013	.026

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardizer[a]	Point Estimate	Lower	Upper
Pair 1	Data PDP_B - Data PDP_D	Cohen's d	36.97788	.789	.092	1.457
		Hedges' correction	40.07375	.728	.085	1.344

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.5 Paired t-Test Output CCC_B and CCC_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data CCC_B	19.9091	11	12.92636	3.89745
	Data CCC_D	16.9091	11	11.87817	3.58140

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data CCC_B & Data CCC_D	11	-.363	.136	.272

Paired Samples Test

		Paired Differences Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Significance One-Sided p	Two-Sided p
Pair 1	Data CCC_B - Data CCC_D	3.00000	20.48902	6.17767	-10.76471	16.76471	.486	10	.319	.638

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	Data CCC_B - Data CCC_D	Cohen's d	20.48902	.146	-.451	.737
		Hedges' correction	22.20441	.135	-.417	.680

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.6 Paired t-Test Output CR_B and CR_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data_CR_B	.8136	11	.01629	.00491
	Data_CR_D	.8645	11	.04886	.01473

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data_CR_B & Data_CR_D	11	.002	.497	.995

Paired Samples Test

		Paired Differences Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Significance One-Sided p	Two-Sided p
Pair 1	Data_CR_B - Data_CR_D	-.05091	.05147	.01552	-.08549	-.01633	-3.281	10	.004	.008

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	Data_CR_B - Data_CR_D	Cohen's d	.05147	-.989	-1.703	-.244
		Hedges' correction	.05578	-.913	-1.571	-.225

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

Table D.3.7 Paired t-Test Output QR_B and QR_D

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Data QR_B	.3736	11	.05240	.01580
	Data QR_D	.4100	11	.05404	.01629

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	Data QR_B & Data QR_D	11	-.148	.332	.663

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper				
Pair 1	Data QR_B - Data QR_D	-.03636	.08066	.02432	-.09055	.01782	-1.495	10	.083	.166

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	Data QR_B - Data QR_D	Cohen's d	.08066	-.451	-1.063	.181
		Hedges' correction	.08741	-.416	-.981	.167

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: SPSS Output, 2026

D.4. Hypothesis Test (Wilcoxon)

Below is the SPSS output for Wilcoxon of the ACP.

Table D.4.1 Paired t-Test Output ACP_B and ACP_D

Test Statistics[a]

	Data ACP_D - Data ACP_B
Z	-2.816[b]
Asymp. Sig. (2-tailed)	.005

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Ranks

		N	Mean Rank	Sum of Ranks
Data ACP_D - Data ACP_B	Negative Ranks	10[a]	6.45	64.50
	Positive Ranks	1[b]	1.50	1.50
	Ties	0[c]		
	Total	11		

a. Data ACP_D < Data ACP_B

b. Data ACP_D > Data ACP_B

c. Data ACP_D = Data ACP_B