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SME's Business Process Improvement in Food Industry Using Business Process Re-Engineering Approach

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Abstract

The SME industry development in Indonesia is significantly contributed to National GDP, but the development in supply chain management is obstructed, due to the ineffective of the warehouse and sales management. In order to minimize losses and improve the performance of the SME industry to achieve efficiency, business process improvement is designed by using the Business Process Re-engineering (BPR) method. This research identifies the problems that exist in SME's current conditions then modeling the business processes. The improvement is designed using several strategies and scenarios by applying BPR best practices. The most efficient improvement strategy is a combination of barcode scanning process using a Handheld Mobile Computer and implementing a payment system using an Electronic Data Capture (EDC) machine which can save processing time by 48%.

Keywords: *Supply Chain Management (SCM), Small and Medium Enterprise (SME), Food Industry, Business Process Re-engineering (BPR), Business Process Modeling Notation (BPMN).*

1. Introduction

From the business scale point of view, the Small and Medium Enterprises (SMEs) in Indonesia made a significant contribution to National GDP, the gross domestic income (GDP) recorded in 2017 reached by 60% at 7,704,635 Billion IDR [1]. Based on the "Indonesia Agency for Creative Economy" data, SMEs in the food industry sector is one of the sectors that dominates the creative industry in Indonesia with the largest contributor to National GDP of 41.69% and followed by the fashion industry in second place with a percentage of 18.15% [2].

The focus of this research in the food industry is ice cream product which is very promising sector for country income compare with other Southeast Asia countries. The largest ice cream market growth in Indonesia reached by 51.9% in year 2013 to 2018 and followed by Vietnam and Thailand with growth of 39.2% and 26.3%. In addition, Indonesia also has the highest Compound Annual Growth Rate (CAGR) in year 2013 to 2018 at a percentage of 8.8%, followed by Vietnam and Thailand at 6.9% and 4.8% [3].

Based on the "National Development Planning Board" data, there are several obstacles for SMEs to develop. Some obstacles in the implementation of supply chain management include the problem of warehouse management with a percentage of 18.8% and sales management with a percentage of 9.7% [4]. It shows that there is inefficiency problem in the warehouse and sales management system.

The purpose of this study is to design business process improvements in SME to improve company performance and shorten the processing time both in warehouse and sales management using Business Process Re-engineering (BPR) methods.

The research object takes place in SME food industry in Indonesia, with frozen food product especially ice cream. The data used in this study are primary data such as SME activities, duration of the activity implementation, resources, and scheduling system by

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conducting interviews and observation with relevant expert in the SME warehouse, finance and operation management.

SME is stand alone and a single productive economic business. SME is separate from the other business/enterprise that owned indirectly or directly, otherwise it conducted by an individual as a single business entity.

In the SME, a product's SC (Supply Chain) starts from suppliers that supply raw material, then to manufacturing, distribution, and finally to retailers. SC describes a company that end to end processes and activities with all functions to provide end-products for customers. These all processes involve the procurement, manufacture, and delivery of products to customers [5].

Several papers conducted research on several SMEs in various countries that related to supply chain management as mention by [6]. Research on SMEs in Spain and Netherlands, SCM integration improves performance if supply complexity is high, while very limited to low complexity. Research on manufacturing companies in China, both contingency and configuration approaches show that supply chain integration is related to operational and business performance. The results of research on SMEs in Sweden show that there is a strong relationship between SCM readiness and performance on SC and finance in SMEs. SCM is an application, which is also part of Information Technology (IT), by utilizing IT, SMEs will be more competitive in facing the competition. One of SCM's goals is IT adoption to integrate and connect with supply chain partners. In addition, the adoption of SCM in SMEs is very interesting because of the limitations of SMEs, such as lack of skills, knowledge, and information technology. IT integration in SMEs will improve performance at a higher level of SCM integration to make the better performance of SMEs.

This research using BPR approach, BPR is one of the strategies in business management that analyse and design workflow of information, materials, and processes in an organization. It give a recommendation whether a process/processes in system should be removed or replaced with the more innovative and effective process/processes [7].

