REDUCING WASTE FROM DELAYS IN THE CUSTOMER SERVICE PROCESS THROUGH DIGITAL 4.0: A CASE STUDY OF BBI BANK, KHON KAEN PROVINCE, THAILAND

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ABSTRACT
This study aims to reduce waste caused by delays in the customer service process through the application of Digital 4.0 technologies at BBI Bank, Khon Kaen Province. The research objectives were to: 1) identify waste caused by process delays; 2) analyze the root causes of these delays; and 3) propose strategies to mitigate waste and improve service efficiency. The study employed a qualitative approach using observation, in-depth interviews, and Value Stream Mapping (VSM) to analyze six key activities in the customer service pro3cess. The findings revealed that queueing time, a non-value-added activity, accounted for 51% of the total process time. The main causes of delays included complex service procedures, insufficient staffing, and a lack of staff expertise. Three strategic approaches were proposed: 1) streamlining service processes using Digital 4.0 tools; 2) integrating digital systems into customer service workflows; and 3) enhancing employee knowledge and skills. Implementing these strategies is expected to significantly reduce transaction times and improve customer satisfaction. The study provides practical insights for banks and service organizations seeking to enhance process efficiency through Lean principles and digital transformation.
Keywords: Waste Reduction, Digital 4.0 technologies, Customer Service Process, Lean, Banking Sector

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INTRODUCTION

In the increasingly competitive banking industry, customer experience has become a critical differentiator. While digital channels are growing rapidly, the in-branch service experience remains an essential touchpoint for many customers (Ayinaddis et al., 2025). However, delays in service processes often lead to customer dissatisfaction and decreased loyalty, directly impacting banks' competitive edge. For BBI Bank in Khon Kaen Province, recent performance indicators have shown that the customer service process fails to meet internal quality benchmarks, with long wait times cited as a major cause of dissatisfaction.

Reducing process delays is a key principle of Lean Thinking, which emphasizes the elimination of non-value-added activities to improve efficiency and customer satisfaction (Hu & Tian, 2019). Concurrently, the adoption of Digital 4.0 technologies offers opportunities to streamline service processes and transform traditional banking operations (Ruangchoengchum & Mindathong, 2021). Despite the growing interest in Lean and digital transformation in the banking sector, there remains limited empirical research, particularly in the Thai context, on how Digital 4.0 tools can be leveraged to reduce service delays and enhance operational performance in bank branches.

This study aims to address this gap by applying Lean principles and Digital 4.0 solutions to analyze and improve the customer service process at BBI Bank, Khon Kaen Province. Using Value Stream Mapping (VSM), the research identifies sources of waste and proposes targeted strategies for service process improvement. The findings provide practical insights for banks seeking to enhance service quality through digital innovation and process optimization.

LITERATURE REVIEWS

Lean Thinking and Waste Reduction in Service Processes

Lean Thinking, initially developed in manufacturing, focuses on the continuous elimination of waste to enhance value and efficiency in business processes (Baag et al., 2019). Among the eight types of waste identified in Lean methodology, waiting time is particularly critical in service contexts, where delays directly impact customer satisfaction and loyalty. In banking services, long wait times are a primary cause of customer dissatisfaction, highlighting the importance of addressing the waste of waiting in service process improvement initiatives (Hermanto et al., 2018).

Value Stream Mapping in Service Process Improvement

Value Stream Mapping (VSM) is a core Lean tool used to visualize and analyze the flow of materials and information in a process, enabling the identification of value-adding and non-value-adding activities (Patil et al., 2022). In service industries, VSM has proven effective in uncovering inefficiencies and guiding process redesign efforts (Makinde et al., 2017). In the banking sector, studies such as Janapiraganit and Namwat (2024) have demonstrated that VSM can significantly reduce service cycle times and improve process transparency and also applied VSM to optimize bank branch operations, though these efforts have primarily focused on traditional Lean applications without leveraging advanced digital tools.

