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Business Process Improvement (BPI) for Evaluation and Improvement of Business Processes

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ABSTRACT. The automotive parts industry currently faces a number of challenges such as production delays, inventory management issues, and inefficient distribution, which impact operational efficiency and customer satisfaction. To address these inefficiencies, the proposed solution is the application of Business Process Improvement (BPI) principles. The purpose of this study is to analyze the application of BPI in evaluating and improving business processes. The research method uses quantitative and qualitative approaches. The quantitative approach is done by modeling and simulation to analyze the current business process conditions. Meanwhile, the qualitative approach was used to identify the main challenges faced by the industry. Data was collected through literature review and observation, and then analyzed through a simulation process to draw conclusions. The results showed that the implementation of BPI principles using Bizagi Modeler was well received and smoothly integrated into the existing workflow, without causing significant disruptions or unexpected problems. Based on the existing business process conditions, the application of Bizagi Modeler successfully identified the main challenges hindering management efficiency as well as provided recommendations for improving business processes based on the simulation results of the most optimized scenario which could reducing cycle time by 20% and improving collaboration between production, logistics, and QA teams, which can reduce coordination delays by 30%.

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1. Introduction

The automotive industry is currently experiencing rapid growth, evident from the variety of vehicles available in society. The high demand for easy mobility significantly influences the development of the automotive industry [1]. Efficient spare parts management is very important in minimizing downtime, optimizing resources and improving overall operational performance. PT. XYZ is a company operating in the spare parts industry, especially as a manufacturer of automotive spare parts. Based on the results of initial observations, several symptoms of problems were found. There are significant differences in production targets and spare parts production results from 2019 – 2023 which for 5 years the production can't achieve the target. For most companies, fostering customer satisfaction reflects a strategic imperative that promises favorable consequences. However, despite the undisputed benefits of satisfying customers, scholars and practitioners raise concerns that in today's competitive environments, customer satisfaction may often not be enough to ensure long-lasting and profitable customer relationships [2]. In the dynamic landscape of the spare parts industry, inefficiencies are emerging as significant obstacles that impact operational performance and customer satisfaction. Delays in production, inaccuracies in inventory management, and sub-optimal distribution processes have had a ripple effect on the industry [3]. These inefficiencies contribute to increased operational costs, hindering the industry's ability to maintain competitiveness and profitability.

In response to the identified inefficiencies, the proposed solution involves the implementation of Business Process Improvement (BPI) principles. Business process management (BPM) is often employed as a driver of integration, by articulating business processes that cross the boundaries of individual business function [4]. BPM is, in essence, a management idea. Organizations perform better when they pay explicit attention to their business processes from start to end [5]. This solution approach is taken on the belief that systematic and data-driven process optimization will result in a more responsive and responsive industry.

2. Literature Review

A business process is a series of instruments to organize an activity and to increase understanding of the interrelationship of an activity. A business process is a collection of activities that are carried out in coordination within an organizational and technical environment. These activities together achieve business goals. Each business process is defined by one organization

(part), but can interact with processes run by other organizations (parts) (Weske, 2017). Business Process Modeling is, in essence, a management idea. Organizations perform better when they pay explicit attention to their business processes from start to end than when they do not [5]. Business Process Improvement is a dynamic field that relies on various theories and methodologies to improve organizational efficiency, quality and overall performance [6]. Business process reengineering is a radical approach to redesigning business processes, challenging organizations to rethink and update existing workflows to achieve significant improvements in performance, quality and efficiency [7]. There are 5 phases to BPI that provide a structured approach for organizations to systematically improve their processes:

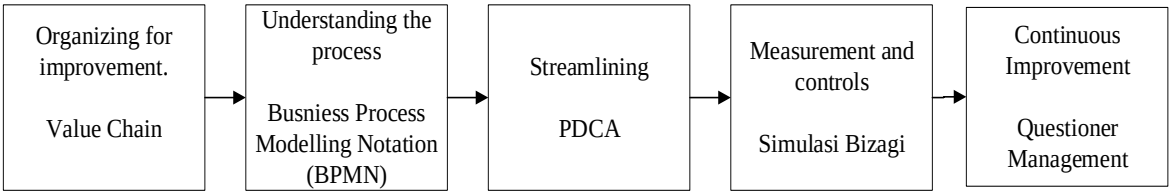

Figure 1. Business Process Improvement Phase [8]

