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Optimizing Certification Submission through an Integrated Information System with DMAIC Framework

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Abstrak

Pengajuan sertifikasi di PT Kereta Api Indonesia dilakukan secara manual yang mengakibatkan berbagai permasalahan seperti ketidakefisienan, kurangnya ketepatan dalam pencatatan, potensi duplikasi data atau kehilangan dokumen, keterlambatan persetujuan akibat alur informasi yang terdesentralisasi, serta kurangnya transparansi yang menyulitkan karyawan untuk memantau status pengajuan sertifikasi mereka. Tujuan penelitian ini ialah untuk menganalisis dan mengusulkan aplikasi sistem informasi untuk pengajuan sertifikasi di PT Kereta Api Indonesia (Persero). Penelitian ini dilakukan menggunakan pendekatan kualitatif melalui wawancara semi terstruktur dan analisis data internal perusahaan, serta mengacu pada kerangka kerja DMAIC (Define, Measure, Analyze, Improve, Control) untuk menemukan dan memperbaiki akar penyebab ketidakefisienan proses.Hasil penelitian ini ialah bahwa untuk mengatasi kekurangan ini, diusulkan sistem pengajuan sertifikasi berbasis mobile dengan sistem informasi terintegrasi, pemrosesan dokumen otomatis, pelacakan waktu nyata, dan peningkatan kemudahan penggunaan bagi pegawai lapangan serta pihak yang memberikan persetujuan. Sistem yang diusulkan ini diharapkan dapat meningkatkan efisiensi, mengurangi keterlambatan, dan mendorong tujuan digitalisasi jangka panjang.

Kata Kunci: Pengajuan Sertifikasi; Sistem Informasi Terintegrasi; Mobile; Framework DMAIC.

Abstract

Certification applications at PT Kereta Api Indonesia are submitted manually, resulting in various problems such as inefficiency, inaccuracy in recording, potential data duplication or document loss, delays in approval due to decentralized information flow, and a lack of transparency that makes it difficult for employees to monitor the status of their certification applications. The objective of this study is to analyze and propose an information system application for certification submissions at PT Kereta Api Indonesia (Persero). This study was conducted using a qualitative approach through semi-structured interviews and internal company data analysis, and refers to the DMAIC (Define, Measure, Analyze, Improve, Control) framework to identify and improve the root causes of process inefficiencies. The results of this study indicate that to address these shortcomings, a mobile-based certification application system with an integrated information system, automated document processing, real-time tracking, and enhanced user-friendliness for field staff and approval authorities is proposed. The proposed system is expected to improve efficiency, reduce delays, and support long-term digitalization objectives.

Keyword: Certification Submission; Integrated Information System; Mobile; DMAIC Framework.

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1. Introduction

In digital era, information systems are critical to enhancing operational effectiveness, precision, and efficiency across many fields such as business, government, and transportation. The digital era is an age of rapid technological advancements, and it is characterized by the global adoption of digital technologies such as internet and cloud computing. All these technologies have transformed industries, drive global connectivity and reshaped business models. Information systems on digital era have evolved beyond being tools for processing data to powerful systems that enable strategic decision making, operational effectiveness, and innovation. The use of the internet has connected billions of people and created a networked world where access to real time information is possible, enabling global communication and collaboration. Information systems not only serve as a means of data processing, but also as the actual basis of strategic decision making and competitiveness enhancement for organizations. In Indonesia, the digital era has evolved very rapidly, especially in the case of information systems, which are now essential in driving growth and innovation in most industries. While the country is learning to evolve with digital technology, information systems have played a significant role in revolutionizing industry and governance. Based on data collected by (Statistik, 2023) entitled Indonesian Telecommunication Statistics 2022 states that, data from the 2022 National SocioEconomic Survey, the percentage of Indonesian citizens who had used the internet within the last three months in 2022 was 66.48%. That is a significant increase compared to last year, 62.10% in 2021. The increases were both in the urban and rural regions, with higher usage of the internet in the urban regions (74.16%) compared to rural regions (55.92%).

With increasing internet penetration in Indonesia, information system development is also occurring at a very fast rate. This can easily be observed in areas such as e-commerce, education, and government, which are continuously being assisted by digital technology for making things more efficient and the delivery of service to people. Government organizations as well as businesses are increasingly relying on digital based information systems to deal with data and make more precise, effective and timely strategic decisions. To manage company systems more effectively, PT Kereta Api Indonesia developed some information systems that combine information technology (software and hardware), data, business processes, and human resources to effective strategies in information management. The following are the information systems available at PT Kereta Api Indonesia. A Human Resource Information System (HRIS) is a crucial tool that integrates various human resources functions such as time management, recruitment, employee performance management, payroll into a centralized digital platform. In PT Kereta Api Indonesia, the Human Resource Information System (HRIS) plays a pivotal role in the collection of worker information from subsidiaries and the head office. Data is typically required to enable efficacious integration of data throughout application development so that the data will be accessible and usable. Currently, the human resources application that is starting to be built is called Employee Super Apps (ESA) which integrates data from the entire KAI Group.

Figure 1. Employee Super Apps Logo

Sikeska is a health information system maintained by PT Kereta Api Indonesia. It integrates health related information, including employees medical histories, particularly those recorded by the companys Mediska clinics. The systems main objective is to enable monitoring, compilation, and management of employees health information in a single integrated system. The Indonesian Ministry of Transportation, through the Direktorat Jenderal Perkeretaapian (DJKA) applies railway human resource certification to

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enhance the competencies of employees in Indonesia with the purpose of reducing the probability of accidents and making rail travel safer. It pertains to the necessity for enhanced competencies in organizational culture, safety protocols, and integrated systems which are imperative for contemporary railway operations (Nahry, 2023). Ministry of Transportation of the Republic of Indonesia, through regulation of the Minister of Transportation of the Republic of Indonesia Number 18 of 2023 regarding the amendment of Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 4 of 2017 concerning the certification of railway personnels competency. The amendments are made to improve the competency of railway operators to meet the growing demands for the railway service. The amendments address the various areas of railway personnel operations, competence, training, certification requirements, and operating systems for manual and automatic railway systems. The regulation aims to enhance the qualifications of personnel operating in the railway sector through the enforcement of more specific standards and procedures in competency testing and certification. These also include specific requirements for special railway equipment operations and impose conditions on maintaining competency by re certification and training (Perhubungan, 2023). For certification of railways infrastructure inspector Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 21 of 2023 is intended to provide assurance that inspectors have the competencies required by the evolving needs and progress in the railway field. The certification and competency scheme are anticipated to allow railway infrastructure inspectors to enhance the safety and operational effectiveness of Indonesia's railway network (Perhubungan, 2023). In addition, it is governed by Regulation of the Minister of Transportation of the Republic of Indonesia Number 23 of 2023, which covers certification of railway infrastructure maintenance personnel (Perhubungan, 2023). The latest regulation, Regulation of the Minister of Transportation of the Republic of Indonesia Number 27 of 2024, guarantees that human resources in the development of railway infrastructure have competencies in accordance with safety and quality standards (Perhubungan, 2024). PT Kereta Api Indonesia realizes its importance competency certification that employees possess the requisite qualifications and skills necessary to adhere to the operational standards of the organization by Direktorat Jenderal Perkeretaapian (DJKA). Furthermore, PT Kereta Api can earn incentive for Infrastructure Maintenance Operation (IMO) competency submitted to the Direktorat Jenderal Perkeretaapian (DJKA). Requirements to generate income from the IMO human resources railway contract are:

1) Certification
2) Attendance
3) Photo documentation, activity data, and proof of delivery

