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Business Process Reengineering Involving Information Technology in a Tin Mining Company

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ABSTRACT

This study aims to modify business process reengineering (BPR) by involving Information Technology (IT) and identifying critical factors in the case study of tin mining companies. Tin mining companies experience delays in the customs clearance process. The process of procuring imported goods from abroad requires the process of checking imported goods (custom clearance) through the Goods Import Notification (PIB) document. Errors or delays in making PIB for imported goods often cause delays in arriving at the warehouse. So it is necessary to change or redesign the process to reduce the delay. Based on the results of data processing on tin mining companies there are three critical factors cause errors or delays in making custom clearance documents, namely: (1) HS code and lartas certain goods do not have permits, (2) invoices sent by suppliers do not match actual data, and (3) The finance department is often late in processing payments bill. This research will produce recommendations to tin mining companies based on the results of BPR modifications. Recommendations for changing business processes for three critical factors causing errors and delays are (1) Utilization of IT in the process of sending information for each department, (2) Adding a pre-written process in the invoice flow by suppliers, and (3) Using IT and the existence of different document colors in the process of approval notes and bills of goods import approval documents (PIB). The results of this study are only recommendations for tin mining companies. So that there is no performance measure for the success of BPR modifications.

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1. Introduction

A business process collects several jobs or processes connected to achieve the desired goal. This goal is achieved when there is a good relationship between each process and the occurrence level of small errors. The first stage in conducting business processes is Business Process Modelling (BPM). BPM deals with documentation, work environment analysis, organization, and business process design. The stages of BPM in an organization can be interpreted as a relationship from top to bottom level. Each of these models can have submodels with their respective processes, such as organizational submodels, goals and objectives, processes, concepts, and constraints (Koubarakasi & Plexousakis, 1999). BPM in its implementation cannot be limited by period. It is due to changing organizational needs in practice (Karagiannis *et al.*, 1996). The current business climate requires dynamic adjustments or improvements for a corporate organization, otherwise an organization may disappear from the market (Nisar *et al.*, 2014; Habib & Shah, 2013). BPM design allows for inconsistencies, imbalances in an organization, and human error. It is caused by several factors, such as knowledge, resources, habits, or processes that have not been efficient and effective. It requires a step or process to make an improvement based on the evaluation or results of the BPM that has been carried out. This process is an improvement stage after running the business process, called Business

Process Reengineering (BPR). BPR can be defined as a fundamental rethinking and radical redesign of business processes to achieve substantial improvements in performance metrics such as cost, speed, quality, and service (Hammer & Champy, 1995). BPR is a strategic tool for organizational change (Goksoy *et al.*, 2012; Kenneth *et al.*, 2018). In addition, BPR is a tool that makes business processes efficient in terms of time and cost (Hussein *et al.*, 2013; Essam & Mansar, 2011).

A process within an organization or company can be redesigned using BPR, not only by changing processes or procedures but also by redesigning machines, knowledge, and behavior by utilizing more modern technology and information systems. The implementation of BPR does not guarantee that successful changes will result. According to, the failure rate of BPR implementation is up to 70% (Musa & Othman, 2016). It can occur due to rejection by employees thinking that BPR can threaten their work. The success factors of BPR vary according to the goals and objectives of the company itself (Drew, 1994). Another definition of BPR, according to Kim & Jang (2002) was the achievement of improving several goals simultaneously, such as quality, cost, time, flexibility, results, innovation, and accuracy. Davenport (1992) explains that BPR is a process of a specific sequence of work activities across time and space, with clearly defined beginnings, goals, and inputs and outputs. The steps in the BPR include three activities, namely (1) Rethink, (2) Redesign, and (3) Retool (Wardhana *et al.*, 2013). Bhaskar (2018) describes BPR as a process management-based tool that companies can use to compete in the market. BPR as a proposed strategy to enhance the organization's success which is an integration of three components, namely Human-Technology-Organization (HTO) (Fetais, 2022).