Digital 4.0 and Service Process Optimization

Digital 4.0, encompassing technologies such as automation, artificial intelligence (AI), robotic process automation (RPA), and Internet of Things (IoT), offers transformative potential for service process optimization (Riyanto et al., 2019). In the banking industry, Digital 4.0 enables streamlined workflows, reduced manual interventions, and enhanced customer experiences through innovations such as self-service kiosks, digital onboarding, and intelligent process automation. Recent research emphasizes that combining Digital 4.0 technologies with Lean principles can accelerate waste reduction and drive agile, customer-centric service delivery (Da Silva et al., 2020).

Integrated Lean and Digital Transformation Frameworks

Although Lean and Digital 4.0 have each been applied to improve banking processes, the integration of these approaches remains an emerging area of study. Integrated frameworks suggest that Digital 4.0 technologies can complement Lean Thinking by automating routine tasks, enabling real-time data-driven decision-making, and facilitating continuous process improvement (Romero et al., 2019). However, empirical research on the practical integration of Lean and Digital 4.0 in Thai banking branches is limited, presenting an opportunity for further exploration.

Research Gap and Contribution

While previous studies have demonstrated the effectiveness of Lean and VSM in reducing waste in banking services, there is a notable gap in research addressing the combined application of Lean and Digital 4.0 in banking context (Ennafiri et al., 2022). Most existing literature focuses on either Lean or digital transformation in isolation, with limited empirical evidence on their synergistic effects in improving in-branch service processes. This study seeks to bridge this gap by applying an integrated Lean-Digital 4.0 approach to analyze and enhance the customer service process at BBI Bank, Khon Kaen Province. The findings aim to contribute practical insights to the growing body of knowledge on Lean-Digital integration in service industries, with implications for both academic research and banking practice.

Conceptual Framework

This conceptual framework integrates Lean Thinking and Digital 4.0 to systematically reduce waste in the customer service process of BBI Bank (Figure 1). Value Stream Mapping (VSM) is employed to analyze the service flow, identify non-value-added activities (NVA) particularly waiting time, and guide targeted interventions combining Lean-based process simplification, Digital tool implementation, and employee capability enhancement, with the ultimate goal of improving service efficiency.

Root causes of delays are identified through qualitative methods (observation and in-depth interviews), supported by Why-Why analysis. Subsequently, Digital 4.0 technologies such as process automation, digital forms, and real-time queue management are proposed to address these root causes and streamline service processes.

The framework also incorporates Lean principles for process simplification and staff development initiatives to ensure sustainable improvements (Figure 1). The expected outcomes include reduced service cycle time, and enhanced process efficiency, contributing to BBI Bank's competitive positioning in the Thai banking sector.

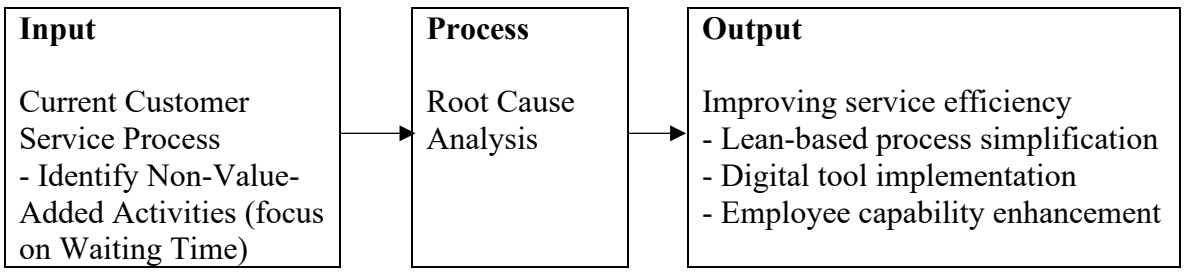

Figure 1 Conceptual Framework

RESEARCH METHODOLOGY

This study adopted a qualitative research approach to explore and analyze waste caused by delays in the customer service process at BBI Bank, Khon Kaen Province, Thailand. A qualitative methodology was deemed appropriate for this study because it enables a deep understanding of process inefficiencies and contextual factors that are often difficult to capture through quantitative methods alone. The study aimed to provide actionable insights for

improving service efficiency and customer experience through the application of Lean principles and Digital 4.0 technologies.

