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Enhancing operational efficiency: implementing business process improvement by integrating the command center in the Indonesian toll road operator company

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ABSTRACT

Business process improvement is a well-known technique for organizations to identify processes that enhance business performance. This study aims to analyze and improve business processes in the company's principal operational processes that are directly related to controlling service requests for assistance with traffic problems on the toll road (Command Center), specifically in communication and handling requests for assistance and complaints from users of one of the toll road operators in Indonesia. Research is conducted by identifying existing processes, the underlying causes of existing problems, and analyzing business processes using the Business Process Improvement methodology and the Bizagi Modeler with Process Modeling and Notation (BPMN). An improvement within this approach is thus examined in a particular scenario. The as-is and to-be processes are measured using a technique of improvement design called the ESIA approach, consisting of four steps: eliminate, simplify, integrate, and automate. The result of the integration of Command Center services can decrease the response time for assisting requests from toll road users and enhance cost-effectiveness, improving customer satisfaction and the overall quality of toll road service.

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Introduction

Traffic congestion and delays are common problems in modern transportation systems. They are especially bad in urban areas and during peak travel times, such as rush hour. When travel conditions are worse than expected, such as due to an accident, construction, a special event, or bad weather, it can have a major impact on the reliability of the transportation network (Dahal et al., 2013). When unexpected traffic congestion happens, the traffic control center operator must quickly assess the situation, predict how the traffic will likely change, and choose the best action to reduce congestion (Liu et al., 2011). Many traffic factors and possible control actions must be considered during decision-making. In addition, the operator must evaluate the interdependencies between traffic conditions and traffic control actions at various network nodes. Traffic

control actions can affect traffic in adjacent road network sections. Even for experienced operators, non-recurring traffic congestion control actions can be difficult to identify (Dahal et al., 2013).

Traffic management centers (TMCs) are the central processing units of the most freeway and arterial management systems. They accomplish this by providing a central location for agencies to share information and coordinate their efforts. It also uses technology to monitor traffic conditions and implement traffic management strategies in real time. This allows the traffic management center to respond to incidents and disruptions quickly, and to keep traffic flowing as smoothly as possible. The traffic management center is an essential part of any transportation system. It is vital in keeping our roads safe, efficient, and sustainable (Jin et al., 2014). Contemporary global practice has demonstrated that effective traffic management within urban street and road networks necessitates implementing a comprehensive city-wide management system, commonly referred to as an intelligent transportation system (ITS). The system in question should possess the ability to facilitate instantaneous communication with municipal services, incorporate video surveillance devices, integrate vehicle monitoring sensors, provide provisions for evaluating traffic intensity and speed through vehicle detectors, feature electronic information boards, and display variable message signs that suggest alternative routes for intricate pathways (Kapitanov et al., 2018).

Numerous agencies are reconfiguring their programs for managing and operating transportation systems to address anticipated and unforeseen circumstances that may affect road and travel conditions and the dependability of the entire system. By improving business processes, practices, and policies, agencies can work together to execute more effective operations strategies to lessen the impact of such events on the transportation system (Dahal et al., 2013). Road traffic management needs to extend the technology coverage scope, integrate the system resources, and improve the comprehensive benefit (Liu et al., 2011). Business processes within the realm of traffic management share several characteristics, including (1) The deployment of equipment and infrastructure in the field to monitor and regulate traffic. This includes traffic sensors, cameras, and control centers; (2) Integrated systems to facilitate monitoring and control. These systems collect data from the field and use it to create a real-time view of traffic conditions, and (3) allocate personnel resources to monitor the network and execute strategies. These personnel use the data from the integrated systems to decide how to manage traffic (Dahal et al., 2013).

In today's world, the success of any organization, the level of satisfaction of its customers and partners, and the strength of its relationships with other businesses all depend on the quality of its products and services 6. Implementing continuous process analysis is crucial for organizations to uphold optimal service levels, efficiently allocate resources, promptly respond to fluctuations, accommodate market demands, ensure stakeholder satisfaction, optimize time and cost, and sustain a competitive advantage h(Rajsman & Škorput, 2022). The successful implementation of improving business processes requires the identification and documentation of process models. Modeling the business processes aids in identifying all fundamental aspects of a business and is a powerful yet straightforward method for comprehending and communicating what occurs in existing processes (Lyridis et al., 2005). In a modern business landscape characterized by intense competition, enterprises must continually enhance their operational procedures to sustain their competitiveness. The task of management entails the ongoing evaluation and enhancement of organizational procedures to enhance their efficiency and efficacy (Bandara & Opsahl, 2017).

The difference between this research and previous research lies in the research subject, where the previous research was conducted at a Greek shipping company, while this research is an Indonesian toll road operator company. This study aims to analyze and improve business processes in the company's principal operational processes that are directly related to controlling service requests for assistance with traffic problems on the toll road (Command Center), specifically in communication and handling requests for assistance and complaints from users of one of the toll road operators in Indonesia. This research focuses on analysing effective communication processes, assistance requests, and complaints from user toll roads between the communication center and the command center through command center integration using a business process improvement approach. To demonstrate how enhanced and integrated core business processes help organizations achieve their goals, including those related to customer satisfaction in the transport industry. Therefore, this study presents a case study from an integration command center at one of Indonesia’s toll road operators.

Business Process Improvement (BPI)

Business Process Management (BPM) refers to a methodical strategy aimed at enhancing the efficiency and efficacy of an entity's processes (Dalmaris et al., 2007). BPM encompasses identifying, modeling, and optimising organisational processes to enhance customer service, minimise expenses, and augment productivity. In the contemporary business landscape characterized by intense competition, enterprises must continually enhance their operational procedures to sustain their competitiveness (Meng Tay & Peng Lim,

2006). BPM is founded on the premise that a company's delivery of any given product or service is contingent upon the execution of multiple activities. Business processes are fundamental for arranging these operations and enhancing comprehension of their interconnections (Weske, 2007). BPM focuses on improving organisations' process efficiencies to reduce costs and improve quality (Syed Ibrahim et al., 2019). BPM is a discipline that focuses on recognising and enhancing organizational processes (Syed Ibrahim et al., 2019). Business Process Improvement (BPI) pertains to the ongoing effort of identifying, analyzing, and improving business processes.