At the beginning of its implementation, BPR was still conventional or relied on manual process changes without any use or utilization of Information Technology (IT) and Information Systems (IS). It can be seen from the research of Hammer & Champy (1995), which modeled BPR focusing on process modification and replacement of existing processes without involving other elements or factors. As time goes by, BPR modeling is getting more and more developed. The current BPR model has considered the IT factor as a factor that has an essential role in the radical redesign process. Many BPR methods have been carried out in previous studies, but broadly BPR is divided into two major groups, which are distinguished at the final stage, namely: (1) only until the design of the BPR concept and (2) until the BPR implementation stage. The final stage of BPR is a transformation process or a prototype design process (Fetais *et al.*, 2022; Huq & Martin, 2006; Davenport & Short, 1990). The final stage of BPR is the implementation and measurement stage of the new process (Hammer & Champy, 1995; Budiono & Loice, 2012; Kwahk & Kim, 1999). The BPR process can be applied to the whole or only part of the organization. BPR has been practiced in general since the 1920s (Goksoy *et al.*, 2012). The knowledge map represents the depiction of the relationship between knowledge as a display (Musa & Othman, 2016; Brian Harrison & Pratt, 2008; Abdellatif *et al.*, 2017; Kwahk & Kim, 1999). It should be noted that in conducting BPR there are several keys to success, such as the cross-functionality of the project team, the process used by the project team to implement the BPR project, the expertise available to the project team regarding the processes being redesigned/re-engineered, the quality of the IT support extended to the project, the project leadership and motivation for the project (Fetais *et al.*, 2022). Generic feature set offered by software tools for process modeling their analysis implementation and management was discussed for the success factor for BPR (Zuhaira & Ahmad, 2021).

This study will modify the BPR model that Budiono & Loice (2012) developed. The design of the BPR model focuses on process changes considering the Information Technology (IT) factor. The development of the method in question is to change or rearrange the existing BPR steps and add other factors, such as the use of Information Systems (IS) that can change the business processes of the current system. Modifying the BPR Model is based on an evaluation of data and time requirements that can be accessed in real-time, both as information needs and as decision-making to reduce human errors and delays in a company's business processes.

2. Methodology

The BPR process is flexible, where the manufacturing flow does not have definite provisions but still must include the core of the BPR process in the organization. The stages of BPR that must exist are objectives, vision, objectives, observation and analysis, problem identification, process modification and new process design. The methodology of this research namely (1) Modification of BPR Model, based on the existing basic BPR model, namely Davenport's BPR Model; BPR of Hammer's model and Budiono & Loice model, (2) Verification and validation of the developed model and (3) Application of the modified case study model at a tin mining company.

The difference between the Hammer model, the Davenport model and the Budiono & Loice model lies in the stages of BPR. Hammer model develops the stages of making BPR models on work processes or activities in organizations that focus on grouping information and combining activities in parallel to form an efficient and effective process flow. While Davenport developed the BPR model by adding the Information Technology (IT) factor into the development of the BPR stage, it was done because IT has an essential role in making BPR which can increase organizational productivity and speed up the processing time. The model developed by Budiono & Loice combines the BPR methods from the two researchers above so that the stages in making BPR are more and more detailed. For example, there are stages of process flow analysis, measurement of existing processes and IT identification, and measure and assessment of work processes. Modifications of the Budiono & Loice model carried out in this study were in the form of changing the flow of the steps for making BPR which began with problem identification to redesign the new process and adding factors to be considered, namely the addition of the stage of determining the factors that influence the process, measuring the level of influence of each factor, identification of IT, IS and process modification. Based on the results of determining the importance of critical factors, it can then be known which part of the business process needs to be improved on the process flow or process flowchart.

