Business Process Improvement Approach in Vehicle Facility Application System: A Case Study at PT Unggul Lancar Sejahtera (ULS)

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ABSTRACT

Deadlock incidents in the vehicle facility application system at PT Unggul Lancar Sejahtera (ULS) caused significant operational delays, with cycle time efficiency as low as 2.02% and frequent manual interventions. This study addresses the problem using the Business Process Improvement (BPI) approach to redesign workflows and eliminate bottlenecks. The proposed solution integrates BPI analysis with the deployment of a Hangfire-based workflow engine, enabling automatic retry mechanisms and process monitoring. The methodology involved identifying Non-Value Added (NVA) activities, restructuring approval flows, and implementing automation to improve transparency and reduce downtime. The research contributes a practical model for process improvement that combines structured BPI analysis with modern workflow orchestration tools. Results show a substantial improvement, with deadlock-handling time reduced from 120 minutes to 0.32 minutes and cycle-time efficiency increasing to 93.99%. Compared to existing manual resolution methods, the proposed approach offers higher reliability, faster recovery, and enhanced visibility, providing a replicable framework for organizations facing similar workflow inefficiencies.

1. Introduction

PT Unggul Lancar Sejahtera (ULS) is an automotive company that provides vehicle facilities for employees to support operational mobility. To modernize its operations, the company has digitized the vehicle facility request process through the B2E/ULS mobile platform. Requests are submitted via a mobile application and follow an approval workflow involving various stakeholders, such as the Loan Officer and the Department Head. Despite digitalization, challenges persist in the current workflow. Troubleshooting during disruptions is still handled manually by the IT team, involving direct data tracing and manipulation across multiple tables. The system also lacks a monitoring feature to track failed requests, making it difficult to identify bottlenecks in the approval process. These inefficiencies result in delays and additional workloads. In 2024, approval-related tickets reached 692 in October alone, with the Human Resources department reporting 30 tickets in August and 132 in September. On average, 10 incidents of disruption occurred daily, with approval delays reaching up to 40 hours in severe cases. These problems reduce productivity, disrupt operational mobility, and indicate that the current workflow is not fully optimized. Therefore, a structured improvement framework is needed to evaluate the existing process and propose a more effective design.

Business Process Improvement (BPI) provides such a framework, as it systematically analyzes workflows, identifies bottlenecks, and redesigns processes to align with organizational goals. Previous studies have demonstrated the effectiveness of BPI across various domains. Setiyani and Setiawan applied BPI in the manufacturing sector to improve production control processes [1]. Mazidah et al. optimized inspection processes in the garment industry using BPI, resulting in reduced non-value-added activities and standardized SOPs [2]. Rahmatillah and Farhatinnisa implemented BPI in the retail sector to streamline cashier operations and reduce transaction errors [3]. Purworaharjo and Firmansyah evaluated academic service processes in higher education through a BPI approach with BPMN modeling [4]. More recently, Maulana proposed a comprehensive BPI model integrating analysis, modeling, and streamlining techniques as a structured guide for organizations [5].

While these studies highlight the versatility of BPI, few contextualize technical challenges, such as approval deadlocks in multi-platform systems, within a structured process improvement framework. This gap emphasizes the importance of adopting a BPI perspective not only for technical optimization but also for enhancing business value and operational efficiency. Therefore, this study aims to analyze the current (AS-IS) vehicle facility request process at PT ULS, identify bottlenecks, and propose improvements toward a more effective and efficient (TO-BE) process using the Business Process Improvement approach.