The systematic methodology is employed to enhance an organization's efficiency, efficacy, and profitability (Amin, 2013). The Business Process Improvement (BPI) methodology has the potential to enhance diverse business processes, ranging from customer service and manufacturing to sales (Bendell, 2005). BPI is a fundamental tool for business development, quality improvement, and change management (Coskun et al., 2008). It is a method for streamlining and managing business activities to increase efficiency, productivity, and agility (Dalmaris et al., 2007). This can lead to a competitive advantage in the market. BPI is a bottom-up approach to improving business processes (Neufeld & Deo, 2018). It involves identifying and addressing problems at the operational level rather than the strategic level. BPI can lead to improvements in internal and external quality parameters, such as processing time, operating costs, productivity, speed of service, customer satisfaction, responsiveness, and reliability (Ranjbarfard et al., 2013).

BPI Phases

Existing BPI methods range from incremental continuous improvement to radical reengineering of the enterprise and its processes (Ranjbarfard et al., 2013). Adopting research by (Mehdouani et al., 2019), the following are the phases of the method for enhancing a business process improvement through simulation consists of: (1) Process Identification, this phase involves identifying the business processes that need to be improved, including the description of goals and the definition of related performance metrics. (2) Process Design As-Is, this phase entails the development of a visual depiction of the present process, commonly referred to as the "as-is model." (3) Analysis As-Is Process aims to define the issues uncovered while modelling the existing process. Process owners and subject matter experts (SMEs) validate the model by walking through all phases and outcomes. If a simulation model does not accurately represent the system, the results will be invalid and may negatively impact decision-making (Safari, 2016). (4) Designing To-Be Process, this phase involves designing a new process that addresses the areas for improvement identified in the previous phase. (5) Process Implementation, at this stage, the analysis is conducted by comparing the initial process model (as-is) to the results of the business process model implementation (to-be) to facilitate the translation of the process model (to-be) for it to be implemented. (6) Process Execution and Control, referring to the execution and control of processes, involves identifying the points in a business process where failures can occur and its implementation strategy to ensure that designed improvements to business processes are carried out as expected.

Business Process Modelling Notation (BPMN)

Graphical notations are often used to communicate ideas more clearly and effectively. This is especially true in complex organizations, where it can be not easy to understand complex processes without a visual representation. Graphical notations can be used to represent business processes, which involve one or more inputs and an output. By visualizing business processes, stakeholders can better understand how work is done and identify opportunities for improvement (Malinova et al., 2022; Weske, 2007). The Business Process Model and Notation (BPMN), which was published in December 2013 by the Object Management Group (OMG), is a widely adopted standard for process modeling. BPMN is the most popular process modeling standard and is utilized by businesses of all sizes to enhance their business processes. BPMN is a graphical notation that uses shapes and symbols to represent activities, events, and workflow through a process. Activities are rounded rectangles, control nodes (called gateways) are diamond shapes, and arcs (called sequence flows) connect them to determine the process order(Andersen, 2007). According to (Bienhaus & Haddud, 2018) GPSS, Arena, Flexsim, ProModel, Simul8, iGrafx, and Vanguard are among many simulation tools that support business process simulation. Over the past 40 years, BPS tools have gone from language-based to drag-and-drop graphic interfaces. This has made BPS tools more accessible to a wider range of users and has led to an increase in the use of BPS for business process improvement (Safari 2016). Other tools that also supported BPMN Simulation e.g., Bizagi and Bonita (Bisogno et al., 2016).

Process Redesign

Andersen, (Andersen, 2007) grouped the redesign process into four stages of the ESIA approach: Eliminate, Simplify, Integrate, and Automate. The suitable activities for each process are: (1) Eliminate excess production, waiting time transport, processing, storage, defects/errors, duplication, reformatting, inspection,

and reconsolidation. (2) Simplify: form, procedures, communication, technology, problem area, flow, processes. (3) Integrate: Jobs, Groups, Customers, Suppliers. (4) Automate: dirty work, difficult, dangerous, boring, data capture, data transfer, data analysis. The first stage is to eliminate all non-value-added activities. Typically, several activities are identified to be non-value-adding and, as a result, can be eliminated without negative repercussions. Once we have eliminated as many unnecessary duties as possible, the next step is to simplify the remaining tasks. Usually, the aspects that fall under the category of "simplify" are related to overly complicated situations (Siha & Saad, 2008).

Following that, the remaining responsibilities involve integrating and improving the flow of deliveries between suppliers, the organization, and customers. This can be achieved on different levels. Firstly, merging multiple smaller tasks into a single larger task is often feasible. This approach has several advantages: it enhances the nature of each employee's work and eliminates the need for interaction between different areas of responsibility. Secondly, it is possible to include various specialists in groups that are responsible for a greater number of tasks. The third level involves integrating the organization with its customers and suppliers. Organizations that establish a close relationship with their suppliers and consumers generally enjoy more stable conditions and greater opportunities for mutual improvement (Jeston & Nelis, 2014). Ultimately, automation serves as the ultimate strategy. When automated processes are well-designed from the beginning, utilising information technology and computerization can be highly effective and yield excellent results as supportive tools.

Command Center

Transportation agencies use traffic management systems (TMS) to improve management and operations, especially in land transportation. Along with traffic system operations and management, TSM can support programs and exchange information with them. The tactical management system (TMS) integrates field equipment, modern communications, and IT (Buer et al., 2018). One of the processes comprising the TSM, also known as the Intelligent Transportation System (ITS), is command and control operations.