2.1 Modified business process re-engineering model

Making process reengineering flexible allows the emergence of different methods or stages of the BPR manufacturing flow following the objectives or vision of the BPR. There are two commonly known BPR models, i.e. the Hammer's model (1996) and the Davenport's model (1990) (Hammer & Champy, 1995). Budiono & Loice's (2012) developed a BPR model combining the Hammer & Davenport BPR models. BPR developed by Hammer (1996) is as follows:

1. Setting results or goals
2. Using the output of the previous process or stages
3. Information processing becomes real work that produces new information
4. Centralized use of resources
5. Combining activities in parallel
6. Making decisions on the work to be done and controlling
7. Assign information to its source

In 1996, Hammer made process improvements in the steps of BPR, namely the BPR Hammer Model (1996), which can be seen in Figure 1. Davenport's model (1990) adds another factor to the BPR model, namely Information Technology (IT) which has an important role in business process redesign. Utilizing IT properly can increase organizational productivity. So the purpose of using IT is not only to automate existing business processes, but also to form a business that focuses on competitive advantage (Davenport & Short, 1990; Budiono & Loice, 2012). Davenport's model (1990) can be referred in Figure 2.

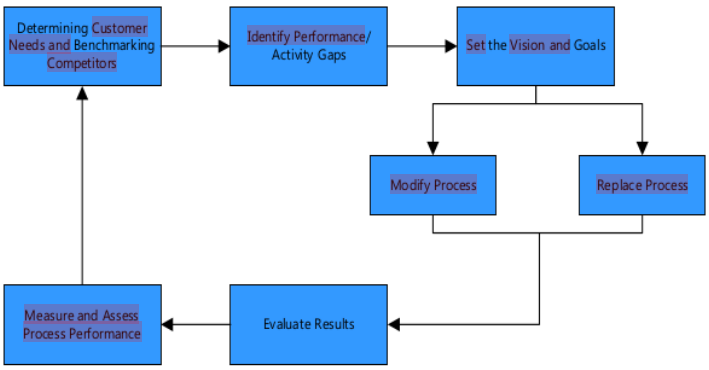

Figure 1. Business process reengineering Hammer's Model (Hammer & Champy, 1995)

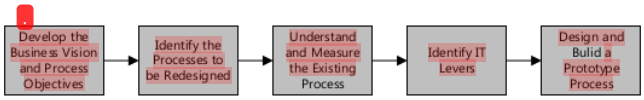

Figure 2. Bussiness Process Reengineering Davenport's Model (Davenport & Short, 1990)

Budiono & Loice (2012) developed a Business Process Reengineering model by adding process flow factors and identifying performance gaps, and determining customer needs, and combining the BPR Hammer's model and BPR Davenport's cycle models. The addition of factors can be seen from the orange BPR step, while the combination can be seen in the blue and gray BPR steps in Figure 3. Modification of the BPR model in this study focuses on the Budiono & Loice model, modifications are made to determining the most influential factors/critical factors, measuring the importance of factors, and adding information system/IT factors in problem-solving. Modifications are shown in yellow. The BPR model in this study can be seen in Figure 4. There are 9 stages of BPR modification of this research model.

Modification of the BPR model in this study focuses on the Budiono & Loice's model, modifications are made to determining the most influential factors (critical factors), measuring the importance of factors and adding information system/IT factors in problem-solving. Modifications are shown in yellow. The BPR model in this study can be seen in Figure 4. Research conducted by Davenport (1992) also added the critical factor determination process, but did not consider the information system/IT factor.

Modification model of business process reengineering needs to be tested for verification and validation. The verification process is carried out by interviewing the manager or supervisor of each department whose business processes are interrelated. In addition to model verification and validation related to BPR modifications, validation and verification can also be carried out on changes to business process flows that have been redesigned. Several studies have examined verification and validity related to BPR. According to Pasaribu *et al.* (2021), the data validation used source triangulation technique. Source triangulation is done to confirm information from several sources or research informants. Source triangulation is done by comparing data from several sources or informants. After redesigning the business process, the to-be process, which has been validated has also been discussed in several studies (Pasaribu *et al.*, 2021). An exploratory study was conducted to investigate the extent to which business process design and analysis (BPDA) techniques were used in designing business processes in Ugandan organizations with an aim to establish the possibility of their adoption explain how to validate the new design model of BPR (Kasse & Nabukenya, 2012). The validation process in this study is carried out by making a questionnaire measuring the suitability of the model to external parties as informants.