2. Methods

The improvement process is carried out using the Business Process Improvement (BPI) approach. BPI is a methodology designed to help organizations redesign and improve business processes with the aim of enhancing performance and reducing waste [6]. BPI consists of three main phases: organizing for improvement, understanding the process, and streamlining, as shown in Figure 1. Figure 1 illustrates the overall research methodology flow that guides this study. The organizing for improvement phase focuses on defining the problem scope, forming cross-functional teams, and collecting initial data. Understanding the process phase involves analyzing the existing workflow (as-is process) to identify inefficiencies and bottlenecks using mapping tools such as BPMN. Finally, the streamlining phase emphasizes designing the improved (to-be) process through simplification, automation, and standardization techniques. These three phases form an iterative cycle in which insights from process analysis inform redesign decisions, while continuous feedback ensures that the improvements remain aligned with organizational performance goals [7]. BPI focuses on identifying problems within business processes and implementing solutions to maximize effectiveness and efficiency [6], emphasizing efficiency improvements without completely overhauling existing workflows.

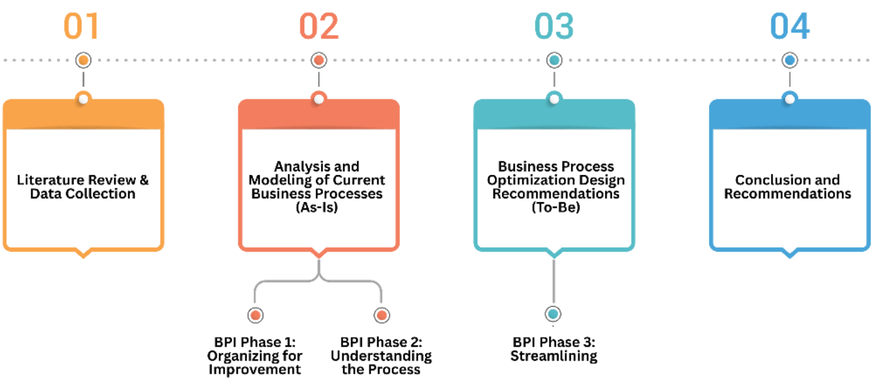

Figure 1. Research Methodology Flow Diagram [7]

2.1. Organizing for Improvement

The Organizing for Improvement stage in the Business Process Improvement (BPI) framework serves as a strategic initiation phase that determines the success of the entire improvement program. At this stage, the primary focus is on establishing a strong methodological foundation by forming cross-functional teams, defining the scope of improvement, and designing the initial data collection plan that will serve as the basis for subsequent analysis. Careful early-stage planning has been shown to increase the accuracy of problem identification and the effectiveness of proposed solutions [8]. Common techniques employed during this phase include guided interviews, on-site observations, and document or system analysis. This multi-method approach aligns with the principle of triangulation to minimize

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bias and improve data validity [9]. Furthermore, incorporating insights from multiple stakeholders helps to develop a comprehensive understanding of the as-is process, which will later be compared to the designed-to-be process. By doing so, the Organizing for Improvement stage ensures that subsequent phases of BPI are grounded in evidence-based understanding and supported by validated information sources [10], [11].

2.2. Understanding the Process

The Understanding the Process phase in the Business Process Improvement (BPI) framework emphasizes constructing a clear, high-level conceptual representation of the current (as-is) business process. This involves process mapping through visual modeling techniques such as flowcharts or BPMN diagrams, which provide stakeholders with a shared view of workflow structures, roles, and interactions [12]. Such visual models serve as effective communication tools that enable both technical and non-technical participants to recognize inefficiencies, redundancies, and potential bottlenecks without presenting detailed performance data at this stage. Establishing this baseline understanding ensures that subsequent phases, such as performance measurement, root cause analysis, and process redesign, are built on an accurate and consensus-driven representation of actual operations [12], [13]. To demonstrate improvements in process performance, the Cycle Time Efficiency approach is employed as the foundation for analyzing efficiency gains. By calculating the ratio of value-adding time to total cycle time, EWS provides a clear measure of how effectively the existing process transforms inputs into outputs. This baseline assessment then guides targeted streamlining efforts and validates subsequent enhancements by comparing pre- and post-improvement efficiency scores.