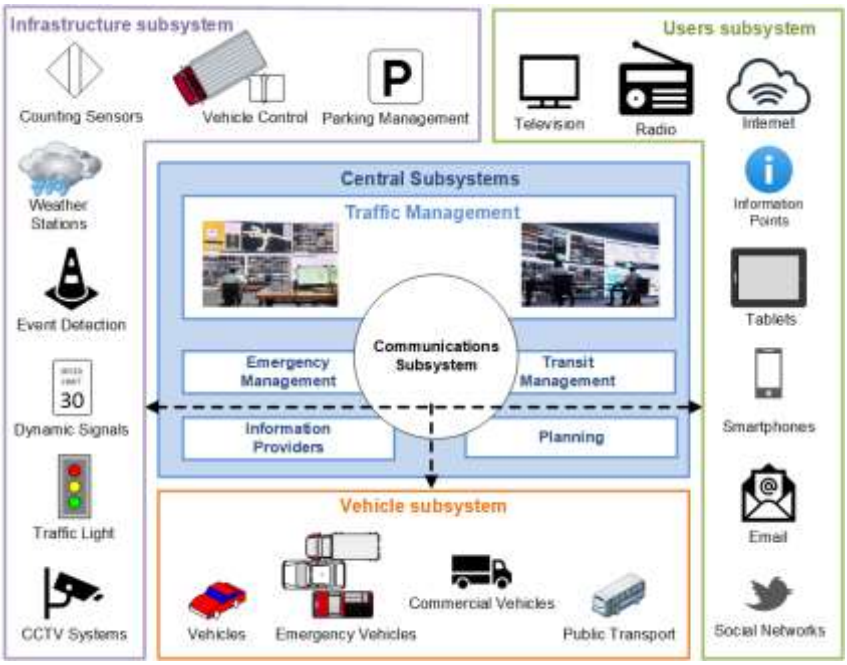

Figure 1. ITS Conceptual Model (Lang et al., 2015)

ITS considers vehicles, infrastructure, and users in all modes of transportation. are telecommunications and computer solutions that improve transportation management, maintenance, monitoring, control, and safety (Lang et al., 2015; Siha & Saad, 2008), as shown in Figure 1. According to the conceptual model, various organizations use several terminologies associated with ITS deployment, including traffic control management, traffic control centers, traffic management centers, and command centers.

Method

The research presents a case study analysis of the enhancement business process of the integration command center using a mixed-methods analysis. The qualitative analysis began with analysis using BPMN of current

business processes in accordance with the research's scope using document and archive procedures and interviews with participants as subject matter experts (SMEs) (Engelhardt, 2018). All data pertaining to the current process (as-is) were collected for quantitative analysis and then analyzed using the Bizagi Modeler based on time. The development of the selected process model for process improvement will be determined based on the data obtained from the as-is process analysis. The modeling outcomes are then simulated with Bizagi Modeler to calculate the duration and cost of the to-be process in Microsoft Excel.

Analysis

Data Collection

The collection of data and documentation of the process is carried out qualitatively to analyze the communication process, including requests for assistance and complaints from toll road users. Then, determine the function at the level of the unit that manages the Command Center Management System and determine the work related to the scope of the activity for further analysis. The necessary data is collected by investigating all information related to the job and then conducting interviews with the owner of the process or subject matter expert (SMEs) among business management whose data is related to the communication process and handling of assistance requests as well as complaints of road users in the Communication Center Area and Command Center in the field of customer management so that information is obtained for mapping the modeling of the form of business elements and measurement metrics that will then be used for simulation of the duration of each process. Data collection is summarized in Table 1, which shows the numbers and roles of interviewees in each research phase.

Table 1. Data Collection Phase

Phase	Methods	Key Participant
Phase (1): Process Identification	• Documentation / Achieves • In-Depth-Interview	• Two Department Heads (Experiences min. 8 years)
Phase (2): Process Design	• Documentation / Achieves • Procedures • Semi-Structured Interviews	• One Department Head (Experiences min. 8 years) • Two Operation Manager (Experiences min. 15 years)
Phase (3): Analysis as-is Process	• Documentation / Achieves • Procedures • Simulation	-
Phase (4): Designing To-Be Process	• Study Literature • Semi-Structured Interviews • Simulation	• One Department Head (Experiences min. 8 years)
Phase (5): Process Implementation	• Study Literature • In-Depth-Interview	• One Board of Director (Experiences min. 13 years)
Phase (6): Process Execution and Control	• Documentation / Achieves • Procedures	-

Data Analysis

Data processing was carried out using Business Process Modeling and Notation (BPMN) under the assumption that the business process simulation (as-is) and (to-be) is a deterministic system or a system whose behavior can be accurately predicted. Where the design-to-be process is carried out utilizing the ESIA (Eliminate, Simplify, Integrate, Automate) methodology and the Business Process Improvement approach, consisting of six phases as follows: (1) Process Identification: During this phase, identification will be performed as part of communicating and handling requests for assistance and complaints regarding traffic management services in the Command Center and Communication Center Area. (2) Process Design As-Is: When carrying out the mapping of traffic services, particularly the communication process and handling of requests for assistance and complaints, the organization's role as well as the process owner, or subject matter expert (SMEs), participates in semi-structured interviews to gather primary and secondary data. This occurs from the time assistance requests are received by the Communication Center Area and Command Center until toll road users accept assistance. (3) Analyzing As-Is Process: After collecting actual and relevant data related to the research topic, analyze the as-is process using the Bizagi Modeler based on quantitative criteria for the

duration of each activity in minutes. Bizagi Modeler is a modeling and documentation application for business processes. Models enable the visual representation of diagrams, models, and business process documentation in BPMN (Business Process Model Notation) standards (Sulfati, 2018). (4) Designing To-Be Process: Based on as-is process visualization, a process model is developed to improve the process. (5) Implementation Process: At this stage, the analysis is conducted by comparing the initial process model (as-is) with the results of the business process model implementation (to-be) to facilitate the translation of the business process model (to-be) to be implemented. (6) Process Execution and Control: The strategy for the implementation of business processes (to-be) is developed based on a review of relevant literature and a SWOT and TOWS analysis conducted using the Interview technique with the Executive Management of the operator toll road company.

Results and Discussion

Toll Road Business Process

In order to comprehend the business process in the field of road toll operations, a mapping of the operational scheme of the road toll in Indonesia is conducted with the participation of various stakeholders, including the regulator consisting of the Minister of State-Owned Enterprises, the Ministry of Public Works and Public Housing, the Toll Road Management Agency, the Toll Road Business Agency, the Toll Operator Company, and users. The management, central, and support processes comprise the business model of the toll road operating system. The core process has various business process activities, such as business planning and development, operation management, information technology, and innovation. The services a toll road operator provides include traffic, transaction, maintenance, electronic toll collection, and information technology services. At the same time, these services fall under the purview of operations management and information technology.