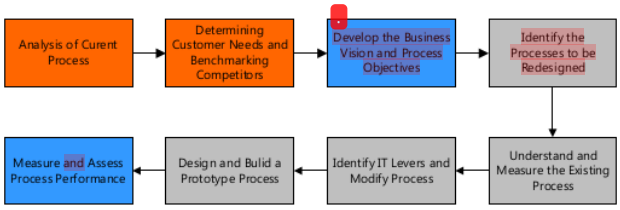

Figure 3. Bussiness process reengineering according to Budiono & Loice's Model (2012)

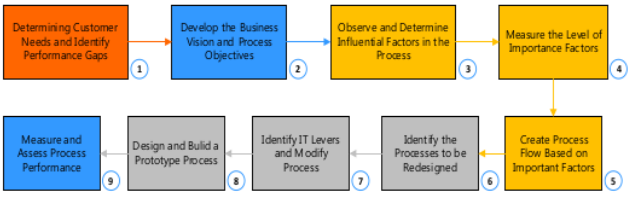

Figure 4. Development of business reengineering (this research)

3. BPR in a Tin Mining Company

The BPR model of this research can be applied to problems at a tin mining company, where there are problems with delays in the customs clearance process. Customs clearance is a process where goods are checked to see whether they are following the import notification document (PIB) by customs. The Export & Import sub-department at a tin mining company takes care of all forms of making import notifications of goods, licensing, and collecting invoices with customs. a tin mining company's imported goods can only be taken from the temporary shelter/quarantine belonging to the customs if all the terms and conditions have been met and the customs have made custom clearance of the goods.

Tin mining company estimates that the customs clearance time is 3 days. The hope is that imported goods can arrive at the warehouse as planned and users/departments who need the goods can operate without any obstacles/waiting for the ordered goods. In fact, this process is mostly done more than 5 days. Thus causing the custom clearance process to be late. In addition, errors often occur in the PIB document process. The process of custom clearance is still experiencing a bill of lading that exceeds the maximum time limit, so the goods arrive late at the warehouse.

Bills of lading are documents containing data or information on imported goods to be checked for conformity with actual goods by customs. Based on the 2017 Malili PIB summary data and the 2018 Malili PIB summary data, it can be seen that the bill of lading experienced delays in customs clearance. The steps for solving problems using the BPR model in this study are as follows:

3.1 Identification of problems

Based on the Key Perfomance Index (KPI) summary data in 2017, it can be seen that from 84 bills of lading, nine bills experienced delays in customs clearance, or 11% of the total bill of lading. For the 2018 KPI summary, it can be seen that from 59 bills of lading, there were 31 bills of lading that experienced delays in customs clearance or 53% of bills of lading experienced delays in total. It is a problem that needs to be resolved so that delays in customs clearance can be minimized or eliminated.

3.2 Vision and mission of development

Based on the description above, the authors examine this research's problem more deeply. The delay in the custom clearance process at a tin mining company aims to reduce the percentage of the delay in the custom clearance process. It is an effort to support one of the company's visions, which is to do the right thing and together become better.

3.3 Observation and determination of influential factors in making and submitting PIB custom clearance process

Based on observations at a tin mining company, the critical factors that affect the delay in the custom clearance process are admin factors, applications, finance, users, methods, customs, HS code and delivery, and suppliers. Next, a causal diagram is made using a fishbone diagram or an Ishikawa diagram. Fishbone diagrams are used to discover more detailed factors affecting process delays (Liliana, 2016). The first step is to identify the problem, determine the factors that influence the process using a fishbone diagram, then distribute a questionnaire to assess the level of importance of each factor so that it is known which factors are essential based on the largest weight ranking.