$$Cycle\ Time\ Efficiency = \frac{\text{Total RVA Time}}{\text{Total Overall Time}}\ x\ 100\% \quad (1)$$

2.3. Streamlining

The Streamlining phase represents the stage where targeted improvement initiatives are designed and refined, drawing upon two complementary approaches: the twelve fundamental tools of Business Process Improvement (BPI) and the Interrelationship of Interrelated Relationships (IIR) framework. The twelve BPI tools are applied to optimize processes within a single business activity, focusing on the elimination of inefficiencies, simplification of workflows, and enhancement of value-added activities. In contrast, the IIR framework addresses process improvements that span multiple business activities, ensuring that interdependent processes are aligned and mutually supportive [14].

3. Results and Discussions

This chapter presents the outcomes of the Business Process Improvement (BPI) implementation, following the stages outlined in Chapter 2. The results are structured according to each BPI phase, highlighting key findings, process changes, and measurable impacts. Supporting data from observations, system records, and stakeholder feedback are included to ensure clarity, traceability, and reliability of the reported improvements.

3.1. Organizing for Improvement

In the Organizing for Improvement phase, the first step is to conduct interviews with users to obtain an initial overview of the company's problems and needs. The interviews are conducted in two stages. The first stage is a semi-formal interview to identify the main issues and challenges faced in the current business process flow. After all interview stages are completed, observations are conducted to identify potential business process obstacles. Results from the interviews are summarized in Table 1.

Table 1. Results of Interviews with Users

No	Interview Results	Interview Code
1.	Company identity includes its name, full address, historical background, vision and mission, and organizational structure.	WCR001

No	Interview Results	Interview Code
2.	The business process is hampered in three types of application forms, namely: (1) KPSM; (2) FSM; (3) COP, with the same problem, namely, delayed approval.	WCR002
3.	Manual handling of issues causes delays in the application process.	WCR003

These findings align with literature emphasizing the importance of addressing bottlenecks through integrated and cross-functional workflows [15]. Subsequently, direct observations of the vehicle facility submission application were conducted to validate interview data and uncover technical constraints unknown to users. This also aligns with recommended practices for improving validity by cross-checking respondent claims against real-world context [16]. Observations led to the identification of three major obstacles: dependence on manual processes (OBS001), limited visibility of approval status within the app (OBS002), and the absence of an automated notification system (OBS003), as shown in Table 2.

Table 2. Application Observation Results

No	Observation Results	Observation Code
1.	Underutilization of Technology. The vehicle facility application process still relies on manual repairs, resulting in delays in the application process.	OBS001
2.	Inadequate Application for Monitoring the Approval Process. The application currently in use does not support accurate monitoring of the approval process, making it impossible to provide a clear picture of the status of applications being processed.	OBS002
3.	No notifications are sent to employees. The vehicle facility application process does not include an automatic notification system that informs employees of the status of their applications. Without adequate notifications, employees cannot easily find out whether their applications are being processed, delayed, or require follow-up.	OBS003

3.2. Understanding the Process

The current business process is clearly illustrated through a flowchart, providing a visual representation of the workflow in the system [17]. This flowchart outlines the sequence of steps from when an employee submits a request, starting with filling out a digital form, followed by approval and validation processes. The first step is the submission by the employee, which is then forwarded to the direct supervisor for approval. Once all approval stages are completed, the transaction data is synchronized with Oracle for transaction storage, and finally, with SAP for the creation of the vehicle PO. This process is further detailed in Figure 2.

To provide a clearer understanding of the time required at each process stage before implementation, time estimations were recorded from start to finish. Observations focused on stages involving user interaction with the system, visible through system data logging. All stages, from initiation by the applicant to final approval, were monitored. For back-end processes, time data was gathered through interviews with users handling deadlock issues. The recorded results showed that the average duration for a vehicle facility request cycle before implementation was 248 minutes, which includes all stages, from request initiation to database synchronization. The long duration indicates bottlenecks, particularly in data retrieval and reworking the request data. These delays were caused by the limitations of the pre-implementation system in identifying blocked requests, requiring manual intervention that consumed time and resources.