In Organizing for improvement, value chain analysis is the full range of activities, which are required to bring a product or service from conception, through the different phases of production, distribution to consumers, and final disposal after us [9]. In Understanding the process, business Process Modeling Notation (BPMN) is a standard for modeling business processes that provides graphical notation to explain a business process. BPMN describes a business process diagram that is based on flow diagram techniques, assembled to create graphic models of business operations where there are activities and flow controls that define work sequences [10]. In streamlining, analyzing use *Plan-Do-Check-Act* (PDCA). The PDSA cycle (or PDCA) is also known as the Deming Cycle or shewhart cycle, the Deming wheel of continuous improvement spiral [11]. In measurement dan control, to automate the "to-be process" model process studied, it will be implemented with Bizagi Modeler. Bizagi Modeler is a tool used to visualize and document business processes using BPMN, a standard graphical notation for business process modeling. The app allows users to store their diagrams in the cloud, so the entire team can access and collaborate in real-time. By deeply understanding each step in a business process, organizations can more easily find areas that need improvement and implement changes that can increase efficiency and productivity [12]. Using Bizagi Modeler has various important benefits that can improve efficiency and collaboration in an organization. Bizagi Modeler offers a

better and practical approach because it is able to describe the entire process with a simple diagram that makes it easier to understand business processes. The purpose of BPMN itself is designed to support business process management by providing a notation that is easy to understand but still able to represent complex processes. With the Bizagi Modeler in BPMN, every user and developer can analyze system functions and requirements on various activities in business processes more clearly and easily understood. This makes it easier for system development to be implemented in accordance with the desired business objectives.[13]. In continuous improvement, lean management identifies seven types of waste, often referred to as "TIMWOOD" (Transportation, Inventory, Motion, Waiting, Overproduction, Over processing, and Defects).

To maintain the originality of the research, several relevant previous studies have been identified, such as research by Rakhman Nanda et al. in 2020 [14], which focused on analyzing and improving business processes using the Business Process Improvement (BPI) method in the catfish fishing business sector at PT MaksiPlus Utama Indonesia. The results of this study indicate that business process efficiency can be improved so that the supply chain can be strengthened. With the BPI method, companies can identify added value in each business activity and reduce activities that do not provide added value. Research by Sudana et al. in 2023 [15], also used the BPI method to analyze and improve business processes at PT Wonojati Wijoyo. This research resulted in a value chain analysis and five main reasons for business process improvement. Wagner in 2021 [16], modeled and simulated business processes using UML class diagrams and DPMN process diagrams to create simulation models. Troncoso et al. in 2020 [17], applied the discrete event simulation method to analyze cycle times in the plastics industry sector, using DES (Discrete Event Simulation) based BPI modeling and simulation. Fani et al. in 2022 [18], designed a product-service system with a hybrid approach for a fashion rental business model. They modeled and simulated current process conditions and designed future alternatives by combining DES and ABM (Agent-Based Modeling). Another study by Mehdouani et al. in 2019 [19], combined business process management (BPM) and simulation models to improve process modeling, execution, and improvement. Herrera in 2023 [20], used dynamic business modeling for sustainability transition in the power industry, applying dynamic business process-based BPI modeling and simulation. Di Leva et al.'s research in 2020 [21], analyzed business processes and change management with a focus on material resource planning and discrete event simulation

based on historical data. Hán et al. in 2020 [22], applied a business process management approach in the hospitality industry, using BPI modeling and simulation based on historical and real-time data. And Adesola and Baines in 2019 [6] , developed and evaluated methodologies for business process improvement, exploring practical approaches, empirical assessments, and extensions in the field of business process management.

The novelty of this research lies in analyzing the application of Business Process Improvement (BPI) to evaluate and improve business processes using Bizagi Modeler, specifically in the automotive parts industry. This research brings a number of benefits, including increased operational efficiency and value creation within the organization. In addition, this research contributes to improving customer satisfaction, streamlining operations to maintain competitiveness and profitability, and providing valuable recommendations for achieving efficiency and effectiveness in business processes in the automotive sector.