Several papers [8] have also conducted research on several companies that have applied BPR in their business processes as well as the benefits they get after applying BPR. These companies implement BPR as a quality improvement tool to reduce costs and cycle times as well as improve quality, production volume and speed of work such as: Mahindra and Mahindra Ltd. with reduction of cycle time and strike rate, also an increase in employee motivation and productivity by 50%; Wal-Mart that reduces restocking time from six weeks to thirty-six hours; Honeywall with reduction: 70% defect rate, 57% consumer rejection, 72% cycle time, 46% investment, and 70% customer waiting time, etc. These companies combine BPR and IT to form an integral system to improve performance in manufacturing companies. Basically, IT helps company to saving more time and improving accuracy in exchanging information about company goals and strategies. This can eliminate many human errors in complex and repetitive tasks. IT can also save money by reducing errors and time spent to complete tasks.

2. Methodology

This paper used BPR Life Cycle (BPR-LC) approach in five main steps: visioning business goals, identifying as-is process, analyzing as-is process, designing to-be process improvements, and evaluating process change.

The first step, visioning business goals by identifying the company's goals from the case and developing strategies. The second step, identifying and modeling current business process to be reengineered. The third step, analyzing problems in existing process that ineffective in business processes and anything that cause delays. The fourth step, redesigning process by modeling to-be process and generate alternatives for implementation plans. The fifth step, evaluating and selecting a process redesign.

Applying some scenarios will be performed to test the to-be process. The simulation is run and modeled with Business Process Modeling Notation (BPMN) using iGrafx software. The two simulations were compared to see each performance.

3. Result and Discussion

3.1 Modeling Current Process (As-Is Process)

Based Current business process is modeled entirely from checking inventory to distribution to consumers, as shown in

Figure **1**. BPMN divides the process based on pool and lane, pool is defined as organization that involved in the related process, where in this study there are three pools, which are Supplier, Company Management, and Wholesaler. While lane is defined as a process group of related pools, in this study there are four lanes in the Company's Management pool which are warehouse management, production, distribution, and finance.

Current business process in SME divided into 14 main processes which are planning, recipe formulation, production, checking finished product inventory, checking raw material inventory, purchasing raw material, raw material storage, finished product storage, picking raw material, picking finished product, shipping, raw material financial management, production financial management, and sales financial management. The current processing time data is processed to become time duration that will be input into the as-is model, according to the onsite schedule.

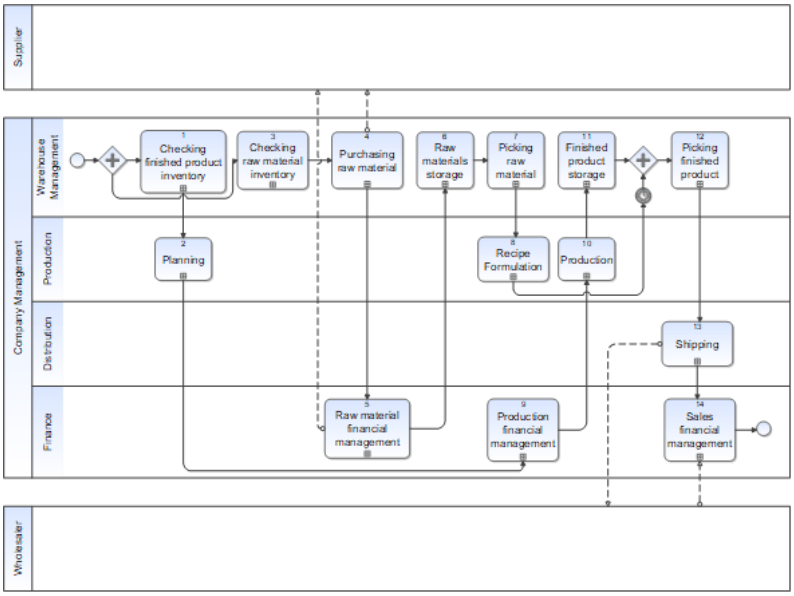

Figure 1. Current Main Process Model (As-Is)