Building on this, a business process improvement approach was applied to measure the cycle time of the vehicle facility request process. This measurement involved identifying and categorizing activities into three main types:

a. Real Value Added (RVA) – Activities that directly transform inputs into outputs desired by customers [18].
b. Business Value Added (BVA) – Activities that don't directly add value for customers but are necessary for business continuity or compliance [18].

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c. Non-Value Added (NVA) – Activities that add no value and are considered waste [18].

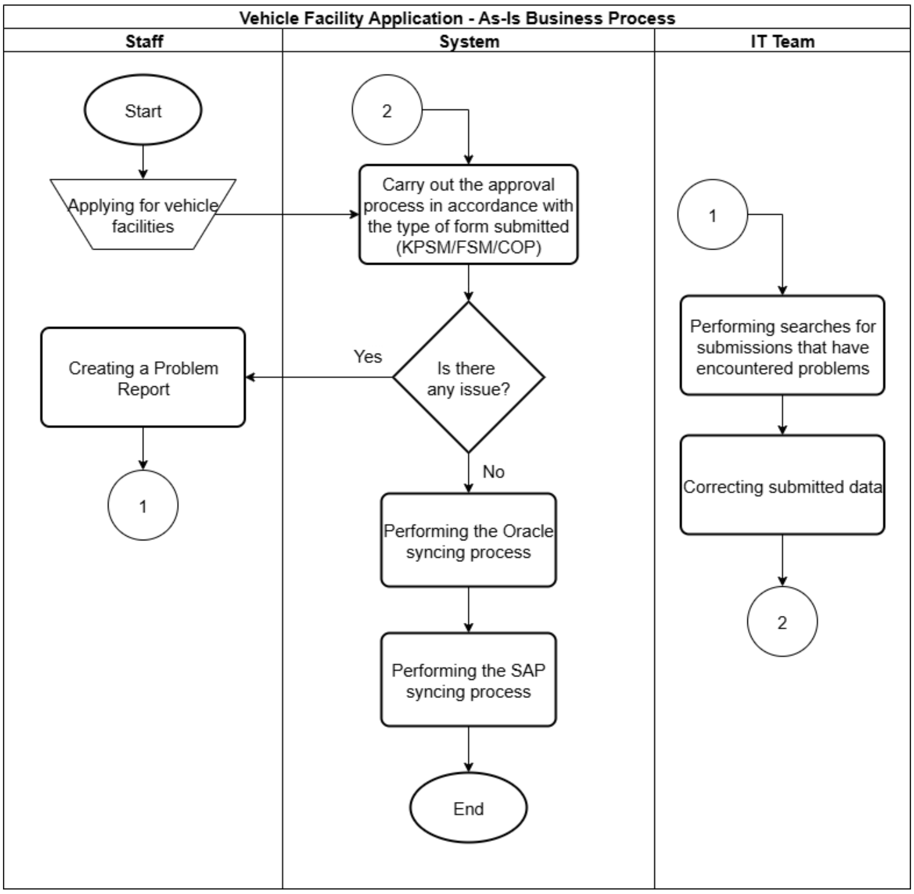

Figure 2. Business Process for Applying for As-Is Vehicle Facilities

This analysis aims to provide a clear picture of each activity's contribution to the total cycle time and identify areas for optimization. The following presents the cycle time measurement results based on the categorization of activities and their respective contributions to the business process before implementation, as shown in Table 3.