The Indonesian Ministry of Transportation, through the Direktorat Jenderal Perkeretaapian (DJKA) create standard railway human resource certification which must be carried out by PT Kereta Api Indonesia. As part of its operations, PT KAI emphasizes strict compliance with safety and competency standards for its employees. Furthermore, PT Kereta Api can earn incentive for IMO competency submitted to the Direktorat Jenderal Perkeretaapian (DJKA), which is a business that is acquired through certification. With the obligation to submit certification regulated by regulations and income obtained from IMO competencies, PT Kereta Api must create an integrated information system emlpoyee submission certification for centralized database. This will make it easier to forward requests for certification to Direktorat Jenderal Perkeretaapian (DJKA). From field employees perspective, they need something that makes it easier to submit certification submission based on their competencies. They are looking at paperless and enhancing the way one enters required competency standards into the certifications they wish to apply for. From the perspective of employee role approver (supervisor, human resource staff and certification unit) perspective, they are responsible for reviewing, recap and approving certifications submission. In the specific case of the certification unit approval, they want a system that is integrated with the Direktorat Jenderal Perkeretaapian (DJKA) application system so that the collected applications can be directly executed in the Direktorat Jenderal Perkeretaapian (DJKA) system. The current problem also arises from the extent of the employee that requires much certification from the parent company PT Kereta Api Indonesia and subsidiaries which results in a long approval process of the certification submission and

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at the end automatically results in delays in the process of applying for the certification application to DJKA. Due to this, PT Kereta Api can lose incentives from IMO competencies and will result in losses for the company. The purpose of this study is to analyze and propose an information system application for certification submissions at PT Kereta Api Indonesia (Persero). Information systems encompass the process of acquiring, storing and processing data to aid decision making and organizational functions. They integrate people, technology and processes to structure information efficiently. Information technology is the hardware, software and networks. They bring communication, enhance productivity, and enable distributed computing solutions to be created, thereby enabling innovation and efficiency in all types of applications across various industries ("Information Technology and Systems," 2023). The significance of intelligent systems in railway transport management, with an emphasis on their role to enhance efficiency and safety of operations. Integrated information systems like these enhance coordination and decision-making for freight and passenger transport. They also enable compliance with rules by modernizing infrastructure and optimizing traffic control. The methodological approach provided here highlights the rising needs and technological innovations demanded of these systems, illustrating their worth in the evolving context of railway transport (Dimitrov & Lalov, 2024). Digital transformation technologies enhance strategic planning and decision making through the ease of data analysis and communication. Fusing information from various sources, the information system produces an integrated overview that informs innovative intelligence programs, eventually enhancing operational efficiency and harmonizing industry requirements and assuring regulatory compliance requirements (Jayakrishnan *et al*., 2023). Software Development Life Cycle (SDLC) is the systematic process that organizations utilize to plan, create, and test quality software, with the reviewed paper marking its imperative role in incorporating security controls in all phases to limit vulnerabilities and establish utmost defense mechanisms against cyber attacks. The research emphasizes that SDLC is not a purely technical process but a socio ethnic process and encompasses a series of supporting practices beyond coding, including risk management, security metrics, culture, policy development, communication processes, ethics, and privacy. These industry, government, and academia-driven strategies intend to integrate security from the beginning of a project through disposal, covering both the technical and non-technical dimensions to achieve a general security culture within organizations (Kudriavtseva & Gadyatskaya, 2022).

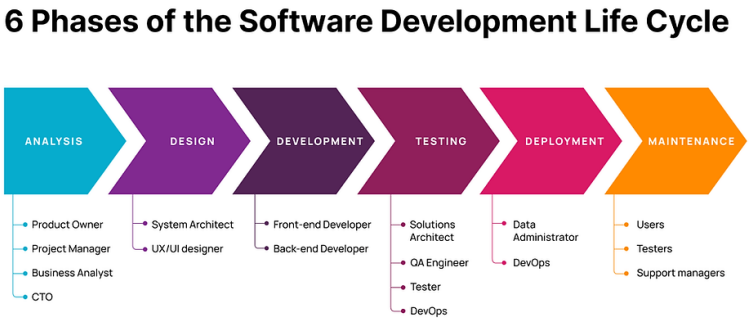

Figure 2. SDLC Flow

Explanation:

1) Analysis: the stage where needs of the user are collected and analyzed. Throughout the Analysis phase, roles like product owner, project manager, business analyst, and CTO assist in comprehension of business requirements, requirements definition, and coordination of the project with the strategy of the company. The cycle moves on to system design, software development, functionality testing, deployment for use, and continuous maintenance to allow ongoing improvement and assistance. There are specific roles within each phase to assist in forming a systematic and efficient development process.
2) Design: the system architecture, user interface (UI), and design of the software are generated. The system architect lays down the overall technical blueprint of the system, ensuring its scalable and

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functional, while the UI/UX designer ensures the system is intuitive and user friendly, prioritizing design aesthetics and user interface to enchance interaction with the software.

3) Development: software coding where developers built the features and functionality.
   Frontend developer ensuring that the user interface is efficient, simple and allowing users to interact smoothly with the software. Another side, backend developer defining the logic, databases, takes care of the server and API that power the application and ensuring the system works effectively and securely behind.
4) Testing: After development, the software is extensively tested to find and rectify bugs and ensure the software is of quality standards. QA engineers responsibility both manual and automated testing, while the tester indetifies and reports any bugs that aries. DevOps also play a critical role in facilitating testing by managing continuous integration and delivery, whereby the software is perpetually tested and updated within a seamless development cycle.
5) Deployment: a session where testing is complete, the software is deployed to the production environment. The Solutions Architect ensures that the solution is both scalable and deployable, designing it to handle growth and future needs. The Data Administrator manages the data flow and storage, ensuring that the system's data is handled efficiently and securely. Meanwhile, DevOps oversees the deployment process, ensuring smooth integration and monitoring of the system to ensure it functions optimally in the production environment.
6) Maintenance: the phase where the software monitors for issues and repairs or updates are performed where necessary. During the maintenance phase, users provide feedback and return any issues discovered during usage. Testers also test ongoing after deployment, to ensure the software remains high quality and functions as planned. Meanwhile, support managers oversee ongoing support activities, resolving any issues that arise, and maintaining the software updated and optimized, towards long term stability and success.

A certification information system is a management information system with the aim to process and manage the certification procedures in an organization (Sembiring *et al*., 2024). The following are laws that regulate sanctions concerning railway certification (Indonesia, 2020) :

1) Article 204, Paragraph (1) of Law No. 11 of 2020 state the operator of the railway facility operating railway equipment with personnel who have not fulfilled the competency certification and thus resulting in an accident and/or fatalities shall be sentenced to a maximum prison term of 1 (one) year and a maximum fine of Rp250,000,000.00 (two hundred fifty million rupiahs).
2) Article 204, Paragraph (2) of Law No. 11 of 2020 state if the act referred to in paragraph (1) results in serious injury to a person, the railway operator may be imprisoned for a maximum of 3 (three) years.
3) Article 204, Paragraph (2) of Law No. 11 of 2020 state if the act referred to in paragraph (1) results in the death of a person, the railway undertaking shall be liable to imprisonment for not more than 5 (five) years.