Business Process Improvement

Phase (1): Process Identification

The toll road operator company in Indonesia has established contracts throughout the country. It employs a two-way communication radio system to connect the Command Center with the entire Communication Center Area. This system centralizes communication control requests for assistance and traffic complaints from road toll users through the Command Center. There are three steps to managing traffic information: input, processing, and output. At the input stage, data can come from four places: reports from road users reports from operational officers, CCTV, and reports from the Communication Center Area. Also, such data or information will be processed or tracked using the media, Radio Communication 2-direction, WhatsApp Group Chat, and Command Center. The result will be information that answers requests for help or complaints through the media, Twitter, radio broadcasts, call centers, and traffic engineering recommendations.

In the event of traffic disruptions on the toll road, the Communication Center Area will receive road user reports containing requests for assistance or complaints from toll road users. Consequently, Communication Center Area officers will conduct CCTV monitoring of the road to ensure conditions, conduct a level analysis of assistance requests, and request operational officers to check a toll road user's condition. At the time of the accident, two conditions existed: first, a normal condition is when the area does not require heavy vehicles and can perform management actions using facilities such as tow trucks, rescue vehicles, ambulances, and their support facilities. The second criterion for an emergency is the need for heavy vehicles and support equipment in the area. Moreover, information on support and verification of the conditions of toll road users will be processed through the Command Center via radio communication (two-way), so if there is a similar traffic disruption on another lane road at the same time, the other Communication Center Area must wait for the line to use the communication route.

Due to the repetitive nature of the process and the need for coordination between the Communication Center Area, the Heavy Vehicle Communication Center, the Operational Officer, and the Command Center simultaneously, operational barriers for operational officers in handling action decision-making include equipment, personnel competency, and restrictions on information access in the area. This can impact the timeliness of processing and the dissatisfaction of toll road users. This may lead to an increase in phone calls, messages, and negative comments on social media, which can harm the company's reputation.

Phase (2): Process Design As-Is

A map of the Customer Relationship Communication Command Center as-is process is described using the Business Process Modeling and Notation (BPMN) modeling technique with Microsoft Visio and Bizagi Modeler to comprehend the process in greater detail based on emergency and normal conditions, as the results of Business Process Level 1 are shown in Figure 2.

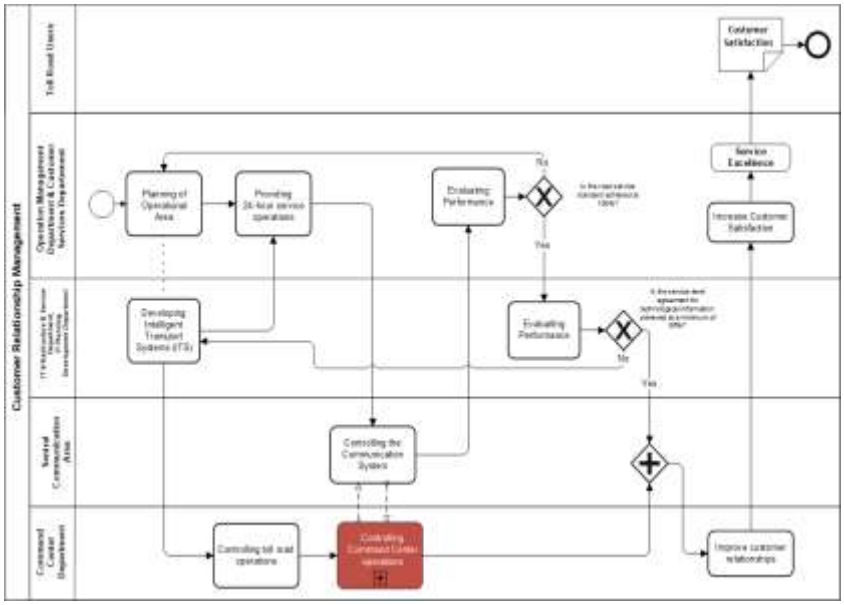

Figure 2. Level 1 (as-is) – Customer Relationship Management

Regarding the mapping of the Business Process Level 2 (as-is) Control Command Center, using the following scheme of analysis and simulation of the process of soliciting assistance from road users in one of the operating areas in the Jakarta, Bogor, Tangerang, Bekasi Region: Area A (where toll road users need assistance) and Area B (where Area A's traffic disturbances have an impact), Communication Center Area C (heavy vehicle pool), is the control center for heavy vehicle and equipment evacuation during a traffic disruption. Area C coordinates the heavy vehicle pool, which serves Jakarta, Bogor, Tangerang, and Bekasi.

In business processes of Level 2 (as-is) and Level 3 (as-is), related personnel are assigned in two sections: 1) Traffic Information Center as a sub-unit of the Command Center related to processes, consisting of a supervisor, operator of the Traffic Information Center, variable message sign operator (VMS), Twitter operator, and customer services officer call center (CSO call center). 2) Communication Center Area, consisting of the Operator Communication Center. Requests for assistance in emergency and normal circumstances with related process business owners, among other things, describe the process mapping at Level 3 (as-is), which consists of (1) Command Center (normal and emergency); (2) Communication Center Area A (normal and emergency); (3) Communication Center Area B (normal and emergency); and (4) Communication Center Area C as a function of heavy vehicle pool (emergency). Details of business processes at Level 2 (as-is) and Level 3 (as-is) under normal conditions are presented in Figure 4. to Figure7.; emergency conditions are illustrated in Figure 8. to Figure 13.