Table 3. Details of Process Implementation Time in the "Pre-Implementation" System Based on Adding Value

No	Activity	Average business time (minutes)								
		KPSM			**FSM**			**COP**		
		RVA	BVA	NVA	RVA	BVA	NVA	RVA	BVA	NVA
1.	Submitting vehicle facilities	5			5			5		
2.	Submitting approval processes	0.02			0.02			0,01		
3.	Creating problem reports			3			3			3
4.	Searching for submission data that has encountered problems			120			120			120
5.	Correcting submission data			120			120			120
6.	Performing Oracle syncing processes		< 1			< 1			< 1	
7.	Performing SAP syncing processes		< 1			< 1			< 1	
Total Time		5.02	< 1	243	5.02	< 1	243	5.01	< 1	243
Total Overall Time		248.02			248.02			248.01		
Time Efficiency		2.02%			2.02%			2.02%		

The cycle time analysis was conducted by measuring the duration of activities within the vehicle facility request process before implementation, categorized into RVA, BVA, and NVA activities. For example, with the total time of RVA activities being 5.02 minutes and the overall total cycle time being 248.02 minutes, the efficiency is calculated as:

$$\text{Cycle Time Efficiency } = \frac{5.02 \text{ Minute}}{248.02 \text{ Minute}} x\, 100\% = 2.02\% \quad (2)$$

This shows that the cycle time efficiency for the process before implementation is 2.02%. The analysis indicates that most of the time is consumed by non-value-added activities, suggesting areas for potential optimization.

3.3. Streamlining

To improve the vehicle facility request process, the implementation of Business Process Improvement (BPI), particularly the Streamlining phase, is crucial. Streamlining simplifies business processes to eliminate bureaucracy, enhancing adaptability [19]. The need for streamlining arose from significant issues identified in the pre-implementation process, as summarized in Table 4.

Table 4. Identification of Problems in the Vehicle Facility Application System Before Implementation

No	Activities	Problem Code
1.	A deadlock occurred during the approval process due to the high number of transactions.	PBM001
2.	There was no notification informing users when submissions were delayed or failed to process, and users still had to submit reports first.	PBM002
3.	The IT team was unable to monitor the status of submissions, resulting in lengthy repair processes.	PBM003
4.	Handling errors in the old system required manual intervention, which slowed down the process and increased the risk of human error.	PBM004

Based on the problem identification outlined in Table 4 and considering the cycle time analysis and low efficiency of the as-is process, this study proposes significant improvements to the vehicle facility request system. These improvements aim to address the root causes of deadlock issues, minimize non-value-added (NVA) activities, and overall enhance process flow and quality. Key Streamlining tools implemented to address deadlock issues and optimize workflow include:

a. Simplification, this is a technique that focuses on reducing process complexity so that business processes can run faster [19].
b. Upgrading aims to maximize the use of existing facilities to improve business process performance [19].
c. Automating and/or Mechanization, this technique involves the use of tools and/or computers in the process so that activities can run more optimally [19].
d. Error Proofing, this is a technique that focuses on preventing errors in the process [19].

The details of implementing each Streamlining technique, along with comparisons to problem codes in Table 4, will be further discussed in Table 5.

Table 5. Proposed Improvements to the Vehicle Facility Application System Before Implementation

No	Problem Code	Repair Technique	Description	Repair Code
1.	PBM001	*Error Proofing*	The improvement focuses on automatically handling deadlocks using a retry mechanism to prevent process failures due to high transaction volumes.	RSL001
2.	PBM002	*Simplification*	The improvement was made by eliminating the need for manual notifications and report submissions, as automatic retries have replaced those functions.	RSL002
3.	PBM003	*Upgrading*	The improvement was made by providing a dashboard for monitoring submission status that can be accessed by the IT team.	RSL003
4.	PBM004	*Automating and/or Mechanization*	The improvement focused on eliminating manual intervention in handling errors through the automation of the approval process.	RSL004