3.4 Measurement of the level of influence for each factor

Determination of the importance of factors is done through ranking through a questionnaire. Questionnaires were distributed to the export and import department of a tin mining company. The number of respondents to the questionnaire was three respondents according to the number of employees involved in the process of making PIB. The results obtained are the three highest factors that cause delays in the customs clearance process, namely:

1. HS Code and Lartas, there is no permit for certain goods (lartas permit).
2. Supplier, the information on the invoice sent by the supplier does not match the actual data.
3. Finance, there is delays in the PIB billing payment process.

The PIB billing payment process often experiences delays due to the need for approval or approval from each relevant manager. PIB billing has a grace period of five days after expenditure because the person in charge or manager is often not there and has their respective activities, so they cannot approve and sign the PIB memo resulting in expired billing. If the billing expires, it is necessary to submit a billing again so that it can cause delays in the custom clearance process waiting for the PIB billing payment.

3.5 Creating business process flows based on critical factors

Making the company's existing business process flow from each critical factor in the previous step to find out problems and changes to be redesigned using the BPR model. Making this business process flow will later be used as a reference in identifying problems that occur. Figure 5 describes the business process of the absence of a permit for certain goods and latent permits while Figure 6 shows the finance department's business process, which is often late in the PIB billing payment process. Figure 7 is a business process, the information on the invoice sent by the supplier does not match the actual data.

