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Risk Management in the Production of Sugar in Mojo Sugar Factory, Sragen Regency

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Abstract

This research aims to determine the degree of risk and kinds of risks and formulate risk handling strategies in sugar production in Mojo Sugar Factory, Sragen Regency. The analysis method used the coefficient of variation (CV) score and the Enterprise Risk Management (ERM) approach. The results showed that the CV score is 0.77, which means that there is a high risk in sugar production in Mojo Sugar Factory. There are 12 risks identified in this research, and these risks are categorized into low, medium, high, and very high categories. The risks that fall under the low status are the risks of broken sugar cane and damaged trucks. Miscalculations in the yield distribution and the late receipt of funds from PT Perkebunan Nusantara (PTPN) IX are the risks under the medium status. The risk considered of high status is the operation difficulties of the new tools, and the risks of very high status are low sugar cane quality, sugar cane sent to different factories, steam drop, the sudden change in the tools' and machines' performance that hampers processing (e.g., stopping while grinding), sugar cane production that is below the Work Plan and Corporate Budget (RKAP), losses, and the total production of sugar below the RKAP. To address these issues, risk management strategies are formulated for each risk identified. For low-status risks, giving strict sanctions to partner farmers and more regular and scheduled maintenance activities have to be implemented. The management strategies for medium-status risk cover the involvement of technology in calculating results and implementing wiser financial management. Experts' assistance in the operation of new tools is viewed as the best strategy for the high-status risk. As for risks under the very high status, holding an intensive meeting, conducting education and training programs for employees, benchmarking with other sugar factories that have better performance, and making good relations with partners are seen as good responses against the risks.

Keywords — Risk, Risk Management, ERM, Risk Analysis, Sugar

Abstrak

Penelitian ini bertujuan untuk mengetahui besarnya risiko, macam risiko, dan merumuskan strategi penanganan risiko pada produksi gula pasir di PG Mojo Kabupaten Sragen. Metode analisis pada penelitian ini adalah dengan mencari nilai koefisien variasi (CV) serta pendekatan *Enterprise Risk Management* (ERM). Hasil penelitian menunujukkan nilai CV sebesar 0,74>0,5 artinya terdapat risiko yang tinggi pada produksi gula pasir di PG Mojo. Terdapat 12 risiko yang diidentifikiasi pada penelitian ini. Risiko dengan status *low* adalah tebu berceceran dan lori rusak; risiko dengan status *medium* adalah salah perhitungan dalam bagi hasil dan keterlambatan penerimaan dana dari direksi PTPN IX; risiko dengan status *high* adalah pengoperasian alat baru yang belum lancar; risiko dengan status *very high* adalah mutu tebu rendah, tebu dikirim ke PG lain, *steam drop*, pemberhentian kinerja alat saat giling, rendemen di bawah RKAP, *losses*, jumlah produksi di bawah RKAP. Strategi penanganan untuk status *low* yaitu dengan pemberian sanksi yang tegas kepada petani mitra, *maintenance* yang lebih teratur dan terjadwal. Strategi untuk status *medium* yaitu penggunaan teknologi dalam perhitungan hasil dan pengelolaan keuangan yang ada di PG Mojo secara bijak. Strategi penanganan untuk status *high* yaitu pendampingan dan pengawalan pengoperasian alat baru oleh ahlinya. Strategi penanganan untuk status *very high* yaitu pelaksanaan rapat rutin antara masing-masing kepala bagian dengan manajer yang lebih intensif, pendidikan dan pelatihan kepada karyawan PG Mojo mengenai produksi gula pasir dalam hal pengoperasian alat dan mesin, melakukan *benchmarking* dengan PG yang memiliki kinerja lebih baik, serta menjalin hubungan yang baik dengan mitra.

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Kata kunci— Risiko; Manajemen Risiko; ERM; Analisis Risiko; Gula Pasir

I. INTRODUCTION

Sugar cane is one of the most eminent commodities in the agricultural subsector in Indonesia, and its total production increased from 2010 to 2015. It plays an important role in fulfilling national food needs by processing sugar cane into sugar (Ministry of Agriculture, 2015). The demand for sugar tends to increase, since sugar is one of the basic needs of the community, which is quite strategic, because it is one of the main sources of calories in the structure of public consumption (Yusuf et al., 2010). The Food and Beverage Entrepreneurs Association (GAPMMI) expected that the food and beverage industry in 2017 would grow by 8%. The current domestic sugar production is estimated to only reach 2.2 million tonnes, whereas the requirement is 5.7 million tons. Hence, about 2.5–3 million tons of sugar is imported annually to meet the needs (Ministry of Agriculture, 2017).