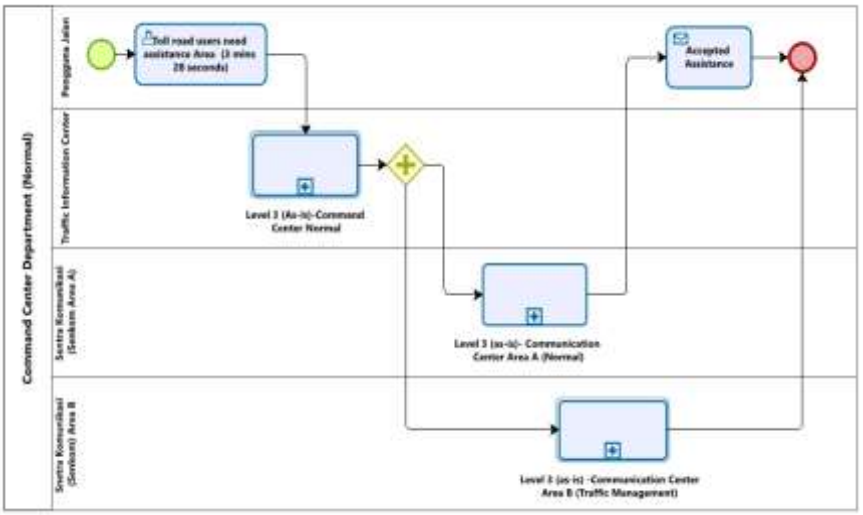

Figure 3. Business Process Level 2 (as-is) Command Center (Normal)

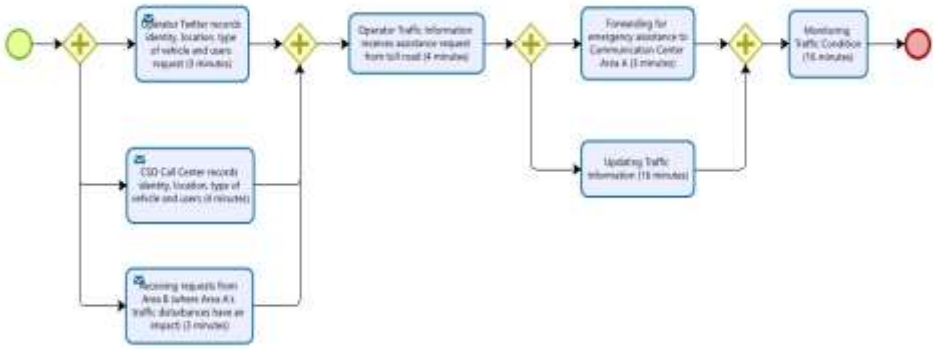

Figure 4. Business Process Level 3 (as-is)-Command Center (Normal)

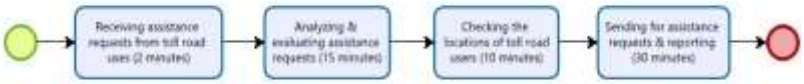

Figure 5. Level 3 (as-is)- Communication Center Area A (Normal)

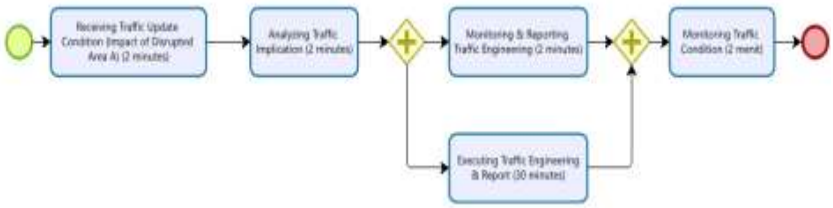

Figure 6. Level 3 (as-is) -Communication Center Area B (Traffic Management) Normal

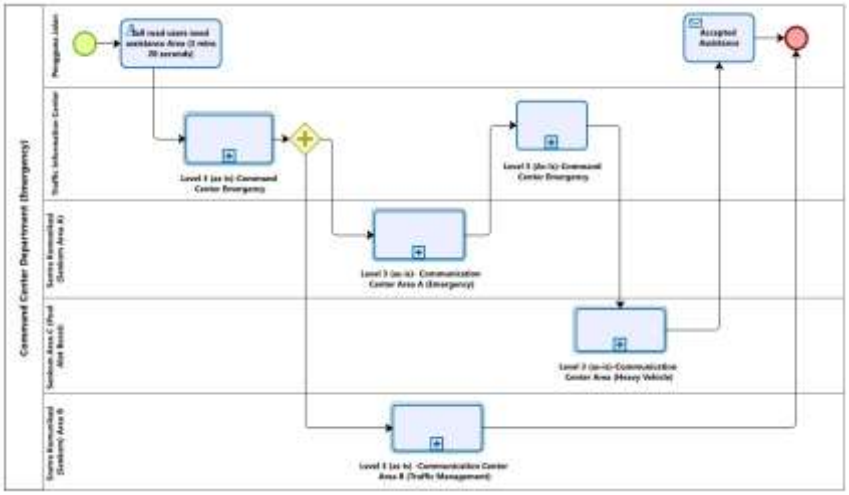

Figure 7. Level 2 (as-is) – Command Center (Emergency)

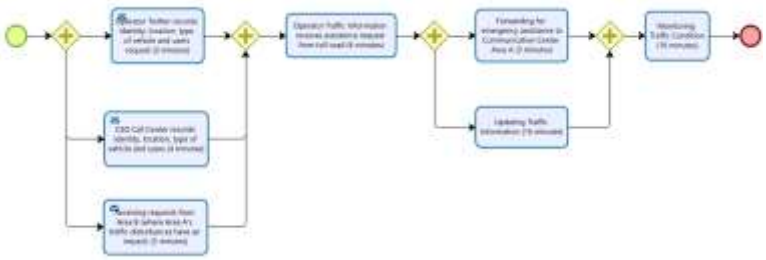

Figure 8. Level 3 (as-is)-Command Center Emergency

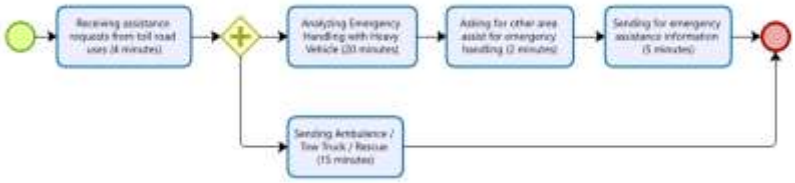

Figure 9. Level 3 (as-is)- Communication Center Area A (Emergency)

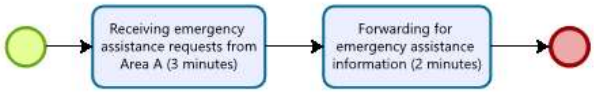

Figure 10. Level 3 (as-is)-Command Center (Emergency)

