Business process improvement in brown sugar industry in Kudus regency

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Abstract. Kudus is a regency which belongs to one of the largest sugar cane farming and brown sugar producer in Indonesia. However, the challenges in sugar cane industry have been so tough lately. The consumption of sugar cane has increased, but the production process takes so long time. Regarding to this condition, it is difficult to compete with other sugar industries in national level, especially refined sugar. This research aimed to help the workers to make brown sugar industry in Kudus become a highly competitive industry, by improving the brown sugar quality, improving the production efficiency so it no longer takes much time, and improving the cost efficiency in order to reduce the production cost. The method implemented in this research was Business Process Improvement (BPI) by using Value Stream Mapping (VSM) as the activity map, based on the added value, Economic Value Added (EVA), and Key Performance Indicator (KPI) as the performance assessment indicators. The research findings revealed that there were two activities that had no added value, such as loading and delivering the sugar cane to the warehouse, cost efficiency, and production efficiency. The Economic Value Added was as much as Rp 256,702,500 before the production, and increased by Rp 1,367,374,835 after the repairment, as many as five times. The production result had increased from 7 quintal to 8 quintal per day. Meanwhile, the use of chemical substance was decreased from 1 kilogram per day to 0, while the production cost was from Rp 4,937 to Rp 4,324, and the selling price increased from Rp 7,000 to Rp 14,000 per kilo, based on the standard production or limitation that has been decided.

1. Introduction

Indonesia is an agricultural country that most of its population depends on the agriculture sector [1]. Kudus is a regency which belongs to one of the largest sugar cane producer. Its harvests has reached the highest number, as much as 3,293,343 quintals. Meanwhile, in other sectors, its harvests are less than 500,000 quintals. Based on these data, it is not surprising that there are many small businesses which concern on processing sugar cane into brown sugar in Kudus regency [2].

One of industries which concern on processing agricultural product is sugar cane industry. The sugar is obtained from sugar cane’s juice. Its color is brown, as well as brown sugar and palm sugar. Hence, sugar cane is also called as brown sugar. Its quality is truly determined by the steps during the cutting process. The longer the sugar is stored, the more it turns into brown, [3].

The production process is still using traditional method, and certainly it still has several obstacles, such as unstable production quality, use of hazardous chemicals, high production cost, low competitiveness, until the threat of revitalizing the sugar, [4].
A strong competition happens due to the existence of imported products. Hence, it forces the factory to supervise not only the quality of the products, but also the quality and performance of internal business processes. Business process is a management approach based on the investigation and analysis about business overview and activities conducted by the management staff. This research aimed to discuss about problems in improving the internal processes in the company, as the last part in process management lifecycle. It concerns with the initial condition and the method implemented in improving production processes.

2. Theoretical Background

2.1. Business Process Improvement

Business Process Improvement (BPI) is a system used to help organizations in making significant progress in their business processes. BPI guarantees that internal and external customers will get a better benefit [5]. Hence, there are five steps in Business Process Improvement, as follows:

![Business Process Improvement Steps](image)

- **Organizing for Improvement**: There are several activities in this step, such as informing the goals of Business Process Improvement to the employees, selecting the critical process, and reviewing business strategies and customer needs. Its purpose is to determine the process that will be improved.
- **Understanding the Process**: There are several activities in this step such as determining the limitation of the process, defining the expectations of the actor of the process, making graphic notations of the business processes flow, and collecting the running time of each process as part of the research data.
- **Streamlining**: Streamlining aims to improve the efficiency, effectiveness, and the ability of a business process in order to be able to adapt. There are several activities in this step such as identifying opportunities for making an improvement, simplifying the processes, reducing bureaucratic time, reducing the processing time, eliminating activities that have no added value, standardizing the processes, and the processes of automation.
- **Measurement and Controls**: In this step, the improvement of business processes or recommendation after simplifying the previous process is implemented, while the control is conducted continuously.
- **Continuous Improvement**: In this step, the improvement of business process is conducted continuously. In addition, it requires several processes such as reviewing, defining the business process problem, and conducting evaluation in order to identify the other things that are supposed to be improved.