The results of the as-is model on BPMN iGrafx show the total process time (cycle time) which consists of working time and waiting time for each process shown in Table 1. The redesigned business process is focused on processes which have waiting times that can waste the business processes, the process then be displayed as “Selected BP”. Waiting time in business process contains of blocking time which in the model is defined as process waiting time because the resources used in other process, as well as the inactive time, which is defined as waiting time because the resources are outside of working hours. There is a waiting time in the production process that exclude from “Selected BP”, because according to the expert the process doesn’t need improvement that will be focused in this research, but just by adding a new production machine.

Table 1. As-Is Process Simulation (Hours)

Swimlane	Avg Cycle	Avg Work	Avg Wait	Selected BP
Main Process (As-Is)	15.00	10.08	4.92	
Production	8.06	7.06	1.00	
Purchasing raw material	0.30	0.30	0.00	
Recipe Formulation	0.37	0.37	0.00	
Checking raw material inventory	1.17	0.40	0.77	V
Checking finished product inventory	0.57	0.09	0.48	V
Raw material financial management	0.12	0.12	0.00	
Sales financial management	0.96	0.00	0.96	V
Production financial management	0.07	0.07	0.00	
Picking raw material	0.03	0.03	<0.01	V
Picking finished product	1.30	0.48	0.82	V
Shipping	0.74	0.74	0.00	
Raw materials storage	0.61	0.24	0.36	V
Finished product storage	1.12	0.33	0.78	V
Planning	0.24	0.24	0.00	

3.2 Analysis of As-Is Process

The processes that have waiting time are chosen as an activity that will be focused to be improved. Problem identification is based on observations and interviews with stakeholders. The root cause of the problem is analysed using the issue tree diagram. A list of SME's problems in the current conditions is shown in

Figure **2**.

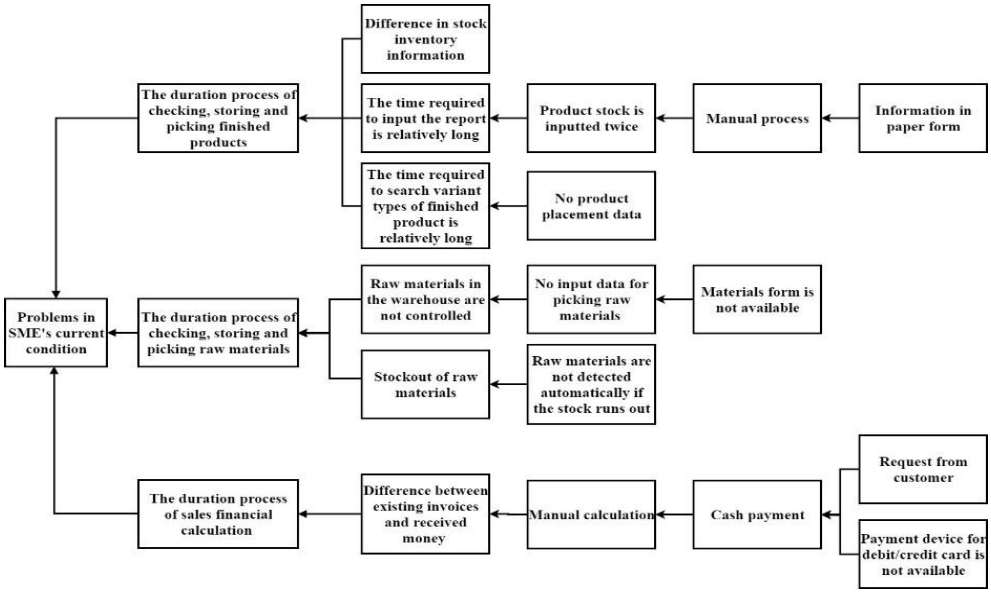

Figure 2. Issue Tree Analysis of As-Is Process

3.3 Designing Improvements (To-Be Process)

The to-be process model is designed by offering solutions through benchmarks to other companies as well as prerequisites for adopting solutions that can change existing business processes. There are two main problems in the current SME business process model, which are the warehouse and financial management system. The time required in the process of checking, storing, and picking finished products and raw materials is relatively long, so the faster process is designed by adding barcode scan process using a Handheld Mobile Computer. In the sales financial management process, the calculation of received money also relatively long, so the strategies are designed by using an Electronic Data Capture (EDC) machine to make financial receipts and calculation more efficient.