Participants and Sampling

The study employed a purposive sampling strategy to select participants who were directly involved in the customer service process. A total of 10 bank staff members were selected from the BBI Bank Khon Kaen branch, including 3 staff members from high counters (providing deposit, withdrawal, fund transfer, and bill payment services) and 2 staff members from low counters (handling account opening, ATM card issuance, and product sales). Participants were chosen based on their role relevance and direct involvement in the service process, ensuring that insights were gathered from experienced personnel across key service touchpoints.

Data Collection Procedures

Data were collected through a combination of direct observation, in-depth semi-structured interviews, and document analysis. The observation phase was conducted over a one-month period, during which the researcher systematically observed the customer service flow, recorded waiting times, and identified process bottlenecks. In-depth interviews were conducted with the selected staff using a semi-structured interview guide to explore their perceptions of service delays, root causes of inefficiencies, and potential digital interventions. Additionally, secondary data, including internal service reports and customer satisfaction surveys, were reviewed to complement and triangulate the primary data.

Analytical Tools and Data Analysis

The primary analytical tool used in this study was Value Stream Mapping (VSM), which facilitated the visualization of the entire customer service process and the identification of value-added (VA), non-value-added (NVA), and necessary non-value-added (NNVA) activities. Why-Why Analysis was employed to systematically identify the root causes of service delays. The qualitative data collected from interviews and observations were analyzed thematically to uncover patterns and insights related to process inefficiencies, staff challenges, and opportunities for digital transformation.

Validity and Trustworthiness

To enhance the validity and trustworthiness of the findings, the study employed triangulation by integrating data from multiple sources: observation, interviews, and document analysis. Member checking was conducted with selected participants to verify the accuracy of the interpreted results and to ensure that the findings accurately reflected their experiences and perspectives. An audit trail was maintained throughout the research process to ensure transparency, rigor, and replicability.

RESEARCH RESULTS

Service Process Analysis

The current customer service process at BBI Bank, Khon Kaen Branch, was analyzed using Value Stream Mapping (VSM) to identify sources of waste and opportunities for process improvement (Figure 2). The process comprises six sequential activities: 1) customer reception and initial guidance, 2) queue ticket issuance and seating, 3) waiting for service, 4) financial transaction processing, 5) product recommendation, and 6) product sales. The analysis focused on categorizing these activities into value-added (VA), non-value-added but necessary (NNVA), and non-value-added (NVA) components to provide a clear understanding of process efficiency.