3. Method

Research Flow

In this sub-chapter, the research steps that will be carried out will be explained in order to produce outcomes that are in accordance with the objectives of this research. The steps of the research to be carried out are as follows:

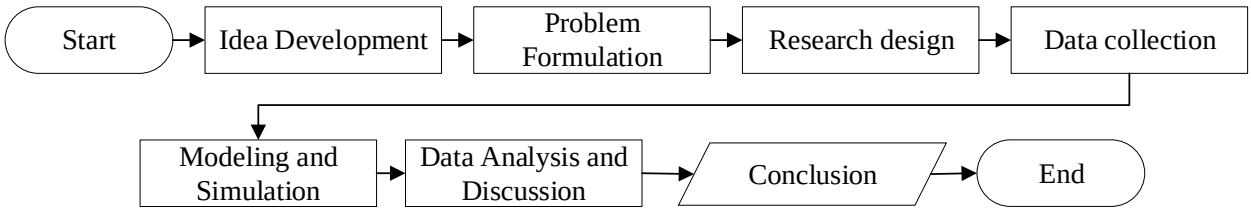

Figure 2. Research Flow

The first step was idea development, where the researcher identified the core of the problem by exploring trends in the auto parts industry. A review of industry literature, market reports, and academic publications helped identify inefficiencies and operational challenges impacting industry performance, such as production delays and suboptimal distribution. The aim was to formulate a clear research problem in order to understand and solve the existing inefficiencies. Furthermore, problem formulation is done by turning the broad problem into specific questions that can be answered. This step is very important in determining the focus of

the research and providing a clear direction. In this study, the formulation of the research question was detailed and strategic to steer the investigation towards concrete insights that could be implemented, focusing on the inefficiencies and operational challenges identified earlier.

At the research design stage, the current state of business processes was assessed using a quantitative approach with modeling and simulation to identify inefficiencies. Meanwhile, a qualitative approach was used to identify key challenges. Relevant data was collected through several stages. The initial stage involved document analysis to understand the documented business processes, followed by direct observation of the business processes to note workflows and potential bottlenecks. The data collected included qualitative and quantitative analysis to identify patterns, themes, inefficiencies and areas for improvement. The modeling and simulation phase include steps in defining and running simulation scenarios. First identify and organize scenarios that match the research objectives and potential business process improvements. Each scenario is described in detail, including conditions, variables, and expected outcomes, and stakeholders are actively involved to provide input. Scenarios were prioritized based on suitability to the research objectives and their potential impact on business processes. Next, the simulation was executed by accurately preparing the environment, systematically running the scenarios, and continuously monitoring the results. Simulation data was comprehensively collected to identify system behaviors and changes, and validated against established objectives and real-world observations, seeking feedback for adjustments to the simulation model. The simulation process is documented in detail in reports that describe the execution of each scenario and the overall simulation experience.

Data analysis begins with the compilation of all data generated during the simulation, including quantitative data and system behavior. This data is then analyzed in depth to identify important patterns, trends, and insights that can be used to evaluate business process performance. Analysis also involves monitoring system responses, identifying unexpected behavior, and noting changes that occur during the simulation. In the final stage, research conclusions were drawn based on the existing conditions of the business process. This research illustrates the main challenges that hinder efficiency in management and provides recommendations for business process improvement based on the simulation results of the most optimized scenario.

4. Research Result and Discussion

Results

This sub-chapter explains the results of data collection in the form of the condition of the company's existing business processes which are arranged in the form of a process map. Business processes as can be seen in Figure 3 consists of 3 main processes, namely management processes, core processes and supporting processes.