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The implementation of the proposed improvements to the vehicle facility request system, as outlined in the previous sections, has resulted in significant changes to the process flow and overall efficiency. By applying key streamlining techniques such as error proofing, simplification, upgrading, and automating/mechanization, the system has been enhanced to address the root causes of inefficiencies and deadlock issues identified in the earlier process analysis. These improvements aimed to eliminate bottlenecks, minimize non-value-added (NVA) activities, and streamline the workflow. Error proofing, through automatic retries, reduced the need for manual checks and ensured a more reliable approval process. Simplification replaced manual tasks like notifications and report submissions with automated processes, cutting down processing time. The addition of a monitoring dashboard allowed the IT team to track submission statuses, enabling faster responses. Finally, automating the approval process minimized delays and boosted overall efficiency. The impact of these improvements is clearly reflected in the post-implementation process. As seen in the "To-Be" business process flow, which is illustrated in Figure 2, the system now operates with a much smoother and faster workflow. Each stage of the process, from submission to approval, has been optimized for speed and efficiency. Despite the improvements achieved, several practical limitations remain. The automation relies heavily on system stability; any failure in the Hangfire service could disrupt retry mechanisms. Additionally, improper configuration of retry intervals may lead to resource overload. Future work should also consider the risk of over-automation, reducing user oversight, and the importance of continuous monitoring to ensure system resilience.

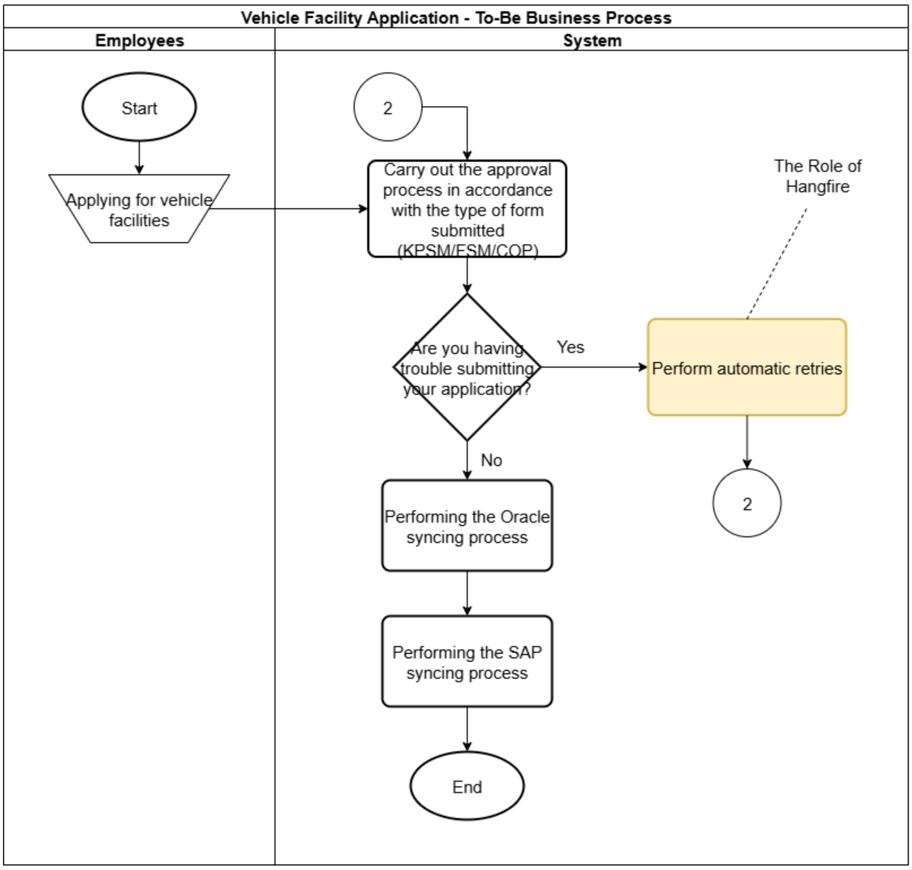

Figure 3. Business Process for Applying for Vehicle Facilities To-Be

Additionally, the cycle time for each activity after the implementation has been analyzed based on the Adding Value framework. The results, as shown in Table 6, highlight a significant reduction in the overall cycle time compared to the pre-implementation system. The categorization of activities into Real Value Added (RVA), Business Value Added (BVA), and Non-Value Added (NVA) has helped identify areas where value was added and where improvements were most effective. The comparison of the cycle times before and after the implementation reveals a substantial decrease in non-value-added activities, directly contributing to the increased efficiency of the system. These results provide a clear indication of the effectiveness of the proposed streamlining techniques and their ability to improve the vehicle facility request system.