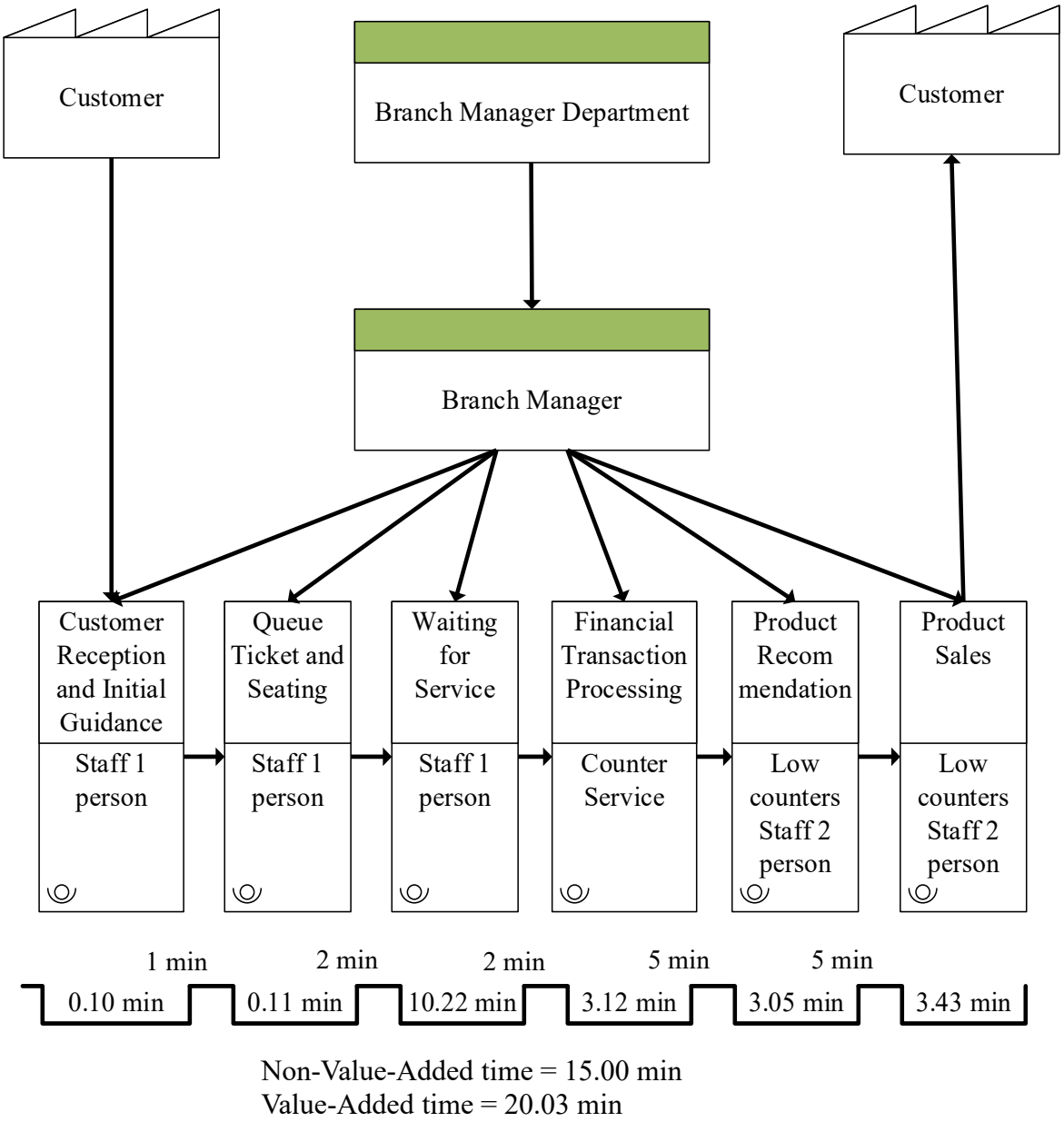

Figure 2 The Value Stream Mapping (VSM) analysis of the customer service process

Analysis of Waiting Time

Table 1 summarizes the results of the VSM analysis. The findings reveal that waiting time (NVA) accounts for the largest proportion of total process time at 51.02%, highlighting a significant opportunity for improvement. Financial transaction processing was identified as the primary value-added activity, contributing 15.58% of the total process time. Other activities, such as customer reception, queue ticket issuance, product recommendation, and product sales, were categorized as NNVA, representing necessary steps to support the customer experience but not directly adding value. The analysis revealed that waiting time accounted for 51.02% of the total service process duration, making it the most significant source of waste. This finding highlights a critical opportunity for process improvement, particularly through the integration of Lean and Digital 4.0 solutions.