User centric design, as part of usability guidelines, profoundly influences certification submission and approval processes by prioritizing users requirements and experiences foremost. Prioritizing accessible interfaces for users makes systems capable of simplifying tasks, reducing mistakes, and improving efficiency for staff and managers. This can instill increased satisfaction and usage levels among users and eventually higher rates of adoption. Overlooking such principles results in disappointing experiences, which underscores the need for implementing usability, UI/UX design within system development to its best capacity (Camargo & Farina, 2024). User centered design enhances usability in systems by focusing on the users needs and expectations, which can significantly contribute to more efficient submission and approval of certifications. Involving users during the design process enabled the Evolution Web Application to identify errors in its interface and enhance them, making it more intuitive and accessible (Pradana *et al*., 2022). Through this, workflows are reduced for employees and managers, making it easier for everyone to use. It reduces errors while enhancing efficiency and making the process smoother and user friendly. Based on (Matorera, 2024), Six Sigma is an ongoing improvement process with the

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overall goal of reducing defects to less than 3.4 per million opportunities (DPMO). It relies on the principles of identifying and eliminating variation within processes in the hope of yielding better quality goods and services. The approach depends on the usage of tools and techniques that have a significant degree of dependency on data collection and analysis. According to the journal, the most fundamental methods contained within Six Sigma are:

Figure 3. DMAIC Components

The methodology utilized to improve existing processes with a focus on reducing defects and variation. It is the best known Six Sigma method utilized in process improvement. The process begins with the problem and project goal definition, followed by data gathering and quantification to define the problem. This is followed by analysis to identify the cause of the problem, and then the implementation of improvement solutions. The final process is monitoring and controlling the improvement results to ensure they are sustained over the long term. The aim of this methodology is to reduce variability and improve overall quality. This method is used when creating new products or processes. It is more designed focused on the process to fulfill customer needs right from the start, as compared to optimizing existing processes. The cycle begins by defining the project and problem objectives, followed by measuring and gathering data to determine the key performance indicators and baseline processes. During analysis, statistical tools are used to identify the root causes of the problem. The improvement aspect involves applying and piloting solutions to deal with these root causes. Lastly, during the verify stage, the solutions are verified to achieve the desired outcomes and that the improvements satisfy the set objectives. Conceptual framework refers to a series of efforts at simplifying the researchers abstraction of the observed phenomenon to ensure that the content of the research is directed, well represented, and easily understood (Pratiwi, 2022).

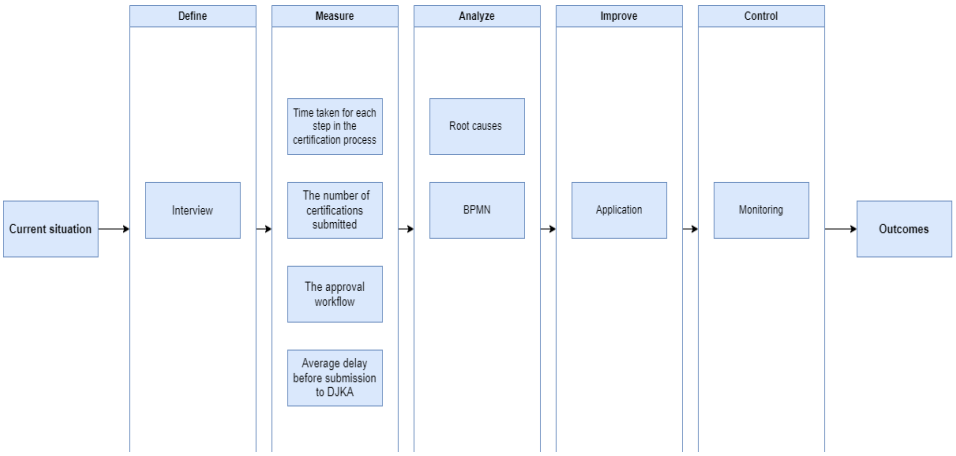

Figure 4. Conceptual Framework

In this research, the conceptual framework was built with DMAIC method which was created by engineer Bill Smith in the 1980s at Motorola. This method was created to improve process performance by addressing variations and inefficiencies systematically (Monday, 2022).

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2. Research Methodology

Research method is an effort to discover and investigate problems with the assistance of scientific and painstaking work processes to collect, process, analyze data, and infer conclusions in a systematic and objective manner with the purpose of solving a problem or testing a hypothesis to obtain knowledge that is beneficial for human existence (Dr.Drs.H.Rifa'i Abu Bakar, 2021). According to (Mohammad Mulyadi, n.d.) Design research is one of the procedures which must be undertaken or created by a researcher to such an extent that the future to be researched study can be executed based on objectives to be accomplished. Design research is a project plan which includes building a construct in such a way that every question can be resolved.

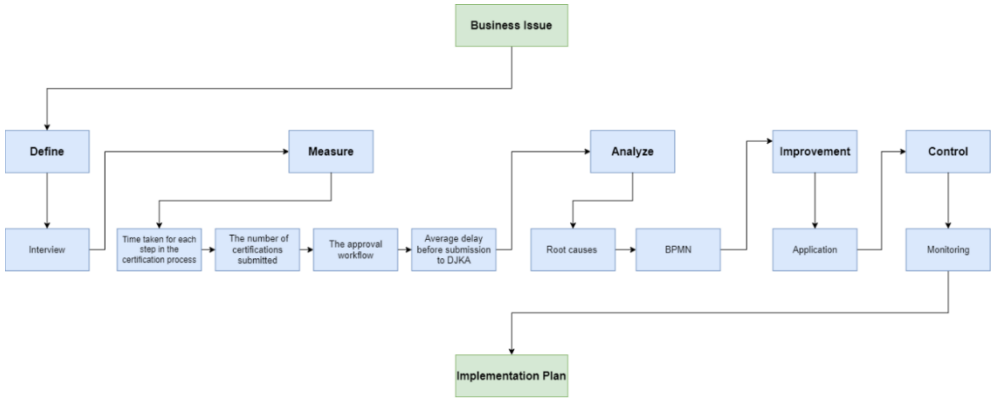

Figure 5. Research Process Flow

Figure 5, shows that the research process begins by defining and detailing the business problem, which confirms the issue, its history, and its impact on the company or stakeholders, aligning objectives with attainable goals. Once the business problem has been defined, the DMAIC method (Define, Measure, Analyze, Improve, Control) is utilized to identify the root causes, assess performance gaps, and gather information to guide decisions on the potential solutions. This research provides an in depth summary of PT Kereta Api Indonesia certification information system requirements needed. This study uses a qualitative approach with interview methods and collecting data from internal database. According to (Georgescu & Anastasiu, 2022) interview is utilized to explain as a critical instrument in social field study, typically employed to find specific information regarding various study questions. It is a method employed by researchers in a bid to meet participants and acquire useful knowledge in relation to research. In this research, semi structured interviews are used as the main data obtained through this approach, allowing for guided conversation while still enabling participants to provide in depth responses.

Table 1. List of Interviewee

Name	Job	Role in Certification
DA [1]	Train Operation Controller	Applicant
Ad [2]	Sintel Staff	Applicant
JS [3]	Head of Technical Implementation Unit of Class 3 Kemiri Station	Approver
BS [4]	Head of Technical Implementation Unit for Class C 2.10 Banjar Signal, Telecommunication and Electricity Resort	Approver
IR [5]	Human Resource Staff Operation Area 2	Approver
DRD [6]	Human Resource Staff Operation Area 6	Approver
ES [7]	Specialist of Certification	Approver and Send Submission to DJKA
IS [8]	Manager of Certification	Approver and Send Submission to DJKA

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Interviewees were divided into 4 categories:

1) The first group consists of sources who are known as [1] and [2], who are field employee of the Kemiri station and Sintel Banjar. This is because their work in jobs that require certification and are responsible for certification submission.
2) The second type has sources named [3] and [4], supervisors of the field employees and the heads of the Kemiri station and the Sintel Banjar station, whose duty is to approve applications for certification.
3) The third group consists of sources by named [5] and [6], who are members of the human resources staff for operational areas 2 and 6. Their responsibility is to check documents and confirm certification submissions.
4) The fourth type consists of documents named [7] and [8], who are team members of the MTCS team (Head Office HR Department) and are the final approvers of certification requests. In addition, they are responsible for continuing submitting certification submission to DJKA.
5) The data analysis method in this thesis utilizes root cause to penetrate to the root of the problem and BPMN to capture the sequence of steps to complete the business process in a manner that is easy to understand.