The fulfillment of national sugar needs must be supported by several factors. One of the factors is the availability of sugar cane, which is the raw material for sugar. According to the Ministry of Agriculture, one of the largest sugar cane plantations in Indonesia is in the province of Central Java, which contributed 10.52% of the total national sugar cane production of Indonesia in 2012–2016. There are two regencies in Central Java that have the highest production: Pati and Sragen. The Mojo Sugar Factory is one of the sugar factories in Sragen.

The Mojo Sugar Factory is a business unit of PT Perkebunan Nusantara (PTPN) IX and has been in operation since 1883. In the sugar production process, the Mojo Sugar Factory has a good potential in producing raw materials considering its location in the center of sugar cane production in Central Java, Sragen. According to the Directorate General of Plantations (2014), Sragen contributes 13.96% of the total sugar cane in Central Java. However, in the production process, it was found that the Mojo Sugar Factory faced several problems, including the amount of raw materials under the Company Work Plan and Budget (RKAP), the fluctuation of sugar cane yields, and the use of old tools and machinery in the factory that are being used since 1883. These problems often hamper the production process at Mojo Sugar Factory. Therefore, in 2015, PTPN IX revitalized the factory by renewing approximately 70% of the machines and tools. The revitalization was expected to increase the yield of sugar. The factory tried to increase the milling capacity from 2,450 tons of cane per day (tcd) to 4,000 tcd, but increasing the production capacity became a challenge. The problems faced by Mojo Sugar Factory, as mentioned before, have an impact on the total sugar production. The data for the amount of sugar production in Mojo Sugar Factory are shown in Table 1.

Table 1. Mojo Sugar Factory's Total Sugar Production in 2013–2017

Year	Sugar Production (Quintal)
2013	243,915.0
2014	175,726.0
2015	158,828.0
2016	140,199.5
2017	124,662.0

Source: Mojo Sugar Factory Performance Figures, 2017

As shown in Table 1, the sugar production in Mojo Sugar Factory decreased from 2013 to 2017, which led to uncertainty for the factory. According to Sutanto (2010), uncertainty can be defined as “a risk.” In business, risk is inevitable and has a detrimental impact on the company. It can also be interpreted as a part of a company's activities.

Mojo Sugar Factory needs to minimize risk in the process of sugar production with better risk management. One approach that can be used in risk management is the Enterprise Risk Management (ERM). According to the COSO Standard of Enterprise Integrated Risk Management Framework (2004), ERM is a process, influenced by the board of directors, management, and other employees, that is applied in strategic arrangements including all parts of the company. It is designed to (1) identify potential events that may affect the entity and (2) manage the existing risks to provide certainty toward the entity’s goal achievement. There are 8 interrelated components in ERM: 1) internal environment, 2) objective setting, 3) event identification, 4) risk assessment, 5) risk response, 6) control activities, 7) information and communication, and 8) monitoring.

This study aims to determine the degree of risk in sugar production, observe the kinds of risks in sugar production, and formulate a risk management strategy for sugar production in Mojo Sugar Factory. This study is

expected to contribute as an input and consideration to Mojo Sugar Factory in making the right decisions related to ERM.

II. LITERATURE REVIEW

A. Sugar

Sugar is one of the five staple foods in Indonesia and is a top priority in the Indonesian agriculture agenda (Lestari et al., 2016). Sugar made from sugar cane becomes a strategic commodity for increasing national food security (Ministry of Agriculture, 2016). White crystal sugar has International Commission for Uniform Methods of Sugar Analysis (ICUMSA) values between 250 and 450 IU. The Ministry of Industry groups these white crystal sugars into 3 categories: 1) white crystal sugar 1 with an ICUMSA value of 250, 2) white crystal sugar 2 with ICUMSA values of 250–350, and 3) white crystal sugar 3 with ICUMSA values of 350–4,507. The higher the ICUMSA value, the more brown the color of the sugar is and the sweeter its taste (The Indonesian Business Competition Supervisory Commission, 2015).

B. Sugar factory

The sugar agro-industry is very complex. On-farm and off-farm activities are integrated to produce sugar commodities that meet expectations (Setyawati et al., 2016). Most of the sugar factories in Java still use old, inefficient machines, resulting in low sugar yield (Hadi et al., 2002); about 68% of the sugar factories in Java have been operating for over 75 years. State-owned enterprises of sugar factories in Java have not been efficient because of limited raw materials, which led to the struggle for raw materials among sugar factories. In addition, 53% of sugar factories in Java have a low milling capacity, which is less than 3,000 tcd (Indraningsih and Malian, 2004).