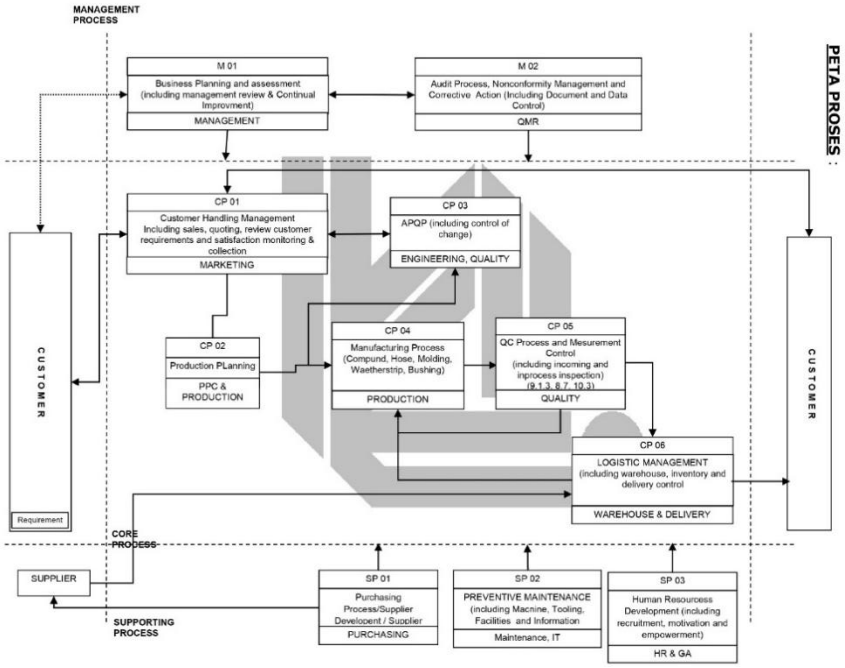

Figure 3. Business Process Map Existing

Organizing for Improvement

Value chain analysis can be carried out to analyze the value of the activities in the molding production business process.

- Inbound Logistics: Receive orders from PPIC, download PO from customers, process PO data and/or create delivery schedules, checking stock of requested goods.
- Operations: PO printing, submission of the PO to the finishing line, making a check sheet for requesting goods to warehouse 3, receipt of goods request check sheet from head of section 2 and preparation of work order for warehouse leader 3, checking work order and submitting work order to all operators, production process under the supervision of the head of warehouse section 3, delivery of parts/products according to request, checking production results to conform to work order, submission of the work order Report to the Head of Section 3, checking parts/final products.

- Outbound Logistics: creating a part/product shortage form
- Marketing and Sales: no activities related to marketing and sales
- Service: review activities, creating work order recaps, and problems.
- Weaknesses in the old business process: lack of efficiency in the Inbound Logistics section. Receiving and processing purchase orders (POs) took a long time due to inefficient stock checks and slow coordination. In addition, the many steps and manual interactions between different parts of the organization caused delays and potential errors. Another weakness was the lack of marketing and sales activities, which meant there were missed opportunities to increase revenue. Furthermore, the absence of efficient communication between the production, logistics, and Quality Assurance (QA) teams also resulted in delays and inefficiencies in day-to-day operations. All these factors together created significant obstacles to the smooth and effective running of the overall business process.

Understanding the Process

Business Process Modeling Notation (BPMN) is used to describe and analyze the workflow of molding production process visually. BPMN diagram was developed based on insights from previous value chain analysis and direct observations of operational workflows. This diagram aims to capture the end-to-end process from initial order receipt to final product delivery, including critical decision points and subprocess interactions.

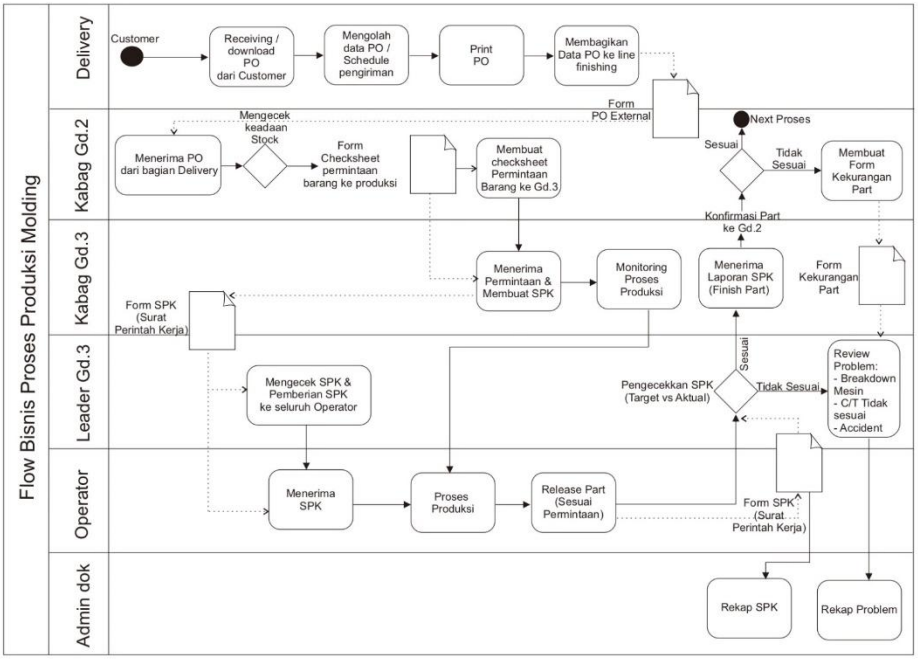

Figure 4. Business Process Modeling Notation of the molding production

Streamlining

The PDCA cycle will be applied to analyze and improve production process systematically. Each stage in the PDCA cycle will be tailored to address specific issues identified through value chain analysis and process mapping.