Table 6. Details of Process Implementation Time in the "Post-Implementation" System Based on Adding Value

No	Activity	Average business time (minutes)								
		KPSM			FSM			COP		
		RVA	BVA	NVA	RVA	BVA	NVA	RVA	BVA	NVA
1.	Submitting vehicle facilities	5			5			5		
2.	Submitting approval processes	0.02			0.02			0.01		
3.	Creating problem reports			0			0			0
4.	Searching for submission data that has encountered problems			0.16			0.16			0.16
5.	Correcting submission data			0.16			0.16			0.16
6.	Performing Oracle syncing processes		< 1			< 1			< 1	
7.	Performing SAP syncing processes		< 1			< 1			< 1	
Total Time		5.02	< 1	0.32	5.02	< 1	0.32	5.01	< 1	0.32
Total Overall Time			5.34			5.34			5.33	
Time Efficiency			93.98%			93.99%			93.96%	

This example represents one of the three types of vehicle facility request processes analyzed in this study. As shown in Table 7, a comparison of the cycle time efficiency before and after the implementation of the KPSM business process reveals a substantial reduction in the total cycle time. Before implementation, the average cycle time was 248.02 minutes. Following the implementation, the total cycle time decreased by 247.70 minutes, resulting in a post-implementation cycle time of 0.32 minutes. Along with this significant reduction in cycle time, there was also a notable improvement in cycle time efficiency. The efficiency of the cycle time before implementation was approximately 2.02%, which increased by 91.96%, reaching 93.98% after the system improvements. This comparison was made using the cycle time data from Table 3 (pre-implementation) and Table 6 (post-implementation).

Table 7. Comparison Analysis of Cycle Time Before and After Implementation of KPSM Type

Description	Before Implementation			After Implementation		
	RVA	BVA	NVA	RVA	BVA	NVA
Cycle Time (minutes)	5.02	< 1	243	5.02	< 1	0.32
Total Cycle Time (minutes)		248.02			5.34	
Cycle Time Efficiency		2.02%			93.98%	

These results indicate that the efficiency gains were not only quantitative but also structural in nature. The dramatic shift in cycle time efficiency suggests that the redesign successfully eliminated critical bottlenecks and unnecessary manual interventions, specifically those related to deadlock handling. This created a more resilient and adaptive workflow where the system manages errors autonomously. Furthermore, the higher proportion of value-added activities reflects better synchronization between system automation and user interactions. This not only accelerates the process but also enhances transparency and accountability in the approval workflow, ensuring that resources are focused on productive tasks rather than troubleshooting.

4. Conclusion

In conclusion, this study has successfully demonstrated the effectiveness of implementing Business Process Improvement (BPI) and Hangfire technology in addressing deadlock issues in the vehicle facility application process at PT Unggul Lancar Sejahtera (ULS). By introducing key streamlining techniques such as error proofing, simplification, upgrading, and automating, the process was optimized to eliminate bottlenecks and non-value-added (NVA) activities. The results showed a significant

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reduction in cycle time, with the handling of deadlocks improving from 120 minutes to just 0.32 minutes, and cycle time efficiency rising from 2.02% to 93.98%. Future research should focus on addressing the handling of input and logic errors, which were not considered in the current system. The system should include input validation before tasks are sent to the Hangfire queue to prevent unnecessary retries, optimize system resources, and ensure failed tasks are either stopped or moved to a special review queue.

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