C. Risk

Risk is the possibility of an undesirable or unexpected bad result (loss). In other words, the "possibility" has shown the uncertainty (Darmawi, 2002). Risk is not something to worry about, but it must be managed (Setyobudi, 2006). The risk of production in agriculture is greater than in other businesses (Simanjuntak, 2013).

D. Risk management

According to Setyobudi (2006), risk management is a culture, process, and structure that is directed toward effective management of potential adverse and bad impacts. It can maximize the opportunities and impacts of profitable events and minimize the chance and impacts of adverse events (Lokobal et al., 2014). The risk management process can help in achieving the goals of a company (Shad and Lai, 2015).

III. METHODOLOGY

The method of this study is descriptive (Surakhmad, 2001). A case study is used as the technique of implementation, which is a form of in-depth research into a social aspect that includes the involved humans (Nasution, 2012). The data used are primary data (obtained from observations and interviews) and secondary data (obtained from data collected from Mojo Sugar Factory, Central Bureau of Statistics, Ministry of Agriculture, etc.). The informants of this study were selected by using a nonprobability sampling method with a purposive sampling technique, so the determination of interviewees is deliberately based on certain considerations (Sugiyono, 2016). The selected informants were Mojo Sugar Factory employees, including the division heads and heads of each subdivision, who were considered well-aware of the details of each division in the factory. Mojo Sugar Factory partner farmers were also selected as informants.

To analyze the risk, the data were analyzed using the coefficient of variation (CV). After calculating the value of variation (V^2) and standard deviation (V), the CV and the lower limit of production (L) can be calculated. If the CV value is ≤ 0.5 and the L value is ≥ 0, it indicates that Mojo Sugar Factory will always avoid the loss or breakeven with production in the amount of L. Meanwhile, if the CV value is >0.5 and the L value is <0, there is a chance of loss that will be borne by Mojo Sugar Factory by bearing a loss in the amount of L (Hernanto, 1991).

The second data analysis method used in this study is the ERM approach. According to COSO (2004), the ERM approach has eight components: the internal environment, setting goals, identifying risk events, risk assessment, risk responses, control activities, information and communication, and supervision. However, this study was not carried out in some components such as control activities, information and communication, and

supervision, because these components were under the company authority when risk management was carried out. On the contrary, this study is only used as an input for companies in carrying out risk management. The stages of the ERM approach used in this study are shown in Figure 1.

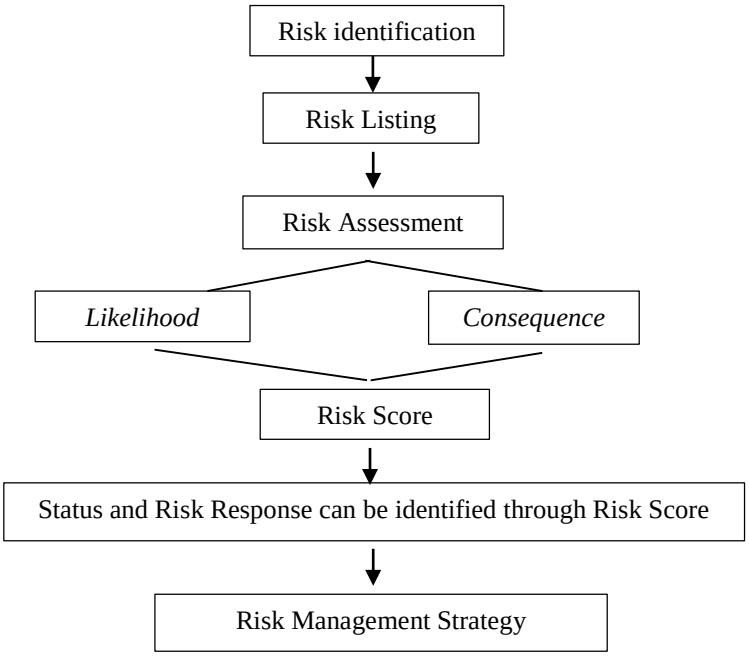

Figure 1. Stages of Enterprise Risk Management

IV. DISCUSSION

A. Risk analysis

The risk of sugar production value can be found by calculating the average of the production, variance, V, CV, and the L. The calculation of the risk of sugar production in Mojo Sugar Factory can be seen in Table 2.