Table 1 Value Stream Mapping Analysis of the Customer Service Process at BBI Bank Khon Kaen Branch,Thailand

Activity Category	Activity Description	Time (minutes)	% of Total Process Time
VA	Financial Transaction Processing	3.12	15.58
NNVA	Customer reception and guidance	0.10	0.50
NNVA	Queue ticket issuance and seating	0.11	0.55
NNVA	Product recommendation introduction	3.05	15.23
NNVA	Product sales (if applicable)	3.43	17.12
NVA	Waiting for service (queueing time)	10.22	51.02
Total		**20.03**	**100.00**

This table presents the results of the Value Stream Mapping (VSM) analysis of the customer service process at BBI Bank, Khon Kaen Branch. The service activities are categorized into value-added (VA), non-value-added but necessary (NNVA), and non-value-added (NVA) activities. The corresponding time contributions of each activity are displayed to highlight key areas of process inefficiency, with a particular emphasis on reducing waiting time through Lean and Digital 4.0 interventions (Dabhade & Yadav, 2015).

Root Causes of Delay

To further understand the root causes of the excessive waiting time, a Why-Why Analysis was conducted. The analysis identified three primary factors contributing to delays:

1) Process Complexity: The service process involves multiple manual steps and customer touchpoints, which increase overall cycle time and lead to prolonged waiting periods.

2) Staff Shortage: Insufficient staffing levels during peak service hours result in limited capacity to handle customer flow efficiently.

3) Lack of Staff Expertise: Some staff members lack the necessary knowledge and skills to manage transactions and customer interactions effectively, leading to longer processing times per customer.

Proposed Improvements

Based on these findings, the study proposes three key improvement strategies to enhance process efficiency and reduce waiting time:

1) Process Simplification (Lean Thinking): Streamlining service steps and eliminating unnecessary activities to accelerate customer flow.

2) Digital Tool Implementation (Digital 4.0): Deploying a Digital Queue Management System to optimize queue flow and reduce waiting time.

Implementing Paperless Transactions to minimize manual form handling.

Leveraging Workflow Automation to enhance the speed and consistency of service delivery.

3) Employee Development: Enhancing staff knowledge and capabilities through targeted training programs and continuous coaching to improve service quality and efficiency.

These proposed interventions are expected to significantly improve customer service performance at BBI Bank by reducing the overall process cycle time and enhancing customer satisfaction.

DISCUSSION & CONCLUSION

The findings of this study underscore the critical impact of waiting time on the customer service process at BBI Bank, Khon Kaen Branch, with 51.02% of the total process cycle time attributed to this non-value-added activity. This result is consistent with existing literature that identifies waiting as a major source of waste in service industries, particularly in banking, where customer experience is a key competitive factor (Sunder et al., 2019).

The application of Value Stream Mapping (VSM) proved highly effective in visualizing the current service process and quantifying inefficiencies. Moreover, the Why-Why Analysis provided valuable insights into the root causes of delays, namely process complexity, staff shortages, and insufficient employee expertise. These challenges align with those reported in previous studies (Sunder et al., 2019), reinforcing the universality of such issues in banking operations.

Importantly, this study contributes new insights by proposing a clear integration of Lean Thinking with Digital 4.0 technologies to address service delays. While Lean methodologies traditionally focus on process redesign, this research highlights the complementary role of Digital 4.0 tools—such as digital queue management systems, paperless transactions, and workflow automation—in enhancing process efficiency and customer experience. This integrated approach aligns with emerging trends in service innovation, supporting the view that Lean-Digital synergy is essential for sustainable process improvement (Tamtam & Tourabi, 2018).

Additionally, the proposed strategy of employee development addresses the human factor in service delivery, recognizing that technology alone cannot fully resolve process inefficiencies. By enhancing staff knowledge and skills, banks can foster a more agile and customer-centric service culture (Estremadoyro et al., 2019).

However, this study has certain limitations. The analysis was based solely on internal staff perspectives; customer feedback was not directly captured, which may limit the understanding of customer-perceived service quality. Furthermore, the findings are derived from a single branch, which may affect their generalizability across the broader banking network. Future research should incorporate customer insights and expand the study across multiple branches to validate and refine the proposed improvement framework.