- Plan - The goal to be achieved is a reduction in cycle time by 20% and increased collaboration between production, logistics and QA teams to reduce coordination delays by 30%.
- Do – the existing activities are streamlining to obtain efficient operations in terms of cycle time

Table 2. Activity Streamlining Process

Activity	Streamlining Type	Notes
Print PO	Elimination and upgrading	• Adding a Big Data Storage system • PO data it will automatically be stored in the database
Sharing PO Data to the finishing line		
Create a Part Shortage Form	Elimination dan Merging	• Create a part shortage form resulting from the final production report by the Head of Division actors. • Problem Review and Problem Recap activities with the name Problem Review activity.
Review Problem		
Problem Recap		

- Check – Existing activities in the company are simulated using the Bizagi modeler to obtain cycle times
- Act - the results of time inefficiency and ineffectiveness found in the activity list are reported to the parties involved in the molding production process. This report is in the form of simulation results of existing activities along with cycle times and recommendations for increasing the efficiency level that has been determined.

Measurement and control

Simulations for existing processes need to be carried out as a comparison for increasing production efficiency to be achieved. Simulations were carried out using Bizagi Modeler software. The simulation parameters used are the time of each activity and the number of orders received. In this simulation, it is assumed that the maximum number of orders received is 2 order numbers.

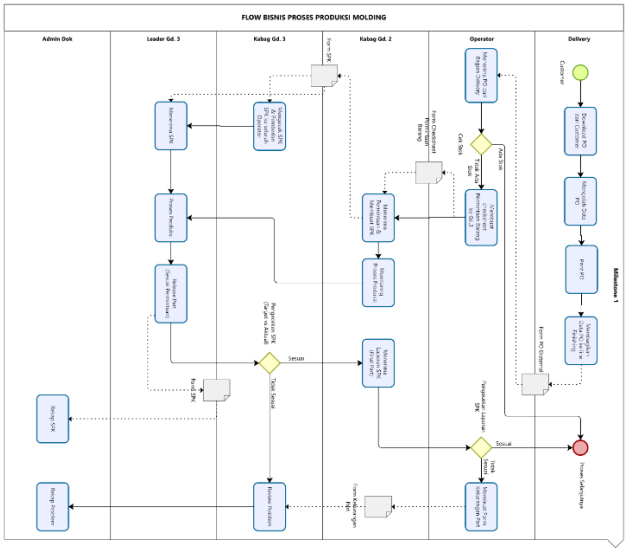

Figure 5. Process diagram of the molding production business process using Bizzagi Modeler

Table 3. Results of running simulations of existing conditions

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)
FLOW BISNIS PROSES PRODUKSI MOLDING	Process	8	8	5	470	185,625	1485

Analysis of existing processes or activities needs to be carried out to increase production efficiency. Some activity analyzes that require improvement include:

- Activities which involve administrative tasks that can be automated using technology solutions. Implementing automated systems for order processing, data management, and document creation can reduce manual errors, save time, and increase accuracy.
- Improve communication and coordination between departments or roles involved in the process.
- Evaluate and optimize stock management processes to ensure efficient inventory levels. Implementing Just-in-Time (JIT) inventory practices or using inventory management software can minimize excess inventory and reduce carrying costs.
- Strengthen quality control measures throughout the production process. Activities such as "Checking work order forms and products of the production process" and "Checking final products" are very important to ensure product quality. Implementing strong quality

assurance protocols, conducting regular inspections, and providing training on quality standards can improve product consistency and customer satisfaction.

- Standardize work processes and procedures to increase efficiency and reduce variation.