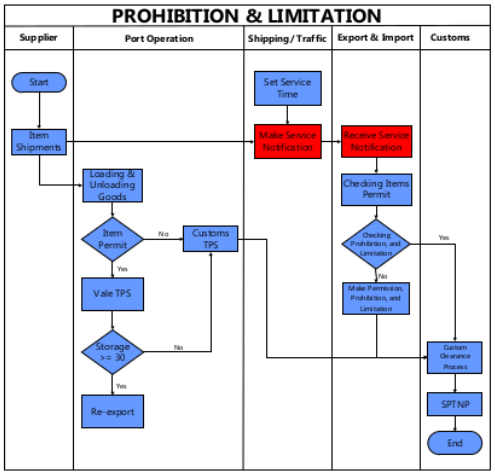

Figure 5. The process of absence of permits for certain goods and lartas permits

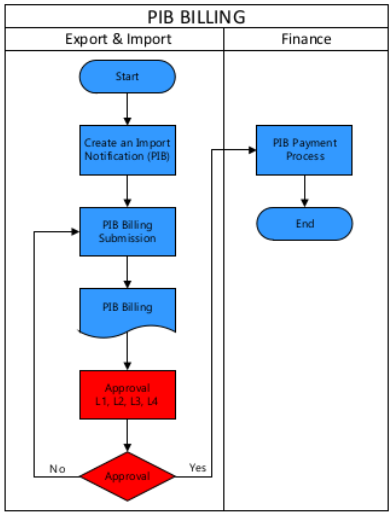

Figure 6. PIB billing approval process

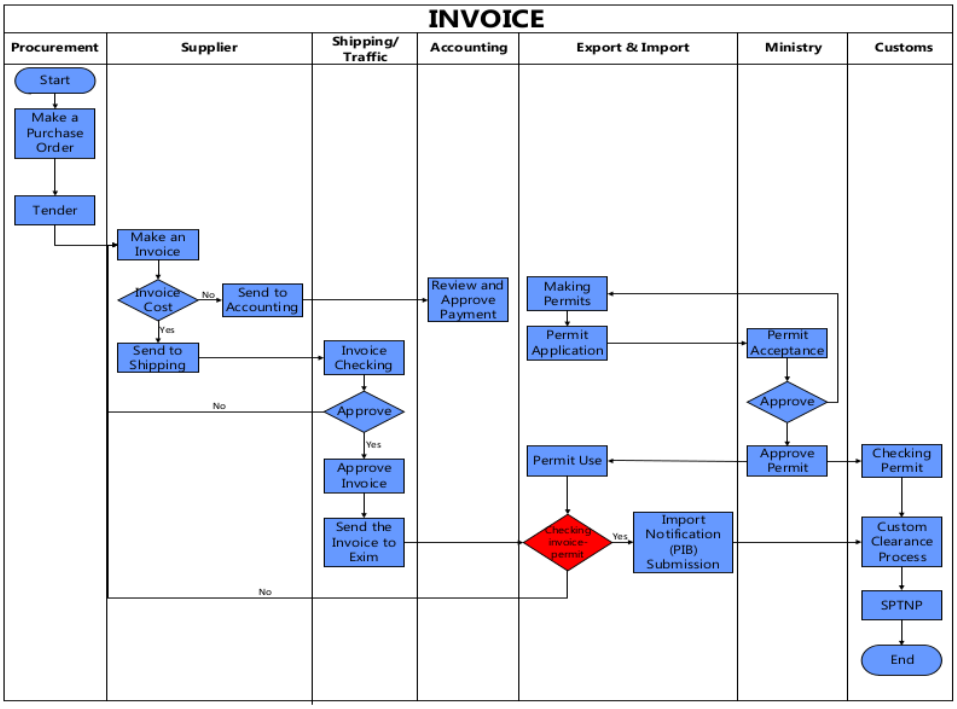

Figure 7. Invoice and permit checking process

3.6 Identifying problems for redesign

After making the process flow using a flowchart, it is necessary to identify the problem that needs to be redesigned using BPR. In the initial process flowchart image above, it can be seen that the problem that needs to be improved is the process flow with a red color in Section 3.5.

1. There is no permit for certain goods and latent permit. The frequent occurrence of delays and errors in submitting information from the shipping and traffic department with exports and imports regarding the shipping schedule for imported goods vessels can result in the imported goods not having a permit and being included in the category of latent goods. So that the custom clearance process cannot be carried out after the goods arrive at the TPS, which has to wait for the lartas permit to be made.
2. The information on the invoice sent by the supplier does not match the actual data. An invoice is one of the documents needed to apply for a permit for imported goods and the customs clearance process. a tin mining company applies for a permit for imported goods according to the description or name on the material master. Overseas suppliers usually have their report or naming of goods, resulting in a mismatch between the supplier's invoice description and the permit submitted by a tin mining company, so it is necessary to revise the invoice so that the customs clearance process can only be carried out.
3. The finance department is often late in the PIB billing payment process. The PIB billing payment process often experiences delays due to the approval of each manager involved in the custom clearance process. PIB Billing has a processing grace period of five days after issuance. The manager or person in charge is often not in place and has a high level of activity. Thus, resulting in being unable to approve and sign the PIB document until the payment billing deadline expires. If the payment billing expires, it will result in a delay in the custom clearance process because it is waiting for the PIB billing payment.

3.7 IT identification, and process modification

The process modification stage in this problem utilizing IT factors and information systems is as follows:

1. The absence of permits for certain goods and permits for lartas.
   In this problem, improvements can be made by utilizing information technology (IT) and information systems, by adding or installing an LCD or monitor containing information about the shipping schedule for imported goods and the permits submitted to the shipping & traffic and export & import departments.
2. The information on the invoice sent by the supplier does not match the actual data.
   Frequent revisions of invoices by suppliers due to a mismatch of invoice descriptions with permits result in delays in the customs clearance process. The reduction needs improvement by adding a process to the process flow, namely making a pre-description of the purchase order (PO) of goods according to the master list.
3. The finance department is often late in the PIB billing payment process.

The delayed approval or PIB note being signed because the person in charge or manager is unavailable can be corrected by utilizing technology and information systems. The applications or software can send PIB memos online to the cell phones of each person in charge or manager. At the same time, the re-design and new concept design processes are carried out to improve business processes after the identification process.