The barcode scan process is used to simplify data input operations that can be accessed in real time using a Handheld Mobile Computer with a high-speed and auto-focus barcode reader. The process of calculate and input finished products and raw materials will be faster where it will be input automatically into a database that integrated with a web application, or with a terminal service that can be connected to a personal computer (PC). The requirement for checking finished products and raw materials inventory can simply proceed by looking at the database reports that are directly updated in real time and accurate. In addition, this process improvement can also minimize the difference in stock inventory information. Adding the barcode scan process using a Handheld Mobile Computer in warehouse management result the comparison between as-is process and to-be process is shown in Figure 3 and Figure 4 for checking finished product inventory process. The process of checking raw material inventory, raw materials storage, picking raw materials, finished product storage, and picking finished products explain in the sentence.

- Process: Checking finished product inventory

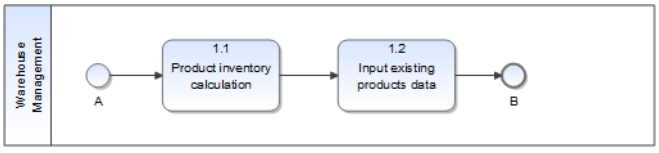

Figure 3. As-Is Subprocess of Checking Finished Product Inventory

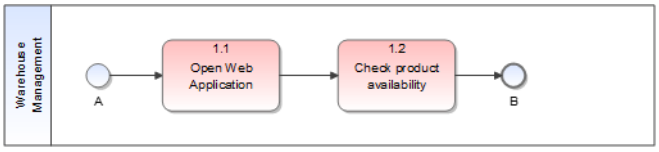

Figure 4. To-Be Subprocess of Checking Finished Product Inventory

- Process: Checking raw material inventory

  As-Is: Unpack and select raw materials → Calculate raw material inventory → Input existing raw materials data → Return raw materials to their place

  To-Be: Open web application → Check raw material availability

- Process: Raw materials storage

  As-Is: Calculate incoming materials → Move materials to the warehouse → Input materials data

  To-Be: Barcode scanning for incoming materials → Move materials to the warehouse → Recheck the database

- Process: Picking raw materials

  As-Is: Find raw materials → Select raw materials

  To-Be: Find raw materials → Barcode scanning

- Process: Finished product storage

  As-Is: Sort finished products per variant → Move products to cold storage → Input products data

  To-Be: Sort finished products per variant → Move products to cold storage and Barcode scanning for incoming products → Recheck the database

- Process: Picking finished products

  As-Is: Receive customer orders → Find products variants → Pack the finished product → Input data

  To-Be: Receive customer orders → Find products variants → Pack the finished product → Barcode scanning

For sales financial management, the strategy is to implement payment system using Electronic Data Capture (EDC). EDC is used to accelerate the sales financial calculation that received from wholesaler. This process improvement can minimize the difference between received money and existing invoices. EDC only uses cellular signals and rechargeable batteries, so it's practical to carry anywhere. Every driver who makes a shipment carries an EDC machine as a payment system for wholesaler. Wholesaler just swipes a debit/credit card on EDC machine then receipt comes out indicating that the payment is paid. Financial admins just need to check payments from wholesaler in accordance with invoices and delivery order, so they don't need to count cash payment and the process of receiving and inputting finances data run more efficiently. Figure 5 to Figure 6 shown the comparison of as-is and to-be process.