Thus, this study applied Lean Thinking and Digital 4.0 principles to analyze and improve the customer service process at BBI Bank, Khon Kaen Branch. The research identified waiting time as the most significant source of process inefficiency, driven by process complexity, staff shortages, and gaps in employee expertise. Through the use of Value Stream Mapping and Why-Why Analysis, the study developed a set of targeted improvement strategies, including process simplification, digital tool implementation, and employee development. These interventions are expected to substantially reduce service delays, enhance process efficiency, and improve customer satisfaction (Wang & Ahmed, 2018). The study contributes to both academic and practical understanding of how Lean and Digital 4.0 can be effectively integrated to optimize service processes in the banking sector. The findings underscore the value of combining process innovation with technological enhancement and human resource development to drive sustainable service excellence.For future research, it is recommended to evaluate the long-term impacts of the proposed interventions, incorporate customer feedback to enrich the analysis, and extend the framework to a multi-branch context to ensure broader applicability and scalability across the banking network.

Implications

1) Practical Implications

The findings of this study provide several actionable insights for banking practitioners seeking to enhance service efficiency and customer experience. First, the integration of Lean Thinking with Digital 4.0 technologies offers a powerful framework for systematically identifying and eliminating process waste, particularly in high-impact areas such as waiting time (Antony, 2011). Banks can leverage tools such as digital queue management systems, paperless workflows, and workflow automation to streamline service processes and reduce customer wait times.

Second, the study highlights the importance of process simplification and staff capability development as complementary strategies to technological innovation. While Digital 4.0 tools

can enhance process efficiency, the human element remains critical. Targeted training and continuous coaching can empower bank staff to deliver faster, more accurate, and more customer-centric services.

Lastly, the use of Value Stream Mapping (VSM) demonstrated its effectiveness as a diagnostic tool for service process improvement in banking. Financial institutions are encouraged to adopt VSM as part of their continuous improvement initiatives to gain a clearer understanding of process inefficiencies and improvement opportunities.

2) Theoretical Implications

This study contributes to the growing body of literature on Lean-Digital integration in service industries. It provides empirical evidence supporting the synergistic potential of combining Lean Thinking and Digital 4.0 tools to drive process efficiency and service quality improvements in the banking sector (Salman & Mishra, 2024). By doing so, the study extends the application of Lean-Digital frameworks beyond manufacturing and logistics, demonstrating their relevance and impact in service-intensive environments such as banking.

Furthermore, the research offers a structured methodological approach—combining VSM, Why-Why Analysis, and qualitative data analysis—that can be replicated in other service contexts. Future research can build upon this framework to explore additional digital enablers (e.g., AI-based customer service, robotic process automation) and their integration with Lean principles.

Suggestions

Based on the findings of this study, several recommendations are proposed for both banking practitioners and future researchers:

Practical Recommendations for Banking Practitioners

1) Adopt Digital Queue Management Systems: Banks should prioritize the implementation of intelligent queue management systems to optimize customer flow and minimize waiting times.

2) Promote Paperless Transactions: Transitioning to digital, paperless transaction processes can significantly reduce service cycle times and enhance operational efficiency.

3) Streamline Service Processes: A thorough review and simplification of customer service workflows should be conducted to eliminate unnecessary steps and improve process agility.

4) Invest in Staff Development: Continuous training and coaching programs should be established to enhance employee expertise, service quality, and customer interaction skills.

Recommendations for Future Research

1) Incorporate Customer Perspectives: Future studies should include customer feedback and satisfaction data to provide a more holistic view of service process improvements.

2) Evaluate Long-Term Impacts: Longitudinal studies are recommended to assess the sustainability and long-term effects of Lean and Digital 4.0 interventions in banking services.

3) Expand Research Scope: Similar studies should be conducted across multiple branches and different banking institutions to validate the generalizability of the proposed improvement framework.

4) Explore Advanced Digital Tools: Further research should investigate the integration of emerging technologies, such as AI-driven customer service, robotic process automation (RPA), and chatbots, with Lean principles to enhance service innovation.

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