Figure 11. Level 3 (as-is)-Communication Center Area C (Heavy Vehicle) Emergency

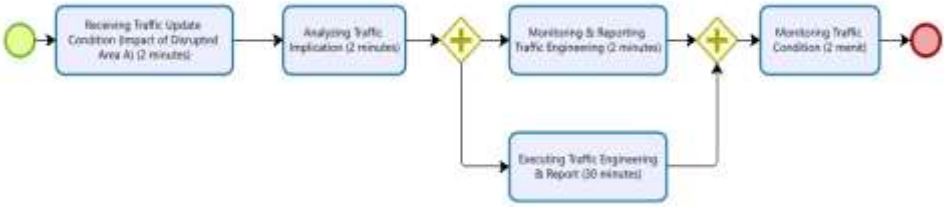

Figure 12. Level 3 (as-is)-Communication Center Area B (Traffic Management) Emergency

Phase (3): Analyzing the As-Is Process

In order to conduct these analyses, process characteristics consist of times and resources must be gathered by analyzing the actual process and then inputted into the simulation software Bizagi Modeler 24. Based on the duration identification of the business process, the overall duration calculation of Business Process Model Level 2 (as-is) and Level 3 (as-is) is simulated using Bizagi Modeler version 3.9, with the following results:

Level 1 - Process Validation

Validation of the business process model by ensuring that the activity traverses the entire mode scenario sequence and behaves as expected, assuming the activity receives at least one thousand tokens so that the model simulation execution can be stable and deliver accurate results. During the validation of a business model, the simulation results will indicate whether the gateway is synchronized with the probability of the decision set, such that the routing process behaves as expected and the entire token has been executed.

Level 2 - Time Analysis

Time simulation measures the total duration of a process. Bizagi assumes unlimited capacity to prevent delays in the process flow. This is the best-case scenario, given the processing flow and time constraints. This analysis requires the input of information including Waiting Time, Arrival Interval Time, and Processing Times.

To acquire a concise simulation, modeling business process model scenarios (as-is) with a simulation duration of 30 days are analyzed at this stage. Bizagi Modeler's validity indicator for scenario simulation data (as-is) indicates that the simulation model is without errors and can therefore be declared valid based on the results of the simulation. It is known that the number of tokens used was 1000, with the same and consistent output, so the data is deemed reliable, along with detailed process validation scenarios for both normal and emergency conditions. The following step involves calculating the duration of Business Process Model Level 2 (as-is) and Level 3 (as-is) by inputting data such as waiting time, arrival interval time, and processing times based on the simulation time. Simulated results showed that the process (as-is) took 1 hour and 34 minutes under normal circumstances and 2 hours and 36 minutes under emergency circumstances.

Phase (4): Designing Process (Improvement)
To improve the current process, redesign conducted by ESIA (Eliminate, Simplify, Integrate, and Automate) approach is identified as follows:

Eliminate
The Communication Center personnel responsible for overseeing Communication Center Area C Officers (heavy vehicle pool) will be eliminated and their duties will be assumed by Communication Center Area B officers, who are in closer proximity to the area they monitor. This is an optimization measure. The establishment of the Command Center will reduce Twitter Operators from five to four, with a daily rotation of three in charge and one reserve, per the officers' three-day on, two-day off shift schedule.

Simplify
On the plan of improvement and change of business processes (as-is), simplification of the communication route control request assistance and complaint road toll user between the command center and communication center area was performed based on the group of zoning divisions of the operation area so that the process would be as shown in the Figure11.

Integrate
By eliminating and simplifying business processes between the Command Center and the 12 Communication Center Areas, one Communication Center Area will be responsible for integrating and executing the control of traffic information and toll road user interference.

To prevent errors in the nomenclature and translation of each staff member's responsibilities, it is necessary to modify the unit's designation and the staff's name. Here are the modifications: (1) Operator of a Traffic Information Center (TIC) to a Traffic Communicator. (2) Variable Message Sign Operator (VMS) to Traffic Operator due to its responsibility to not only update the information on traffic information to be delivered via VMS, but also to conduct integrated data monitoring that can be performed from road CCTV. (3) Officers of the Area Communication Center to Traffic Communicators. (4) Integration of Intelligence Transportation System (ITS)-Based Monitoring Operators entrusted with monitoring the company's traffic monitoring-based ITS application and infrastructure. (5) Modifications to the Communication Center Area Jakarta-Bogor-Tangerang-Bekasi to the Traffic Information Center Western Region.

Automate
Optimization of the use of communication media and monitoring report management of integrated traffic disturbances based on information technology or Intelligence Transport System (ITS) that has already begun its development, as well as the transfer of the duties of the Traffic Communicator to the Operator Monitoring ITS Based Area, which the Traffic Information Center of the Region supervises. Based on the design of business process improvement, the business process scenario level 2 and 3 (to-be) analysis is then carried out to find out the time required in running the (to-be) process with the following simulation as designed in Figure 13, Figure 14. and Figure 15.