2.2. Value Stream Mapping

The first step in value stream mapping is preparing a map of the current state. Analyzing the material flow under current conditions will provide information about activities that have value added and no value added (for example, machine time, unnecessary space, the number of reworks, mileage, and inefficiency). In the second step, the information obtained from the current state map is used to prepare the desired future state map, where the cost should be reduced and the number of activities that do not have value added will be minimized. There are several questions that should be answered during this step, for example [6]:

- What is takt-time (expected time between units of production output, which is synchronized with customers’ demands)?
• Is it possible to introduce a continuous flow?
• Can a production be controlled with a pull system?

Value stream mapping is not only used to reduce the cost or eliminate waste. This VSM model is reducing variability and optimizing the use of resources, such as material, personnel, and equipment. The main purpose of VSM is to create business processes based on customers’ desires. Therefore, analysis of customer requests and desires should be reviewed and assessed in advance. The data needed to analyze VSM may not always be available, even if the data are available, it cannot be systematically collected [6].

2.3. Economic Value Added
Economic Value Added (EVA) is defined as operational profit after the tax is subtracted by capital costs. On the other words, EVA is a measurement of residual income which reduces capital costs to operating income [7]. Based on these things, EVA is determined by two things, such as the net profit after tax and cost of capital level. By operating profit after tax, it illustrates the results of value creation in the company, while the costs of capital can be interpreted as sacrifices incurred in creating value. The amount of compensation depends on the risk that company takes, means that investors do not like risk (risk averse). On the other words, the higher the risk, the higher the level of development that investors demand [7].

The benefits of using EVA as a performance measurement tool are as follows [7]:
• EVA is especially useful as a company performance appraiser where the focus of performance appraisal is on value creation.
• EVA will make the companies to be more concerned with its capital structure rules.
• EVA can be used to identify activities or projects that provide higher return than the cost of capital.
• With EVA, managers think and act like shareholders, such as selecting investments that maximize the rate of return and minimizing the level of capital costs. Hence, its value can be maximized.

3. Research Methodology
The method implemented in this research was Business Process Improvement (BPI) by using Value Stream Mapping (VSM) as the activity map, based on the added value, Economic Value Added (EVA), and Key Performance Indicator (KPI) as the performance assessment indicators.

3.1. Business Process Analysis
At this stage, the implementation of the first step of Business Process Improvement (BPI) is organizing for improvement. By analyzing business processes, it can find out which business processes that should be improved. In this research, improvements will be conducted in the process of producing brown sugar, from cutting to packaging.

3.2. Business Process Selection Calculating the Value Added and Business Process Performance
The selection of this business process will be conducted by using Value Stream Mapping (VSM) method, so it can identify which activity that should be improved. This Value Stream Mapping (VSM) method will breakdown the entire activities of brown sugar production. After that, it analyzes which activities that had Value Added (VA), Non Value Added (NVA), and Necessary but Non Value Added (NNVA). Another analysis can be conducted in order to determine which activities that need improvement.

3.3. Calculating the Value Added and Business Process Performance
In order to determine the value added of a business process, the Economic Value Added methods are as follows:
• Calculate the annual income that has been subtracted by tax;
• Calculate capital requirements;
• Calculate the EVA values
4. Results and Discussion

4.1. Value Stream Mapping Results

Based on the results of Value Stream Mapping, the production process was divided into two work stations, such as plantation work station and production warehouse station. In the plantation work station, there were two activities that did not have value added, such as loading sugar cane to the truck and its trip to the production warehouse. According to [8] and [9], two activities can be re-engineered by using grinding machine and refining the sugar cane palm juice, but it will spend more costs while the capacity of brown sugar was not as big as granulated sugar. Hence, the innovation from Hamidi and Pramudita could not be implemented in this research. By concerning the priorities, the proposal to replace production machinery to plantation land is not necessary for this time since the distance between the plantation and the warehouse is not too long and when it has been delivered to the sugar cane warehouse, it is immediately milled.