2.1 Root Cause Analysis (RCA)

According to (Raghavan, 2015), The RCA procedure will need to be carried out when a sentinel event is first discovered and will typically comprise the establishment of a team of primary stakeholders, investigation of the situation and gathering of information in relation to the process, assessment of possible causes, the design and presentation of recommendations, and the application of "test of change" to the new procedure. Research confirms that application of the RCA process can lead to a cultural shift within the organization, from blame at the personal level to acknowledgement of systemic errors, and policy making for patient safety and eventually, a reduction in the frequency of occurrence of the sentinel event in question. Correct use of the RCA process requires rigorous adherence to methodology, thorough analysis of the event and possible causes, and a competent team. Hindsight bias and single-causality bias would severely hinder the outcome of an RCA, resulting in changes to practice that are not highly effective and potentially causing harm in the form of misallocation of resources. On the other hand, a well conducted RCA can bring significant value to other quantitative measures of quality of care. The root cause analysis (RCA) is necessary in thesis analysis to identify and resolve the underlying issues faced by PT Kereta Api Indonesia in the certification submission process. The manual and nonintegrated process of certification leads to delays and mistakes, thus resulting in the loss of incentives that can be obtained by PT KAI. RCA allows for digging into the root causes of the problem, such as the lack of integration with the DJKA system, complicated approval processes, and high volumes of submissions, while providing more effective and efficient solutions.

Through RCA, the company can increase efficiency and simplify the use of resources. By recognizing the root cause of the problem, solutions can be directed to the most significant system improvements, such as creating a unified digital system and reducing reliance on manual intervention. Furthermore, RCA also allows for accelerating the certification process, reducing the time and cost required, and simplifying the submission and approval process. This will, in turn, enhance performance and satisfaction for the employees involved in the process. Furthermore, RCA facilitates more efficient, data-driven decision-making. With definitive information on the existing issues, PT KAI management can make better decisions on how to improve the system and expedite the certification. RCA also helps to create a culture of continual improvement in the firm, so that the problems identified today can be properly addressed and the occurrence of identical issues in the future can be avoided. This will have a positive impact on PT KAI image and performance in the long term. Step in the RCA Process in this thesis:

1) Situation Assessment: The initial step is assessing the situation to determine the problem properly. This encompasses the collection of appropriate data and problem definition in detail.
2) Data Gathering: Gather all relevant and possible data about the issue. The data becomes the basis of analysis.

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3) Cause/Effect Analysis: Determine and examine all probable contributory causes using tools such as the fishbone diagram. It aids in the visualization of the cause and effect relationship.
4) Identification of Causes: The RCA determines the exact causes of the issue through brainstorming and constant questioning of "what" and "why."
5) Sorting and Analysis of Causes: The causes sorted are analyzed to determine which ones warrant further examination. This process is critical in limiting the focus to the most critical causes.
6) Development of Action Plan: After identifying the root causes, an action plan is drawn up to correct them. The plan indicates what to do, who is to do it, and when.

In this research using the DMAIC method, the root cause analysis will focus on the identification of causes with fishbone diagram. The fishbone diagram would be an effective tool to identify and categorize the various root causes that contribute to the problems PT KAI has with submitting certifications. This would help to break down the overall issues like delays in the processing of certifications into finer areas of people (field officers and certification approvers), process (approval procedure), policy (regulations and standards required), technology (limitations of the present system), and communication (co-ordination with the Direktorat Jenderal Perkeretaapian). This graph would visually organize the causes for inefficiencies and delays.

2.2 BPMN (Business Process Model and Notation)

BPMN (Business Process Model and Notation) is the right method to use in analyzing the PT Kereta Api Indonesia certification submission process since it can graphically and architecturally model business processes. This allows one to map all the steps in the submission process, from the employee's submission to the supervisor's approval to the data submission to the Directorate General of Railways (DJKA). Hence, BPMN marks out the areas with probable issues in the process as well as obtains a clear picture of the areas to be improved. BPMN also simplifies the detection of issues in the certification process, such as delays or inefficiencies within certain steps. This methodology also improves communication among teams in the process so that one has a common sense of perception of the workflow. This is essential in facilitating good coordination and making decisions in a knowledge-based manner to optimize the system. Due to its flexibility, BPMN can support complex certification processes with various types of certifications and statuses (new, renewal, grade promotion or replacement). BPMN also supports automation and simplification of processes, reducing reliance on manual processes and speeding up the certification submission process. Moreover, BPMN supports ongoing evaluation of the process, in line with the objective of the thesis to improve effectiveness, accessibility, and ease during the certification submission process at PT KAI.

3. Results And Discussion

3.1 Results

The results of this research are presented together with a detailed discussion of the results. The focus is laid on answering the research questions and objectives presented in the introduction. The results are grounded on analysis of the current certification submission process of PT Kereta Api Indonesia about the situation of employees, supervisors, and the certification team. DMAIC method is the best suited to use in this thesis, because it begins with the Define stage which is crucial to nicely describe the business problem. PT Kereta Api Indonesia's intrinsic problem lies with the inefficiency of the process of submitting for and approving certifications. With DMAIC employed in the research, the research carefully defines such a long and problematic process as the key problem to be resolved. This structured approach allows the entire nature of the problem to be realized, and research is focused on optimizing the certification process. DMAIC biggest strength lies in its ability to define clear objectives. In this thesis, the primary research objectives are to identify the issues in the current certification process and to suggest a system optimization that makes it more usable, effective, and accessible. DMAIC is used to translate these broad

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goals into definitive, quantifiable, and actionable objectives. Through the definition of these objectives with precise specifications, the research can be tailored to address the most serious issues and ensure solutions proposed are feasible and efficient. The focus of DMAIC on data collection and measurement in the Measure phase allows for the quantification of current performance of the certification system. Without taking this step, then it would be impossible to gauge the true number of inefficiencies, such as how long it takes for certifications to process or how many times there are delays. These are the metrics in which a baseline must be built, to measure improvement once the recommended solutions have been implemented. At the end, the control and improvement phases of DMAIC allow the study to develop effective solutions and sustain them in the long term. In this study, the solution is to create a digitalized, automated process of certification submissions that can integrate into existing infrastructure easily. DMAIC ensures the solutions are designed to address causes that were segregated during the analytical phase and be implemented in a systematic manner. Moreover, the Control phase ensures sustained improvements, through continuous monitoring and adjustment, so that PT Kereta Api Indonesia can continue to improve the efficiency of its certification process. Based on the results of the interviewee above, the DMAIC process will be carried out as follows: PT Kereta Api Indonesia is at a disadvantage when it comes to its certification application and approval process, a cumbersome and inefficient process that disallows the company to be awarded incentives by the Indonesian Ministry of Transportation (DJKA) and can result in delays in operations.

Table 2. Define Issues

Category	Interviewee
Manual certification submission process.	"Submission is done by the management. In my experience, field employee like me is asked to collect documents such as an ID card, a Mediska clinic health certificate, and the latest training certificate, and then these documents are submitted hard copy to the HR department." [1] "When i was field staff, i actually believed that the process of filing the manual certification was not ideal. For example, we did not have sufficient time since we used to move around collecting the hard copies of the required documents such as ID cards and diplomas. Secondly, since we needed to collect these hard copy documents beforehand, it implied a very likely cause of delays in certification. Finally, after collecting the documents, our files were inaccurate and had to be returned to us, so data updating was not optimized." [3] "At the manual submission of certification stage, the submission is made physically, which quite obviously takes a lot of time, sometimes even several months." [4] "As i know, manual submission of certification continues to utilize paper documents, and then these will be collected by the management (Regional HR to Head Office HR) and forwarded to DJKA." [7]
The time to complete the manual certification submission.	"I vaguely recall, once we received the physical documents, we had to wait for a call to attend training from the center, which may take up to 2 months at the most." [1] "Until my recollection, it may be more than 2 months before we received a call for training. Then we waited also to receive the smartcard." [3] "For me, it is not possible to gather physical documents immediately, because the documents could have been stacked somewhere, which could take about a week.