Table 2. The Risk of Sugar Production in Mojo Sugar Factory, Sragen in 36 Periods (2014–2017)

No.	Information	Total
1.	Total Production (Tons)	100,707.28
2.	Average of Production (Tons)	2,797.42
3.	Variance (V^2)	4,282,068.93
4.	Standard Deviation (V)	2,069,32
5.	Coefficient of Variance (CV)	0,74
6.	Lower Limit of Production (L)	−1,341.21

Source: Secondary Data Analysis, 2018

From Table 2, it can be seen that the total production from 2014 to 2017 is 100,707.28 tons, and the obtained average production in the last 30 periods (2014–2017) was 2,797.42 tons per period. The V^2 is 4,282,068.93 tons, the V is worth 2,069,326 tons, and the CV value is 0.74 (higher than 0.5). Thus, it can be interpreted that there is a high risk in the production of sugar in PG Mojo. Meanwhile, the L is −1,341.21 (lower than 0), which means that in one milling season, there is a possibility of a loss of sugar production of up to 1,341.21 tons.

B. Enterprise Risk Management

The ERM implemented in the risk management of sugar production in Mojo Sugar Factory has several stages.

a. Internal Environment

Mojo Sugar Factory is a factory under the PTPN IX management located in Sragen Regency. PTPN IX, as the parent company, is hugely involved in the operations of Mojo Sugar Factory. As a whole, Mojo Sugar Factory has carried out operational activities well from the base to the tip.

b. Objective Setting is a component of the risk identification stage wherein Mojo Sugar Factory sets goals so that the identification process occurs.

a) *Strategic Objective* includes increasing the quantity and quality of the sugar by revitalizing the factory. The raw materials in Sragen are quite abundant. This is the reason PTPN IX directors decided to revitalize Mojo Sugar Factory, which was planned to be finished in 2019.
b) *Operating Objective* is conducted by running a standard system of production, operational standards, and good quality management. Currently, Mojo Sugar Factory already holds ISO:9001 certificates on quality management, and there is already maintenance for tools and machines, both during the milling period and beyond the milling period.
c) *Reporting Objective* is in the form of reporting a company's achievements, raw materials, and finances that are used as a basis for determining its policies. The report made by Mojo Sugar Factory is addressed to the PTPN IX directors, investors, partner farmers, and internal management of Mojo Sugar Factory.
d) *Compliance Objective* is done by complying with the regulations made by the government. Mojo Sugar Factory follows the regulations and has reached the standards set by the government. Up to today, the sugar standard set by the government based on the Indonesian National Standards is White Crystal Sugar type 2.

c. Event Identification

Risk identification in the production of sugar in Mojo Sugar Factory is conducted in all sections, including the plant, installation, processing, and Administration, Finance, and General (AFG). These four sections are interrelated in sugar production. Table 3 lists the risks identified in the production of sugar in Mojo Sugar Factory.

Table 3. List of Risks in the Production of Sugar in Mojo Sugar Factory

Section	No	Risk	Cause of Risk
Plant (A)	A1	Low sugar cane quality (very dirty, stale, and Brix <18%)	a) Sugar cane is not worth cutting. b) There is not much dirt on the sugar cane to be processed. c) Sugar cane is stale.
	A2	Broken sugar cane (falling from a crane)	a) A lot of sugar cane has already been cut (partial) before entering the sugar cane table.
	A3	Damaged trucks	a) Old trucks in poor condition b) Inadequate railway conditions
	A4	Sugar cane is sent to other sugar mills	a) No strong bond with the farmers b) Performance competition with other sugar mills
Installation (B)	B1	Steam drop	a) Low brix extorting yield b) Late fuel bait c) The grinding process is not smooth.
	B2	Unskilled operation of new machines and tools	a) Adjustment of new equipment by employees b) Lack of training for employees on the handling of new machines and tools
	B3	Tools and machines stop working while grinding	a) Damaged tools or machines b) Lack of maintenance of tools or machines
Processing (C)	C1	The production of sugar cane is below the Work Plan and Corporate Budget (RKAP)	a) Low quality of raw materials b) Ineffective performance of tools and processing
	C2	Losses (loss of sugar in	a) Bad sugar cane extorting

		the production process)	b) Interference during the production process
	C3	The total production of sugar is below the RKAP	a) Production capacity is not reached. b) There is a high milling stop hour.
Administration, Finance, and General (D)	D1	Miscalculation of yield distribution to partner farmers	a) Employee negligence in calculating and sharing the results with partner farmers
	D2	Late receipt of funds that have been requested to the directors of PTPN IX	a) The old and complicated bureaucratic system

Source: Processed Primary Data

d. Risk Assessment

Risk assessment is carried out using two indicators: consequence and likelihood. Consequence is the impact of risk, whereas likelihood is the possibility of risk arising within a period. This risk assessment uses quantitative analysis with a numerical scale. The likelihood measurement scale is divided into 5 values: 1 = rare risk, 2 = unlikely risk, 3 = moderate risk, 4 = likely risk, and 5 = almost certain risk. The consequence measurement scale is also divided into 5 values: 1 = insignificant impacts, 2 = minor impacts, 3 = moderate impacts, 4 = major impacts, and 5 = catastrophic impacts. The risk assessment results in a risk value/score by multiplying the likelihood and consequence value of each risk (The Standards Australia/New Zealand (AS/NZS 4360), 1999). The results of the likelihood and consequence assessment of each identified risk are shown in Table 4 below.