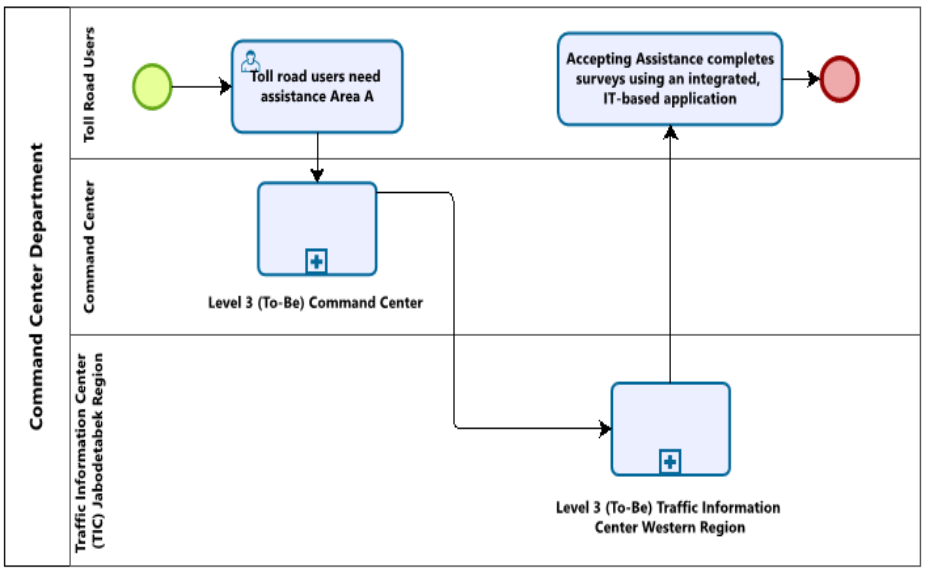

Figure 13. Business Process Level 2 (to-be) Command Center

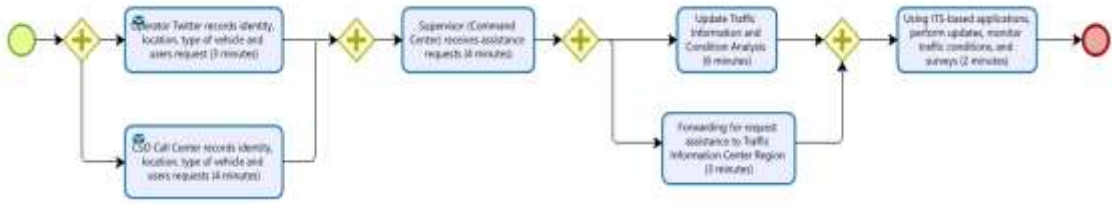

Figure 14. Business Process Level 3 (to-be)-Command Center

Figure 15. Business Process Level 3 (to-be) TIC Jakarta-Bogor-Tangerang-Bekasi Region

According to the business process improvement design, business process scenario analysis levels 2 and 3 (to-be) to determine the time it takes to run the process (to-be), with the simulation time of the entire process yielding 1 hour, 44 minutes process time.

Phase (5): Implementation Process

It is possible to compare the business process (as-is) to the design of the business process model (to-be) based on the analysis (to-be) conducted in the previous phase. The simulation of the business process model (to-be) indicates that more effective processes exist. This is evidenced by a reduction in the number of tasks, gateways, start events, and end events relative to the business process (as-is) and emergency conditions, as shown in Table 1. This condition may be accompanied by a process efficiency of 52 minutes, which is the difference in process time (as-is) and (to-be). Improvements to business processes at levels 2 and 3 impact operating cost effectiveness. Based on the unit price of the contract for service operations on the toll roads operated by the toll road operator, a recalculation is performed by converting the number of personnel in charge of the business model of the process (to-be) with the unit price per personnel of the contracts for road operations in the Jakarta-Bogor-Tangerang-Bekasi Region in 2021, resulting in a potential value of process efficacy of 46,57%.

Table 2. Business Process Comparison

Activities	Process (As-is)	Process (To-be)
Task	24	22
Gateway	8	6
Start Event	6	3
End Event	6	4
Process	11	5
Sub-Process	0	0
Time Process (mins)	156	104

Phase (6): Process Execution and Control

Based on the process of business improvement, a set of scenarios and justifications was designed. A single case study approach was chosen to ensure detailed and in-depth insights about implementation in the transport industry. Formulation of operations strategy is the process of articulating the strategy's various objectives and decisions. Unlike daily operations management, the formulation of an operations strategy is likely to be an infrequent occurrence (Anggapraja, 2016).

In determining the external and internal factors in carrying out the analysis of implementation strategies, the research identified them based on the study of research literature related to the research topic (Dalmaris et al., 2007; Lang et al., 2015; Malinova et al., 2022; Siha & Saad, 2008) and the results of in-depth interviews

with the executive management on the opportunities and threats of road toll business in Indonesia, as well as the current internal conditions of the company, as the results as follow: (1) Collaborate with the IT Department to execute a pilot project of a proposed business model, evaluate its effectiveness, identify areas for improvement, and assess its potential for further development. (2) Establish a monitoring system to facilitate the implementation of the upcoming business model while concurrently executing the pilot project. The objective is to complete the monitoring system before the pilot evaluation project concludes. (3) Reviewing and preparing Standard Operating Procedures (SOPs) involves modifying business processes to create a new operational model (to-be) and developing a transitional scenario and tools to support the transition. (4) Establish the implementation of the forthcoming business process model as a key performance indicator (KPI) department's objective and provide weekly updates on the management meeting agenda. (5) Ensure the facilities and infrastructure are ready for the implementation of the to-be business model by utilizing existing assets simultaneously with the pilot project execution. This should be achieved before the pilot project assessment is completed. (6) Engage vendors in the technology development process through a contractual build and transfer approach and impart knowledge on the technology development plan to the team, rather than to individual personnel. (7) Developing and disseminating a model implementation plan through appropriate management communication channels to ensure comprehensive stakeholder outreach. (8) Recruit experienced personnel in marketing and technology to support the implementation of the business model (to-be) using a performance-based contract system. This will enhance the competence of operational personnel and ensure successful implementation. (9) Communicate the company's performance to stakeholders and external parties through the successful implementation of the future business model.

Collaborate with the IT Department to continuously improve the business model (to-be) in response to market requirements and develop the Intelligent Toll Road System (ITRS) and cyber security threats. When assessing potential future options for the organization and project, automation, specifically workflow, is often cited as a potential or desirable solution. While workflow can be advantageous in specific situations, prioritizing people and establishing a suitable culture, motivation, responsibility, ownership, accountability, performance measures, feedback, and rewards is the most crucial element (Jeston & Nelis, 2014; Sulfati, 2018). Continuous development is a critical success factor in today's highly competitive business environments. Organizations have invested significantly in developing their digital infrastructure to maintain competitiveness (Buer et al., 2018) The assessment of process improvement implementation involves measuring progress achieved within a specific timeframe and developing an adjustment plan. This is done by evaluating the importance of operational performance objectives such as financial performance, customer satisfaction, internal department processes, and staff development. Consistent enforcement of reward and punishment policies is necessary for staff who fail to meet expected performance criteria.