3.8 Business Process Redesign and New Concept Design

After identifying IT needs in section 3.7, The redesign and new concept of information systems, and process improvements is carried out. Improvements to the flow of the information delivery process can be seen in Figure 8. There is no permit for certain goods and licenses for lartas. Figure 9 describes the business process improvement in PIB approval billing process flow. The information on the invoice sent by the supplier does not match the actual data. The business process of the finance department, which is often late in the PIB billing payment process, and its improvement process can be seen in 0.

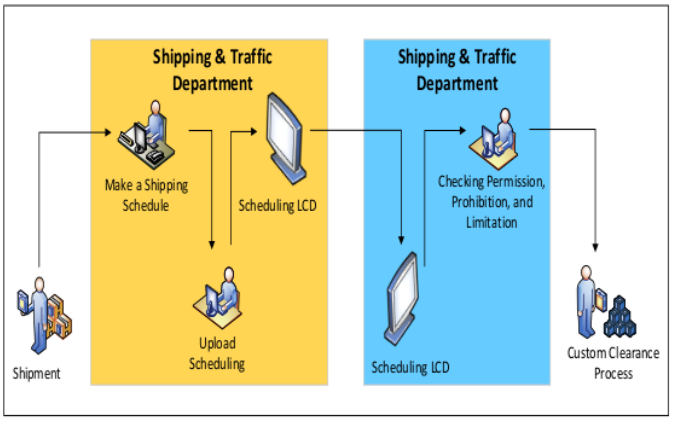

Figure 8. Improvement of Information Submission Process

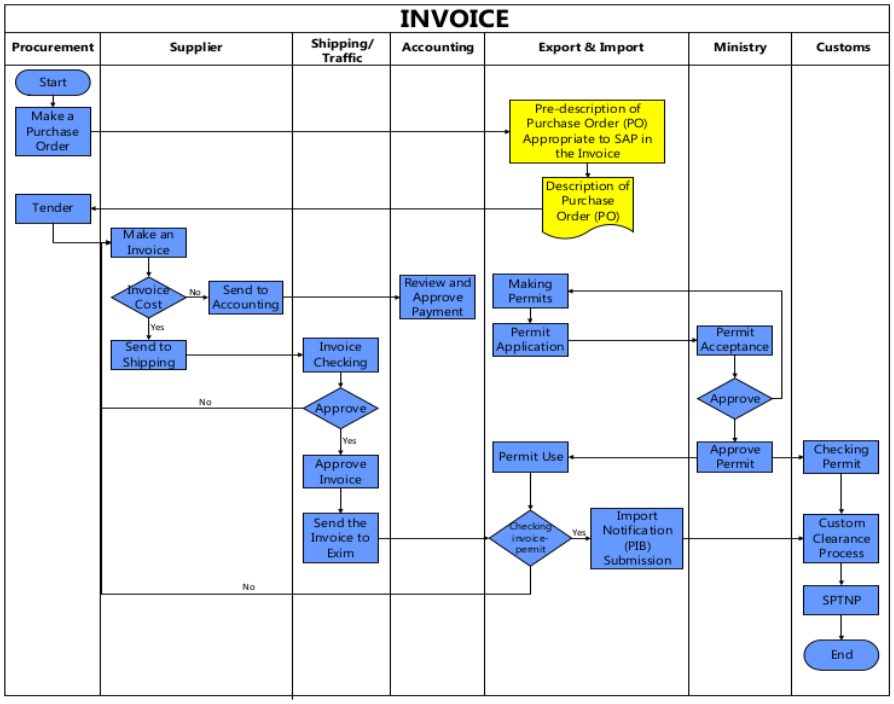

Figure 9. Improvements of invoice process flow

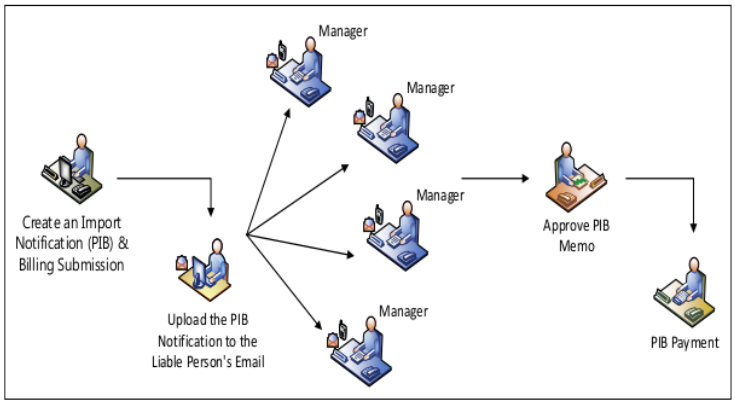

Figure 10. Approval Billing Process Flow Improvement

On the critical factor of the problem of delays in customs clearance at a tin mining company. improvement of business processes to solve problems of errors and delays in custom clearance can be done by adding processes, changing flowcharts or designing new concepts. Utilization of technology to convey information in the form of using LED TVs that can provide information on ship services and goods permits. This can also be used to reduce the error rate in providing information in each department.

The first is the absence of permits for certain goods and consignment permits which focus on delivering information or notification of shipping schedules for imported ships and permits that still needs improvement. This can be solved by utilizing IT and information systems in the form of using LCDs or monitors in each related

department which aims as a medium for conveying information. The use of technology here can make information visible and updated more clearly, so there will be no mismatch of data.

The second problem factor, namely, the information on the invoice sent by the supplier does not match the actual data, which is solved by adding a new procedure to the process flowchart, namely making a pre-description of the PO for the goods according to the master list which will later be sent to the winning supplier of the tender. This is so that the supplier makes an invoice for the goods per the master list which will later be matched with the permit submitted, so that there are no description errors in the custom clearance process.