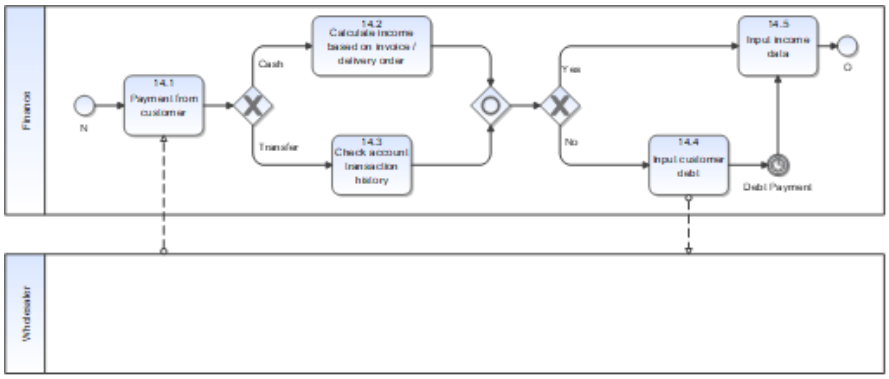

Figure 5. As-Is Subprocess of Sales Financial Management

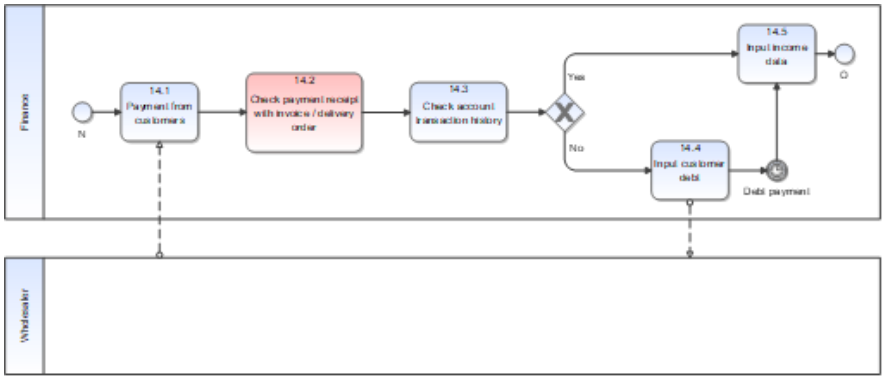

Figure 6. To-Be Subprocess of Sales Financial Management

After combining alternative strategies, which are barcode scan process using a Handheld Mobile Computer and payment system using EDC machine with BPR best practices, 3 models were obtained based on the 2 improvement plans, the design process improvement strategies described in Table 2.

Table 2. Design Process Improvement Strategies

Models	Strategies	
	Barcode scan process using a Handheld Mobile Computer	Payment system using EDC machine
1	V	
2		V
3	V	V

3.4 Simulation Result of To-Be Model

The to-be model is combined based on strategies above using iGrafx software and BPR best practices approach, so the business processes can operate more efficient with shorter time. Table 3 shows the results of the to-be model of the main process with a combination

of strategies, which are barcode scan process using a Handheld Mobile Computer and payment system using EDC machine. In this to-be model there are changes that occur in the Company's Management pool, which are warehouse and finance management.

Table 3. To-Be Process Simulation (Hours)

Swimlane	Avg Cycle	Avg Work	Avg Wait
Main Process (To-Be)	7.84	7.84	0.00
Production	7.06	7.06	0.00
Purchase of raw materials	0.30	0.30	0.00
Recipe Formulation	0.37	0.37	0.00
Checking raw material inventory	0.15	0.15	0.00
Checking finished product inventory	0.14	0.14	0.00
Raw materials financial management	0.12	0.12	0.00
Sales financial management	0.12	0.12	0.00
Production financial management	0.07	0.07	0.00
Raw materials release	0.06	0.06	0.00
Finished product release	0.78	0.78	0.00
Shipping to wholesaler	0.74	0.74	0.00
Raw materials storage	0.30	0.30	0.00
Finished product storage	0.33	0.33	0.00
Production planning	0.24	0.24	0.00

The model comparison of as-is and to-be results shown in Table 4 and generate the most optimal solution with a total average processing time of 7.84 hours, which is model 3 with a combination of 2 solutions which are barcode scan process using a Handheld Mobile Computer and payment system using EDC machine. With this combination of strategies, it can affect the reduction in total average time and waiting time in each process, so it can reduce operational costs throughout the entire process, especially in the warehouse and financial management lane.