Conclusion

The integration of Command Center control services into business operations can minimize the time required to respond to help requests from toll road users, increase toll road operating traffic service standards, and improve cost efficiency. The (to-be) business process model has the potential to provide a process efficiency of 33.33%, or 52 minutes, with an operating cost efficiency of 46.57% Increased communication processes for road toll users' requests for assistance and complaints about traffic disruptions are intended to contribute to developing the operating strategy for improving service excellence in road toll operations. Changes in business processes are more concise and reduce the process of coordination between personnel, allowing strategic and operational decisions related to road user assistance and traffic engineering to be made faster and more accurately and enabling road users to receive immediate assistance. Furthermore, a more efficient and accurate process for managing traffic disruptions can improve customer satisfaction with the services provided and the company's image. Improving business processes becomes one way for companies to create competitive advantage strategies and new business opportunities through service monitoring and traffic control. Due to the implementation of the unimplemented business process models, it is impossible to measure the effectiveness of the business process model (to-be), so further research can be conducted on improving business processes with the same topic (transport services) using probabilistic simulation.

References

Amin, M. Al. (2013). *A systematic approach for selecting lean strategies and assessing leanness in manufacturing organizations*. Queensland University of Technology.

Andersen, B. (2007). *Business process improvement toolbox*. Quality Press.

Anggapraja, I. T. (2016). Pengaruh Penerapan Knowledge Management dan Pengembangan Sumber Daya Manusia terhadap Kinerja Karyawan PT Telkom Tbk.(Studi Explanatory Survey pada Karyawan Unit Human Capital Management PT Telkom Tbk.). *Jurnal Aplikasi Manajemen*, *14*(1), 140–146.

Bandara, W., & Opsahl, H. (2017). Developing organization-wide BPM capabilities in an SME: the approaches used, challenges and outcomes. *Journal of Information Technology Teaching Cases*, *7*(2), 92–113.

Bendell, T. (2005). Structuring business process improvement methodologies. *Total Quality Management and Business Excellence*, *16*(8–9), 969–978.

Bienhaus, F., & Haddud, A. (2018). Procurement 4.0: factors influencing the digitisation of procurement and supply chains. *Business Process Management Journal*, *24*(4), 965–984.

Bisogno, S., Calabrese, A., Gastaldi, M., & Levialdi Ghiron, N. (2016). Combining modelling and simulation approaches: How to measure performance of business processes. *Business Process Management Journal*, *22*(1), 56–74.

Buer, S.-V., Fragapane, G. I., & Strandhagen, J. O. (2018). The data-driven process improvement cycle: Using digitalization for continuous improvement. *IFAC-PapersOnLine*, *51*(11), 1035–1040.

Coskun, S., Basligil, H., & Baracli, H. (2008). A weakness determination and analysis model for business process improvement. *Business Process Management Journal*, *14*(2), 243–261.

Dahal, K., Almejalli, K., & Hossain, M. A. (2013). Decision support for coordinated road traffic control actions. *Decision Support Systems*, *54*(2), 962–975.

Dalmaris, P., Tsui, E., Hall, B., & Smith, B. (2007). A framework for the improvement of knowledge-intensive business processes. *Business Process Management Journal*, *13*(2), 279–305.

Engelhardt, C. C. (2018). *Business process analysis of na optoelectronic sector company: process modeling and analysis in a German SME*.

Jeston, J., & Nelis, J. (2014). *Business process management*. Routledge.

Jin, X., Zhang, Z., & Gan, A. (2014). *Traffic Management Centers: Challenges, Best Practices, and Future Plans*.

Kapitanov, V., Silyanov, V., Monina, O., & Chubukov, A. (2018). Methods for traffic management efficiency improvement in cities. *Transportation Research Procedia*, *36*, 252–259.

Lang, M., Wehner, B., Falk, T., Griesberger, P., & Leist, S. (2015). *Evaluating business process improvement patterns by simulation*.

Liu, Y., Chang, G.-L., & Yu, J. (2011). An integrated control model for freeway corridor under nonrecurrent congestion. *IEEE Transactions on Vehicular Technology*, *60*(4), 1404–1418.

Lyridis, D. V, Fyrvik, T., Kapetanis, G. N., Ventikos, N., Anaxagorou, P., Uthaug, E., & Psaraftis, H. N. (2005). Optimizing shipping company operations using business process modelling. *Maritime Policy & Management*, *32*(4), 403–420.

Malinova, M., Gross, S., & Mendling, J. (2022). A study into the contingencies of process improvement methods. *Information Systems*, *104*, 101880.

Mehdouani, K., Missaoui, N., & Ghannouchi, S. A. (2019). An approach for business process improvement based on simulation technique. *Procedia Computer Science*, *164*, 225–232.

Meng Tay, K., & Peng Lim, C. (2006). Fuzzy FMEA with a guided rules reduction system for prioritization of failures. *International Journal of Quality & Reliability Management*, *23*(8), 1047–1066.

Neufeld, N., & Deo, B. (2018). Business Process Management (BPM)–Literature Review. *IIE Annual Conference. Proceedings*, 348–353.

Rajsman, M., & Škorput, P. (2022). Methodological approach for evaluation and improvement of quality transport service in public road passenger transport. *Tehnički Vjesnik*, *29*(1), 139–148.

Ranjbarfard, M., Aghdasi, M., Albadvi, A., & Hassanzadeh, M. (2013). Identifying knowledge management problems using a process-based method (a case study of process 137). *Business Process Management Journal*, *19*(2), 263–291.

Safari, A. (2016). An effective practical approach for business process modeling and simulation in service industries. *Knowledge and Process Management*, *23*(1), 31–45.

Siha, S. M., & Saad, G. H. (2008). Business process improvement: empirical assessment and extensions. *Business Process Management Journal*, *14*(6), 778–802.

Sulfati, A. (2018). Efektivitas Pengembangan Usaha Mikro Di Indonesia. *Jurnal Aplikasi Manajemen, Ekonomi Dan Bisnis*, *2*(2), 59–69.

Syed Ibrahim, M., Hanif, A., Jamal, F. Q., & Ahsan, A. (2019). Towards successful business process improvement–An extension of change acceleration process model. *PLoS One*, *14*(11), e0225669.

Weske, M. (2007). *Business process management architectures*. Springer.