The third problematic factor is the finance department, which is often late in processing PIB bill payments, which can be overcome or reduced by utilizing information technology and systems. Changes or modifications made are in the form of using an application that will send notifications and PIB memo document files to the person in charge or related manager via cellphone. This is done because the business level for each manager is different. So it is necessary to use an easy, fast, and real-time application to approve PIB memos without meeting face-to-face. The process of signing the PIB memo by the relevant manager was improved by using document folders with different colors to determine the difference in the importance of each note based on the number of days before the PIB billing expired. PIB billing expires after five days of expenditure. The process of signing the PIB note by the manager can be done by using a colored document folder to distinguish the level of importance to be signed immediately based on the number of days before the PIB bill expires. Billing payment expiration time is 5 days. The color differences of the folders namely: (1) The use of a white document folder for PIB memos that have just been issued up to three days after expenditure, and (2) The use of a red document folder is used for PIB memos from the fourth and fifth days after expenditure. The memo signing for the red document folder must be prioritized because it is approaching the expiration date of the PIB billing.

The results of this study are recommendations for tin mining companies. Implementation of improvements can be implemented immediately and it can be seen how much the efficiency and effectiveness of delays in the custom clearance process. Implementation could not be carried out due to several constraints one of which was time. Business process simulation can be done using the help of software, but in this study it will not be discussed.

4. Conclusion

The use of the BPR method to solve problems in a process in an organization or company is one flexible step, many factors need to be considered so that the process runs more effectively and efficiently following the problems to be solved. Improvements are made by considering the use of IT/information systems that are currently developing. Changes in the form of new processes, process additions and process flowchart changes. Utilization of technology to convey information that can reduce errors Adding a pre-description process flow to a flowchart can reduce mistakes in process descriptions.

Using mobile applications or software that can be accessed via mobile phones is a corrective step for problems so that it is very efficient without the need to wait in the workspace while for process improvements. This will later provide the company feedback to reduce the delay in the custom clearance process. Future research can carry out simulations of business process improvements that have been recommended using simulation software and carry out the verification and validation processes.

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