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	Afterwards, they are picked up and sent to management, and management's approval until we are called for training could take about 2 months." [4] "The challenging aspect of this manual process is gathering the hard copy documents, then the management choice, and figuring out whether we are eligible for training, which requires about 2 months." [7]
The process of delaying the manual certification approval.	"For me as the immediate supervisor of the employee, the standard approval time is 1 working day. However, if we have received documents from the employee that are not accurate, we reject them and we instruct them to substitute them with the right documents first." [1] "As a matter of fact, it will be done in 1 day. But the field employee always brings the documents carelessly and hence we need to send the documents back to them and wait for the right ones to come back to us. It will take more than a week if such an incident takes place." [3] "The checking time can very well be one day. We conduct the checking and approval daily. However, the submissions that we receive tend to have erroneous or incomplete documents from the employees. Such incidents cause delays because we must wait for the employees to correct the documents as per instructions." [4] "Every day we conduct approval, and the dailies received in approvals are verified immediately. For full and correct documents, we will proceed and transmit them to DJKA. Our certification submission will be received by DJKA within 2 to 5 days and at DJKA, submission will be processed in 14 working days. If the documents are not correct or are incomplete, we return them to the regional HR Department so that the employees can redo them and resubmit with the correct documents." [7]

The result of this interview created an issues statement, process currently involves physical submission of documents, lengthy process time and inefficient. The process generally lasts some months and causes delays, inaccuracy in documentation, and inefficient tracking, which impacts efficiency in the certification process. The key issues of the current process have been identified as:

1) Time Consumption: The manual submission process is an extremely lengthy process time, taking months at times.
2) Physical Documentation: Employees must collect physical documents, leading to delays and inefficiencies.
3) Inaccurate Files: After document submission, inaccuracies in the files require updates or resubmissions.
4) No Tracking: There is no way to track the status of the submission, leading to uncertainty for employees and processing inefficiencies.

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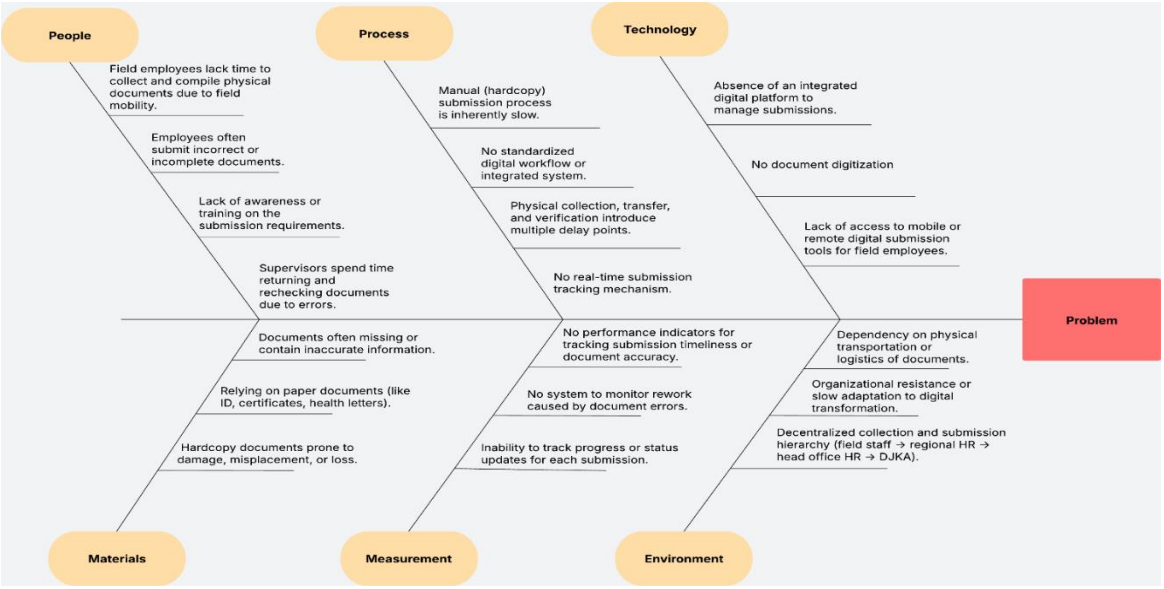

Figure 6. Manual Process - Fishbone Diagram

To identify the root causes of delay and inefficiency in the manual process of submitting certifications, a fishbone diagram analysis was conducted. The diagram follows the major contributing factors to six categories: People, Process, Technology, Materials, Measurement, and Environment. Through this way, it is evident that the issues are not merely due to the intrinsically lengthy manual process and reliance on physical documentation, but also due to the lack of a unified digital system, ineffective tracking and performance measurement, and ineffective human resources capacity to understand and execute the submission process properly. It forms a foundation for the creation of comprehensive digitalization solutions and system improvement.

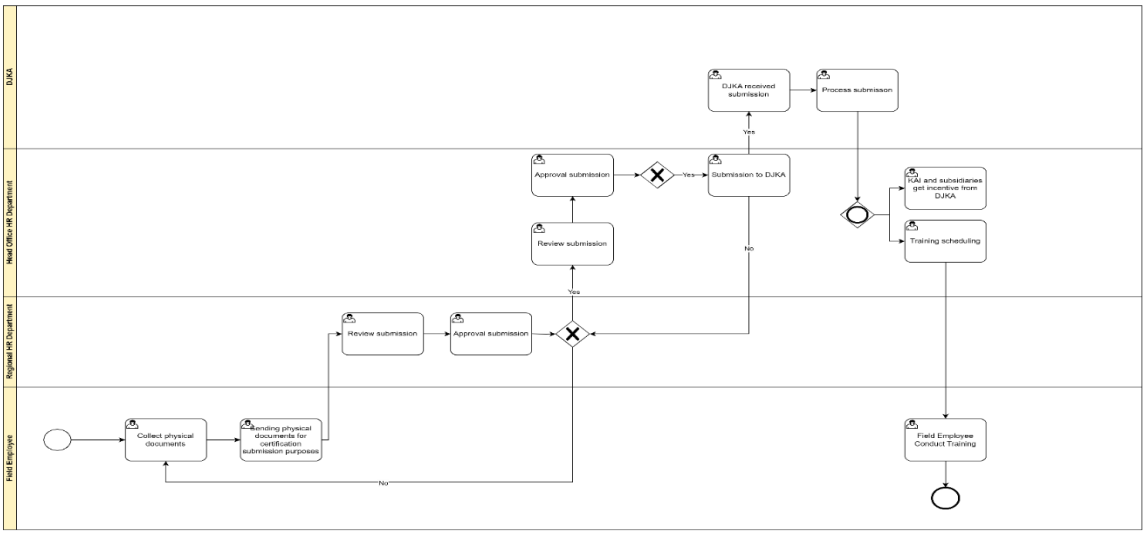

Figure 7. Manual flow - BPMN Diagram

This diagram illustrates the process of manually initiating a certification request. Four parties are involved in this process: Field Employee, Regional HR Department, Head Office HR Department, and DJKA. None of the process is automated, from initiation of the certification request to the last where it is submitted, all done through physical documents.