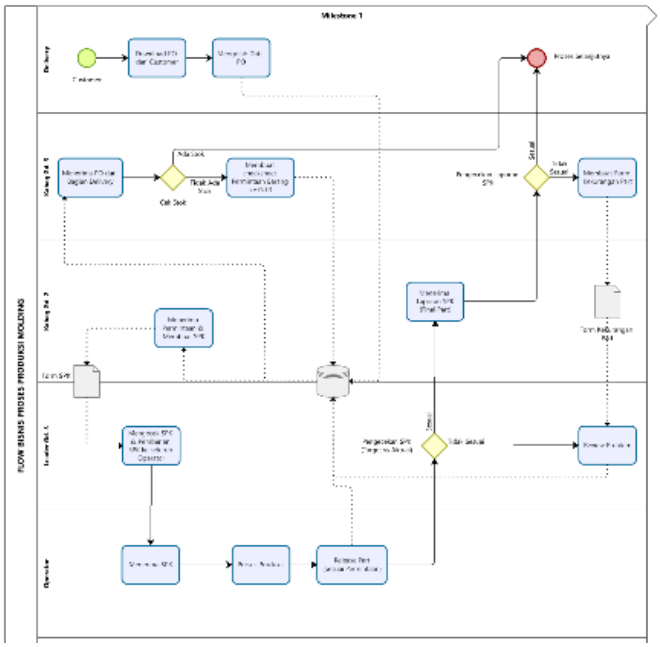

Figure 6. New Process diagram of the molding production business process using Bizzagi Modeler

Table 4. Results of running simulations of new conditions

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)
FLOW BISNIS PROSES PRODUKSI MOLDING	Process	6	6	5	460	164.167	985

Continuous Improvement

- Improvement in Cycle Time: Unanimous agreement among respondents regarding improvement in cycle time indicates the effectiveness of utilizing Bizagi Modeler for process simulation. Respondents 1, 2, and 3 highlighted significant reductions in processing times at various stages of the production process.
- Quality Concerns: While Respondents 1 and 3 expressed optimisms regarding the overall benefits of the simulation changes to product quality, Respondent 2 raised specific concerns regarding the potential impact on product quality. These respondents emphasized the importance of conducting rigorous testing and validation to ensure that efficiency

improvements do not come at the expense of the commitment in providing high quality products. Proactively addressing these concerns will protect reputation and market competitiveness, strengthen its position as a trusted provider of reliable products in the automotive industry.

- Communication and Collaboration: Respondents 1 and 3 identified significant improvements in communication and collaboration between teams as one of the main benefits of the simulation change. By simplifying workflows and increasing visibility into production processes, the new scenario facilitates smoother coordination between production, logistics and quality assurance teams. Improved communication is known to reduce misunderstandings and delays, creating a more unified operational environment.
- No New Challenges Mentioned: Interestingly, none of the respondents mentioned any specific new challenges or problems arising from the implementation of new scenarios simulated in Bizagi Modeler. These observations indicate that the simulation changes were well received and seamlessly integrated into the existing workflow without introducing significant disruptions or unexpected problems.
- Suggestions for Further Improvements: Respondent 3 provided valuable insight by suggesting further exploration of improvements to increase the effectiveness of the new scenario. These recommendations highlight the iterative nature of process improvement initiatives, where continuous evaluation and refinement are essential for continued improvement in operational efficiency and effectiveness.

5. Conclusion and Recommendation

The conclusion of this research shows that the application of Business Process Improvement (BPI) principles using Bizagi Modeler has been successfully implemented. The process changes made through simulation in Bizagi Modeler were seamlessly accepted and effectively integrated into the existing workflow, without causing significant disruptions or unexpected problems. This research evaluates the current business process, identifies key issues that hinder efficiency, and offers solutions based on simulations. Based on the simulation results of the most optimized scenario, this study provides recommendations to improve the business process. These include reducing cycle time by 20% and improving collaboration between production, logistics, and QA teams, which can reduce coordination delays by 30%.

The results recommend that the next steps include practical testing of the recommendations that have been generated through simulation. Field trials are important to assess how the proposed changes affect real conditions and to measure the actual results of implementing the recommendations. Future research is also recommended to explore the application of BPI principles in other similar contexts or industries, to understand how BPI can be applied more broadly. This includes analyzing the long-term impact of BPI, the effectiveness of the recommendations in various situations, and the search and development of new methods to further improve collaboration and efficiency in business processes.

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Conflicts of Interest: The authors declare that there are no conflicts of interest regarding the publication of this paper.

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