In the production warehouse work station, all activities had added value. Therefore, no activity that needs to be evaluated or eliminated. However, based on the observations, there are several needs that should be improved at the production warehouse station, as follows:

1. Measuring the brix values;
2. Eliminating chemicals that help the sugar cane palm juice purification process;
3. Installing filters on the sugar cane palm juice distribution hose;
4. Installing an automatic temperature sensor and mixer;
5. Giving a fan on the drying tray;
6. Separating the production room with the warehouse and fuel.

4.2. Business Process Improvement
By analyzing the proposed production based on the subsequent changes, there were no cutting activities yet there was an additional activity in the production process. Although there were 2 activities in VSM that had no value added, the alternative proposals could not be implemented since the distance and production capacity of brown sugar is not as far and as large as granulated sugar. In addition, brix value measurement activity is added before cutting and cleaning process. This additional activity aimed to provide a minimum standard of brix value that will be cut down and made into raw material, as the process of making brown sugar. In the production process, the change was not significant since several additional tools were proposed in order to control the production process, so the quality will be much better.

4.3. Economic Value Added Value

Table 1. The Comparison of EVA value on the Previous Business Process and Proposed Business Process

|                          | Previous Business Process | Proposed Business Process |
|--------------------------|---------------------------|---------------------------|
| Production Capacity (per year) | 140,000 Kg                | 160,000 Kg                |
| Net Sales (per year)      | Rp 980,000,000             | Rp 2,240,000,000          |
| Operation Cost (per year) | Rp 691,200,000             | Rp 716,200,000            |
| Tax                       | Rp 28,880,000              | Rp 152,380,000            |
| Net Operating Profit After Tax | Rp 259,920,000           | Rp 1,384,380,000          |
| Cost of Capital           | Rp 45,000,000              | Rp 65,350,000             |
| EVA Value                 | Rp 256,702,500             | Rp 1,367,374,835          |

After proposing several improvements, it is known that the production capacity has increased by 20,000 kg / year, which affect on increases in sales value more than 100%. Meanwhile, the NOPAT increased five times, and the cost of capital also increased by Rp 20,350,000, and the proposed EVA value increased five times rather than the previous business process.
4.4. Key Performance Indicator

| No. | Key Performance Indicator (KPI)                          | Unit of Measurement | Target Value (Before) | Target Value (After) |
|-----|----------------------------------------------------------|---------------------|-----------------------|----------------------|
| 1   | Production Capacity (per day)                            | Quintal             | 7                     | 8                    |
| 2   | The use of Chemical Material (Kapur)                     | Kilogram            | 1                     | 0                    |
| 3   | Production Cost                                          | Rupiah              | 4937/ Kg              | 4324/ Kg             |
| 4   | Selling Price                                           | Rupiah              | 7000/kg               | 14000/kg             |
| 5   | Production Time                                          | Hour                | 8                     | 8                    |
| 6   | Sugar Cane Cutting and Cleaning Process                  | %                   | -                     | 30                   |
| 7   | Brix Value                                               | %                   | 10 (Maximum)          | Minimal 11,4         |
| 8   | Temperature (cooking process) 1 s.d 8 °C                 | -                   | 60 s.d. 65            |
| 9   | Temperature (cooking process) 9 & 10 °C                  | -                   | 100 s.d 110           |
| 10  | Temperature in Refrigeration Room °C                     | -                   | ≤ 25                  |

5. Conclusion

Based on the results of research conducted on the brown sugar industry in Kandangmas, Dawe, Kudus Regency, it can be concluded as follows:

1. By implementing the proposed improvements, the quality of the brown sugar is able to compete in the market;
2. By spending similar required times between the previous business process and new proposal that is 8 hours per day, it revealed that the previous business process produced 7 quintals per day, meanwhile in proposed business process, it can produce 8 quintals of brown sugar per day.
3. In the additional activity on business process proposal, installing a number of tools can reduce the production cost (per kilogram).
4. The proposed improvements have value added in terms of quality and cost as many as five times rather than the initial EVA value. Therefore, those improvements have added value when being implemented.