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3.2 Discussion

The discussion section must interpret and analyze the results that have been presented. Explain the meaning of these findings and how these findings contribute to the knowledge that exists in related fields. Compare the results of this study with the results of previous studies that have been described in the literature review section. Discuss whether these results support or contrary to previous findings and provide possible explanations for each difference. In this section, it must also be mentioned the limitations of research that may affect the validity or generalization of findings. Explain how this limitation can be overcome in future research. Also discuss practical, theoretical, or policy implications for research findings. Explain how these results can be used in practice or how they contribute to existing theories. Give suggestions for further research based on the findings and limitations of this research. Measure has the overall purpose of taking relevant data for improving understanding of the process in research. The overall purpose of this stage is measurement of the existing process performance, setting a benchmark, and determination of measurement criteria utilized in evaluation of improvements realized in the next phase. Here is an analysis of the BPMN diagram that will discuss each process involved in the manual submissions for certification

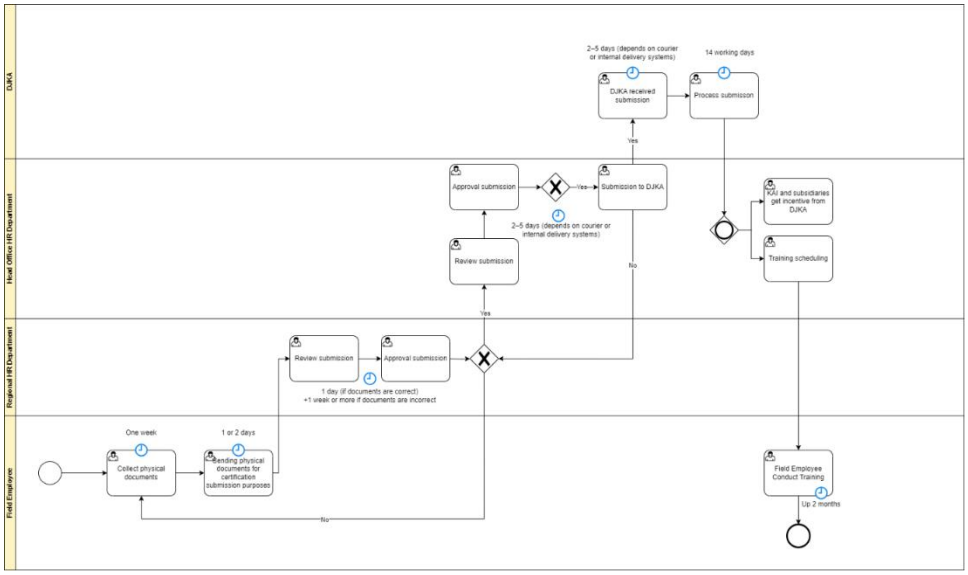

Figure 8. Time Consumption Data - BPMN Diagram

This diagram explains the detailed lengthy process time during the manual certification submission process. Based on the interview results above, the process can start from physical documents collected by the field employee within one week. The field employee will then send the physical documents to the Regional HR Department for submission of certification within 1 or 2 days. After certification submission is received by the Regional HR Department, they will clear and process it. If documents submitted are correct, only 1 day is required for approval. If the documents are in error, it will be 1 week because the department will first search for the files within the employee database. If the documents cannot be found in the employee database, the Regional HR Department will return the certification submission to the field employee to revise. The second one is that the approved certification submission will then be sent to the Head Office HR Department. In this case, the Regional HR Department is also responsible for verifying and signing the certification, but it differs in that the Head Office HR Department is also responsible for submitting the application to DJKA. If everything goes as per the usual procedure, this will be accomplished in 2 to 5 days. However, if there are mistakes found in the submission, first search for the files within the employee database. If the documents cannot be found in the employee database, sit will be returned to the Regional HR Department and subsequently to the field employee for correction. Upon approval by the Head Office HR Department, DJKA will receive (takes 2 to 5 days) and process (14

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working days) the certification submission submitted by PT KAI Indonesia's Head Office HR Department. Processed, PT Kereta Api Indonesia will receive incentives simultaneously with the Head Office HR Department organizing training for field employees. Finally, the field employees will be trained. The entire process, including training, can take more than 2 months, which is long process and non effective. In this phase, analyze using root cause analysis with fishbone diagram and BPMN diagram. The fishbone diagram is a powerful tool to find the root causes of a problem by grouping potential causes into various categories, including people, processes, systems, materials, etc. For the case of the manual submission process for certification in PT KAI, the fishbone diagram facilitates decomposing the most important issues such as time lags, physical documentation mistakes, and inefficiencies in tracking, which are all key problems identified in the Define phase. Other than that, BPMN is a graphic notation tool to describe business processes in flowchart. It diagrammatically describes the steps, decisions, and actions that are performed throughout the process. The roots of the issues encountered in the process of manual submission of certification are as follows:

1) Time consumption is due to manual paper based processing, lack of automation, and sloppy document handling.
2) Physical documentation issues arise from paper dependence, hand on handling, and document collection mistakes.
3) Inaccurate files are due to human errors, lack of attention to detail, and lack of pre-validation of documents.
4) No tracking is a direct consequence of the absence of a unified digital platform for submission status and tracking.

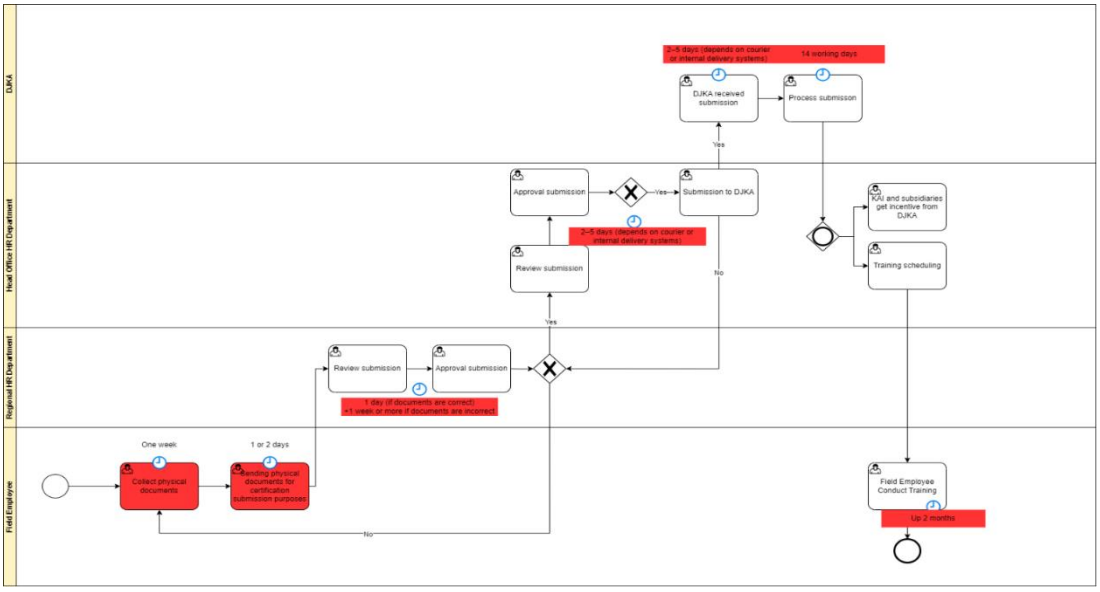

Figure 9. Analyze Process - BPMN Diagram

Table 3. Web Based Issue

Category	Interviewee
Process web based certification submission	"Currently, certification submissions are done via a website. First, log in to the E-Office website, which is like the companys internal portal. There, you will find the online certification menu. Click on that menu, and it will open the online certification website. Click the Submission menu, then i choose the competency, level, and submission type. After that, i just upload the required documents, including a photo. As for the diploma, ID card, and health certificate are automatically filled in, pulled from internal employee data and medical checkups from the Mediska clinic. Once everything is completed, i just click save, and the certification submission is

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automatically forwarded to the approval process. Everything is greatly simplified."[1]

"Now it is much easier with the certification submission via the website. I just need to upload the required documents, and some documents are already auto filled such as diploma, ID card, and health certificate, retrieved from stored employee data. Then i click save, and the submission is directly sent through four stages of approval. These four approval stages involve my direct supervisor, my manager, the Regional HR Department, and Head Office HR Department. It is very helpful and much easier."[2]

"As an approver, i am very much helped by the certification submission through the website. It is easier for me to approve submissions. I log in to the certification website application via E-Office, and immediately see a list of who has submitted a request. I check the documents to see if they are correct or not. If something is incorrectly uploaded or the documents are inappropriate, i just fill in the comments and reject the submission. Then the employees submission status will change to 'rejected', and they will have to re-submission it. If the documents are correct, i click approve, and the documents will be forwarded to the next step until the employee is called for training."[3]