Table 4. Comparison of As-Is and To-Be Results

Models	Strategies	Transaction Statistics (Hours)			Efficiency
		Avg Cycle Time	Avg Work	Avg Wait	
As-Is	-	15.00	10.08	4.92	-
1	Barcode scan process using a Handheld	8.84	7.99	0.85	41%

Models	Strategies	Transaction Statistics (Hours)			Efficiency
	Mobile Computer				
2	Payment system using EDC machine Barcode scan process using a Handheld	11,10	9,01	2,09	26%
3	Mobile Computer + Payment system using EDC machine	7,84	7,84	0,00	48%

3.5 Test the Model with Scenarios

The scenarios are conditions that possibly happen to SME during their business processes and test the performance of SME beyond their normal conditions.

3.5.1 Increased Demand Scenarios

The increase in demand scenario shown affects the warehouse and financial management lane. In the combination of the two strategies, the total average business process time is 10.35 hours with an increase 24% of the to-be process.

This scenario affects the process of warehouse management, this is because when demand increase, the number of finished products in the warehouse will also increase. When the number of finished products exceeds the warehouse capacity, the SME must rent an additional warehouse where more goods will be allocated to the rented warehouse, which causes additional costs for shipping the goods. If demand is increase, the probability of inventory exceeds the capacity will be high, because the amount of raw materials and finished products will also increase, so it is assumed that the amount of inventory exceeds the capacity of warehouse. When demand increases, the intensity of deliveries to wholesalers will be more often, therefore SMEs will also need more fees for car rental. This scenario also affects sales financial management where checking payments takes more time than normal conditions without scenarios. In addition, this scenario also affects the number of working hours by adding employee work hours on weekends, where SME must pay more in salaries. In these conditions the company will gain profits if the finished products outflow as well as the delivery run smoothly, and customer demand fit with production planning.

3.5.2 Decreased Demand Scenarios

The decrease in demand scenarios, where the amount of raw materials and finished products is less than normal condition which causes the transfer of goods to the warehouse will be faster. In the combination of the two strategies, the average total business process time is 6.55 hours with a decrease 16% of the to-be process.

In this scenario, the company doesn't need to rent additional warehouses because the warehouse can save an inventory of raw materials and finished products which are not relatively large and still below the normal demand limit. In this scenario production work hours will be less than normal conditions, which can reduce the cost of employee salaries because production activities do not run every day. However, SME continue to incur warehouse storage costs to store existing raw materials and finished products.

4. Conclusion

Based on the research that has been conducted, it was found several inefficient problems because there are delays in the existing SME business processes, which are in the management of warehouse management precisely in the process of checking the inventory, picking, and sorting of raw materials and finished products. In addition, delays also occur in sales financial management process. This research successfully designed business process improvements in SME by shorten processing time that can increase the efficiency both in warehouses and sales management using Business Process Reengineering (BPR) methods.

The current business process model gets an average total time of 15 hours per day. The improvement design generates 3 models which are using Handled Mobile Computer, EDC machine, and a combination of both. Each of model tested with an increase and decrease in demand scenario. The process improvement model using the strategy of adding a barcode scan process using a Handheld Mobile Computer saves business process time by 41% with an average total time of 8.84 hours. While the process improvement model using a payment system strategy using EDC machines saves business process time by 26% with an average total time of 11.1 hours.

The combination of these strategies with the adoption of BPR best practices saves 48% of the current process, with an average total time of 7.84 hours, which has the least waiting time compared to other models. So, this strategy is the most optimal strategy to improve business processes in SME.

This research is recommended to SME in order to achieve much better in managing company business activities. SME are expected to be able to apply BPR to their business processes in order to gain market share, increase profits, reduce costs, improve quality, and more competitive.

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