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References

[1] M. Praditya, “ANALISIS USAHA INDUSTRI GULA JAWA SKALA RUMAH TANGGA DI KABUPATEN WONOGIRI,” UNIVERSITAS SEBELAS MARET, 2010.
[2] R. Sipan, “Harapan Karmijan Pupus, Harga Gula Merah Jatuh di Saat Banyak Pengusaha Tak Produksi,” Seputar Kudus, 2017. [Online]. Available: http://seputarkudus.com/2017/03/harapan-karmijan-pupus-harga-gula-merah-jatuh-di-saat-banyak-pengusahaan-tak-produksi.html.
[3] Isknews.com, “Harga Menurun, Pembuat Gula Merah Dari Tebu Resah,” Isknews.com, 2014. [Online]. Available: https://isknews.com/harga-menurun-pembuat-gula-merah-dari-tebu-resah/. [Accessed: 11-Oct-2019].
[4] B. Ramadhan, “REENGINEERING PROSES BISNIS PADA PEMBUATAN GULA MERAH TEBU,” Universitas Islam Indonesia, 2011.
[5] R. Y. L. Hende, N. Y. Setiawan, and Y. T. Mursityo, “Perancangan Perbaikan Bisnis Proses Menggunakan Metode Business Process Improvement Pada Layanan Penerbitan Majalah,” J.
[6] D. C. Zaroni, “Menciptakan Proses Lean dengan Menggunakan Value Stream Mapping,” *Supply Chain Indonesia*, 2015. [Online]. Available: http://supplychainindonesia.com/new/menciptakan-proses-lean-dengan-menggunakan-value-stream-mapping/. [Accessed: 20-Sep-2019].

[7] A. Hanafi and L. Putri, “Penggunaan Economic Value Added (eva) untuk Mengukur Kinerja dan Penentuan Struktur Modal Optimal pada Perusahaan Telekomunikasi (Go Publik),” *Manaj. dan Bnis Sriwijij.*, vol. 11, no. 2, pp. 83–98, 2013.

[8] F. Hamidi, “DESAIN MESIN PEMURNIAN NIRA TEBU SECARA MOBILE UNTUK MENDUKUNG REKAYASA PROSES BISNIS PADA INDUSTRI GULA,” UNIVERSITAS ISLAM INDONESIA, 2018.

[9] Syafira Ivani Pramudita, “DESAIN MESIN EKSTRAKSI NIRA TEBU SECARA MOBILE UNTUK MENDUKUNG REKAYASA PROSES BISNIS PADA INDUSTRI GULA,” UNIVERSITAS ISLAM INDONESIA, 2018.

[10] H. Prabowo, “Penerapan Economic Value Added untuk Memaksimalkan Nilai Perusahaan: Studi Kasus PT XYZ,” *The Winners*, vol. 5, no. 1, p. 19, 2004.

[11] T. Prayogo and T. Octavia, “Identifikasi Waste dengan Menggunakan Value Stream Mapping di Gudang PT . XYZ,” vol. 1, no. 2, pp. 119–126, 2013.

[12] TAUFIQ IMMAWAN, “MODEL REKAYASA ULANG PROSES BISNIS INDUSTRI BATIK MENUU RANTAI PASOK BERKELANJUTAN DI SURAKARTA,” INSTITUT PERTANIAN BOGOR, 2015.

[13] I. B. Suratno, “Economic Value Added: Dari Suatu Alat Penilai Kinerja Manajemen Menuju Konsep Pemerataan Pendapatan,” *J. Pendidik. Akunt. Indones.*, vol. 4, no. 2, 2014.