"The current process is logging in from the internal company portal, which directs to the certification website page. Since i am in an approval role, i usually go straight to the approval menu, where a list of employees needing my approval appears. I check each of their certification submissions to see whether the uploads are correct or not. If they are not, i reject them; if they are, i approve and pass them to the next step, up to the final step at Head Office HR Department."[4]

"The certification submission process via the website begins with field employees submitting according to their competencies, uploading the correct documents, and passing through four stages of approval. I serve as the third level approver and part of the Regional HR Department. My role includes not only checking documents but also revising them if our team has the necessary data. We can modify the documents, so the employee doesn't have to re-upload them. However, if we don't have the necessary data, we're forced to reject the submission, and the field employee must submit again with the correct documents.
If all the documents are deemed correct, i approve them, and the process moves to the fourth step, which is handled by Head Office HR Department."[5]

"In the current process, field employees simply select the certification submission according to their competencies, then upload the appropriate documents. If the flow is correct, the submission will automatically pass through four steps of approval to eventually be submitted to DJKA. I am part of the HR team at the third approval step. I check the documents to ensure they are accurate. If not, i first check our employee database to see if our HR team has the needed data, so i can replace or upload it without rejecting the submission. If the data isn't found, unfortunately, i must reject it, provide a reason via the website, and the employee will need to re-submission.
Regional HR Department is authorized to replace incorrect documents if the correct data is stored in the employee database. If the documents are already appropriate, the approval continues to the Head Office HR Department."[6]

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	"Field employees just submit their certification application based on their competencies, upload the correct documents, and wait for the four approval step. I am part of the head office HR team and represent the fourth step. Like the Regional HR Department, we also have the authority to replace incorrect documents if we find any. The difference is, that once our team approves the submission, it can immediately become a draft in the DJKA application. This makes it much easier for our team because we don't need to manually input each certification request one by one into the DJKA system."[7] "On the current website, certification submissions are submitted digitally by field employees. All uploaded documents are digital, and some like the ID card, diploma, and health certificate are automatically retrieved from employees database. This really simplifies things for the field employees. After the document submission process is complete, it goes through four steps of approval: the employees direct supervisor, the employees manager, Regional HR Department, and Head Office HR Department. I am in the Head Office HR Department at the fourth step, with the same authority as the Regional HR Department to monitor, compile reports, and even replace documents if the submitted files are still incorrect but only if the correct files are available in the employee database. If not, the submissions must be rejected, and the field employees has to re-submission. The difference is that we can directly generate a draft certification request to DJKA automatically, without having to open the DJKA application and manually input each submission, which saves a lot of time."[8]
Problem web based certification submission	"Being a field employee, my challenge is more of being attentive to the file format required. As an example, for a certificate from the DJKA to apply for a renewal, the file must be in PDF form and not more than 2MB. Thus, if my file is more than 2MB, i must compress it first."[1] "My difficulty is in paying closer attention to file types and updating the digital files. Sometimes my version of the scanned document is black and white, but now they want colour scans. I must rescan and reconstruct it as a PDF file. Similarly, if i upload the wrong file by error and the certification application gets rejected, I have to re-upload it. So, it is really a matter of having to increase attention to detail." [2] "The issue i am having is that many of the field employees still submit files that aren't requirement. Such as if the photo is supposed to have a coloured background and they send it in black and white, i have no choice but to reject it, which takes a considerable amount of time."[3] "On my part, certification submissions that are submitted by field employees tend to have incorrect documents. For instance, the certificate is not legible, or they upload a diploma rather than a work statement, which has nothing to do with it. So, i will reject the application and return it for the field employee to re-upload the correct documents."[4] "The issue is during document review, if the documents are complete, i can approve it in a few minutes. But if theres a problem with the files, it takes a whole day or more. We must thoroughly check if we have the problematic document on file, if we do, we upload it ourselves; if not, we reject the submission, and the field employee must redo everything. Another example: a field employees make submission for certification in January, but it only reaches us in March. This usually happens

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	because of rejections by their immediate supervisor or manager due to incomplete documents like diplomas or training certificates, which causes the process to restart, and the employees must re-upload everything."[5] "Usually, the problem comes from the certification documents not fit the requirements, which forces us to return them to the field employees. Another issue is the lack of reminders for approvers to promptly process the submissions that are already in the system."[6] "In my opinion, besides the documents being incorrect most of the time, another problem is that higher level managers do not supervise them enough. Sometimes they are not diligent enough to monitor and approve the submissions their field employees make, and this slows down the approval process. It requires training and awareness from them."[7] "As the final approver, we lack personnel in our team, so in case of numerous submissions, we need up to five days to check and approve them. Additionally, I believe that documents such as the DJKA certificate should not need to be re-uploaded, it should already be in the database. In the future, any data that is already present and stored in the employees database should not need re-uploading and should be included automatically." [8]
Expected changes in the certification submission process	"I need notifications that will serve as reminders, especially if my certification submission is declined so that i can make new submission immediately."[1] "From our side, documents already supposed to be included in database employee integrated immediately, so that we don't have to keep re-uploading them."[2] "As an approver, as i travel on business rather frequently, i need notifications so i can open the system immediately, verify, and approve certification requests."[3] "Honestly, it is a bit inconvenient for me to always have to open my laptop to check and approve certification applications, especially since i often work in the field."[4] "Maybe we could have a more specific guide on document upload requirements. I would like a notification system to let me know when there are certification applications pending approval." [5] "There should be a notification reminder for certification applications which have been submitted and need to be approved." [6] "There should be innovations to make it easier for field employees to submit certification, as well as for approvers to review them. Since they work in the field, it is often difficult for them to access the website on laptop. Most importantly, there must be a reminder notification to ensure approvers check and approve applications on time."[7] "It is important to make things easier for field employees, both those certifications submissions and the approvers. Documents that need integration should be aligned quickly so they don't need to be uploaded again. In addition, notifications are very important as reminders for both the applicant and the final approver, so the workflow proceeds smoothly and properly."[8]

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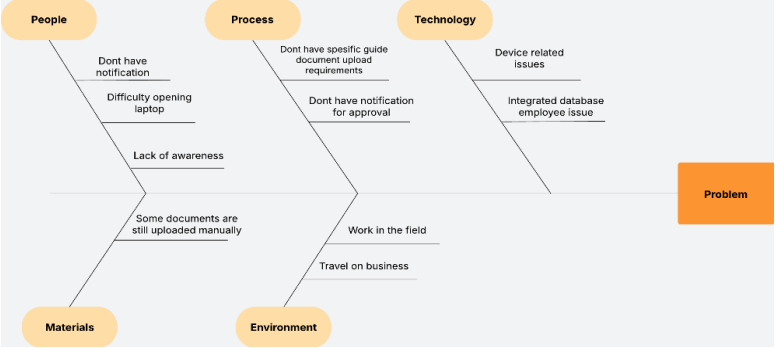

Figure 10. Fishbone Diagram - Web Based

In the People category, the issue arises because the users have weak notification systems and struggle with the use of devices like laptops. The implication is that some employees may not be notified straight away when they should respond, and it could take a while. Physical or technical barriers to accessing their devices could also further delay response or submission of documents. In addition, awareness of the responsibility to approve certification submission must be carried out quickly so as not to hinder the workflow. This points to the need for more robust user training or easier to use equipment. The Process category indicates a lack of standard operating procedures, but specifically for the needs of document uploads and approval notices. In the absence of a clear, standardized process, uncertainty can exist as to what is to be filed, by when, and how. Variabilities of practice can result among the team, as well as taint the integrity and timeliness of the documentation process. From the Technology side, two major issues arise: device issues and employee database issues that come with it. This means the technical infrastructure is out of date, incompatible, or poorly maintained, all which might prevent smooth task execution. In case technology fails to support the requirements of users, productivity and accuracy suffer equally. In addition to this, Materials and Environment are also being added to the central issue. Some documents are continuing to be manually uploaded in a state of partial or failed digital transformation that includes too many unnecessary steps. The Environment category notes that employees are often out in the field or on the road, which adds further logistical challenges to having consistent document handling and approvals. These factors are implying more mobile-enabled solutions and enhanced remote assistance. Overall, the diagram visually depicts systemic issues on human, procedural, and technical fronts. Fixes for the problem will likely include a combination of more effective communication systems, more concise documentation procedures, revised or more compatible technology, and coordination of supporting remote work with better tools and support systems

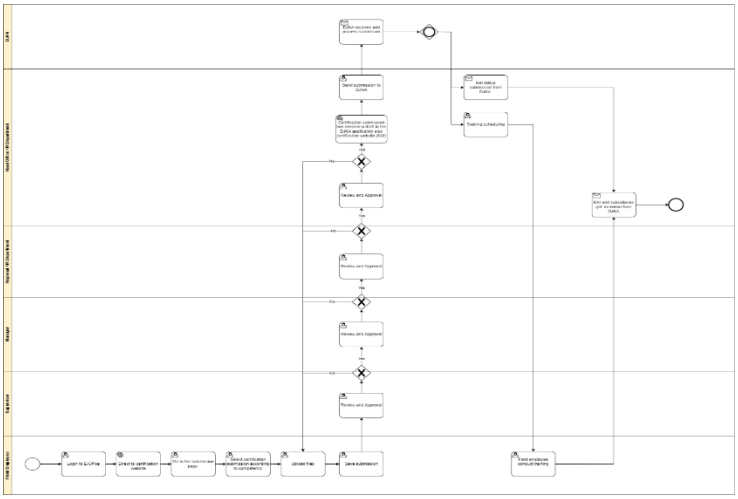

Figure 11. BPMN Diagram - Web Base

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The certification process begins with initiation by the field employee, who logs into the E-Office application, navigates to the Certification Online menu, and is redirected to the certification site. There, they apply for a certificate by uploading supporting documents, saving the application, and submitting it for the first approval step. In the first step, the supervisor reviews the submitted documents; if the documents are incorrect or incomplete, the request is rejected and returned to the field employee for resubmission. If the documents are valid, the supervisor approves the request and forwards it to the next approval step, which is the manager. In the second step, the manager follows the same review process: if the documents are incorrect or incomplete, the request is rejected and sent back to the field employee. If valid, the manager approves the request and sends it to the Regional HR Department for the third approval step. At this stage, the Regional HR Department reviews the documents; if they are invalid, they check the employee database for correct data. If the correct data is found, they update the submission; if not, the request is rejected and returned to the field employee. If the documents are valid, the request is approved and forwarded to the final approval step, which is the Head Office HR Department. In the final step, the Head Office HR Department reviews the documents in the same way, checking the employee database if the documents are invalid. If the correct data is found, they update the submission; if not, the request is rejected and returned to the field employee. If the documents are valid, the request is approved and converted into a draft in the DJKA application. The Head Office HR Department then submits the certification to DJKA via the KAI certification website. Once DJKA receives data, the head office HR team schedules training for the field employees and parallel Head Office HR team get status from DJKA. After training completion, KAI receives incentives from DJKA. But it comes with some issues, ranging from the approvers ignorance of carrying out approvals because they are not getting reminders or notifications for the same, to certain some documents that still need to be uploaded manually even though they could be attached with the employee database, and field employee facing issues in submitting and carrying out the process of approval.

Table 4. Certification Submission Data

Certification Submission on Website					
Supervisor	Manager	Regional HR	Head Office HR	Approved	Declined
127	91	156	150	12810	972

Table 4 provides a summary of the certification submission details submitted through the website application. The data provides an overview of the number of submissions that are sitting at each of the four steps of approval. It also provides a signal of how many certification submissions have gone through step 4 and been approved and how many have been rejected also requiring a resubmission by field employee. This data is run daily, based on approvals and new submissions. To ensure the continued proper functioning of the newly implemented certification system, several control methods will be applied for its ongoing management. Initially, the system will need to be continuously monitored after implementation to ensure that all processes are working as expected. Regular system audits will be conducted to verify that the system is performing optimally. Key Performance Indicators (KPIs) will track important metrics such as time delays, submission quality, and the speed of integration with DJKA, providing valuable insights into areas needing improvement. Additionally, protocols will be established to sustain improvements through ongoing training, system updates, and gathering user feedback. Periodic reviews, either quarterly or semi-annually, will evaluate the effectiveness of the system and allow for adjustments to be made as necessary. To address the current issues, particularly with the web-based certification submission system, a mobile-based certification submission information system will be developed. This mobile solution will enhance usability, effectiveness, and accessibility, ensuring a more efficient and user-friendly process for handling certification submissions. The mobile system will incorporate features designed to resolve the identified problems, improving the overall user experience.

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Table 5. Proposed menu on mobile based

No	Menu	Purpose	Impact
1	Notification	To be reminder about all responsibilities.	1. Field employees will be informed of their current certification application status. 2. Approvers will be notified of certification submissions in a pending state requiring their approval.
2	Submission	Field employees can send certification submission by mobile based using documents which are already integrated within the employee database.	Field employees can submit certification applications without re-uploading documents as the data is already connected.
3	Approval	Supervisor, Manager and Regional HR Department and Head Office HR Department can review and approval certification submission from field employees.	Approvers can view and approve submissions without any hassle, anytime and anywhere.
4	History	Field employees can view their certifications submission history.	Field employees can view their submission history and track their approval status progress.
5	Monitoring	Regional HR Department and Head Office HR Department can view and monitor certification submission by field employees.	Head office HR Department and Regional HR Department can monitor submissions of field employees, so they can see what certification submission have been submitted by each employee.
6	Monitoring Submission	Regional HR Department and Head Office HR Department can view documents and monitor certification submission by field employees.	Head office HR Department and Regional HR Department can monitor submissions of field employees up to the details of the document, so they can see what certification submissions detail have been submitted by each employee.

4. Conclusion

Based on the results and discussion, the main challenge was that field employees and approvers were required to physically collect and submit documents, causing delays, information errors, and a complete lack of submission monitoring. This inefficiency not only disrupted operations but also led the company to lose significant incentives provided by the Directorate General of Railways (DJKA). To address these issues, the organization transitioned from a traditional paper-based certification information system to a web-based system. This new system significantly reduced submission time and errors by consolidating employee databases and automating most processes. It also introduced a four-step approval workflow with real-time tracking, enhancing transparency and making it easier for both employees and approvers to monitor submissions. However, the web-based system had some drawbacks: field employees faced difficulties navigating the system via laptops, some documents already in internal databases still required manual uploading, and there was no automated reminder for approvers and employees, leading to unnecessary delays, especially when approvers were not reminded of pending requests. Further analysis using fishbone diagrams and BPMN models revealed additional root causes, including the lack of mobile access for employees, inadequate standard operating procedures, and underutilized integration with internal systems.

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Based on the analysis and proposed solutions, several recommendations are made for PT Kereta Api Indonesia. First, it is advised to develop and adopt a mobile-based certification information system to complement the existing web-based platform. This mobile application will enhance flexibility for field employees and allow approvers to process submissions from any location, thus minimizing delays caused by dependency on laptops or their unavailability. Second, an integrated notification system should be implemented to provide instant alerts for pending approvals or rejections, prompt users to resubmit rejected applications quickly, and remind approvers at regular intervals to sustain workflow momentum. Lastly, the company should conduct regular system reviews and user training sessions, including quarterly monitoring of key performance indicators such as average submission-to-approval time and error rates, as well as ongoing training for field employees and approvers to reinforce best practices and keep users updated on system changes.

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