Table 4. Risk Assessment in the Production of Sugar in Mojo Sugar Factory

Section	No	Risk	*Likelihood*	*Consequence*	Score
Plant (A)	A1	Low sugar cane quality (very dirty, stale, and Brix <18%)	4	4	16
	A2	Broken sugar cane (falling from crane)	2	2	4
	A3	Damaged trucks	1	2	2
	A4	Sugar cane is sent to other sugar mills	4	5	20
Installation (B)	B1	Steam drop	3	5	15
	B2	Unskilled operation of new machines and tools	3	3	9
	B3	Tools and machines stop working while grinding	4	5	20
Processing (C)	C1	The production of sugar cane is below the Work Plan and Corporate Budget (RKAP)	5	4	20
	C2	Losses (loss of sugar in the production process)	5	3	15
	C3	The total production of sugar is below the RKAP	5	5	25
AFG (D)	D1	Miscalculation of yield distribution to partner farmers	4	2	8
	D2	Late receipt of funds that have been proposed to the directors of PTPN IX	4	2	8

Source: Primary Data Analysis, 2018

e. Risk Response

In this stage, risk is classified into Low, Medium, High, and Very High. The level of risk is described in the form of a risk map. Figure 2 shows the risk map that explains the risk status of sugar production in Mojo Sugar Factory.

Likelihood	*Consequences*				
	Insignificant (1)	*Minor* (2)	*Moderate* (3)	*Major* 4)	*Catastrophic* (5)
Almost certain (5)			−C2	−C1	−C3
Likely (4)		−D1 −D2		−A1	−A4 −B3
Moderate (3)			−B2		−B1
Unlikely (2)		−A2			
Rare (1)		−A3			

Figure 2. Risk Map of Production of Sugar in Mojo Sugar Factory

Descriptions:
Green = low risk status
Cream = medium risk status
Yellow = high risk status
Red = very high risk status

The next step, after knowing the status of each risk, is formulating strategies to manage the risks that emerged in the production of sugar in Mojo Sugar Factory. This risk management strategy is based on the risk response of each risk status. The following are the risk responses for each risk status in this study:

1) *Very high risk*: This risk requires special attention from the company's executive management (*unacceptable*).
2) *High risk*: This risk requires special attention, responsibility, and determination of the action plan from the company's management (*issues*).
3) *Medium risk*: This risk can be accepted and managed through monitoring or specific instructions with clear responsibilities from specified management (*supplementary issue*).
4) *Low risk*: This risk is acceptable.

The risk management strategy in the production of sugar in Mojo Sugar Factory can be seen in Table 5.

Table 5. Risk Management Strategy

Status	Management Strategy	Risk
Low	Give strict sanctions to partner farmers who send sugar cane in broken conditions	Broken sugar cane (falling from a crane) (A2)
	Perform more regular and scheduled maintenance activities	Damaged trucks (A3)
Medium	Involve technology in calculating the yield	Miscalculation of yield distribution to partner farmers (D1)
	Manage the finances of Mojo Sugar Factory wisely according to priority	Late receipt of funds that have been proposed to the directors of PTPN IX (D2)
High	Assisting and escorting the operations of new tools and machines by the experts	Unskilled operation of new machines and tools (B2)
Very High	Hold regular meetings intensively between each division head and the Mojo Sugar Factory manager to discuss and evaluate the performance of each division	Low sugar cane quality (A1), sugar cane is sent to other sugar mills (A4)
		Steam drop (B1), tools and machines stop working while grinding (B3)
		The production of sugar cane is below the Work Plan and Corporate Budget (WPCB) (C1), losses (C2), the total production of sugar is below the WPCB (C3)

	Conduct an education and training program for Mojo Sugar Factory employees regarding the operation of tools and machines for producing sugar	Steam drop (B1), tools and machines stop working while grinding (B3)
		Losses (C2)
	Benchmarking with other sugar mills that perform better than Mojo Sugar Factory	Low sugar cane quality (A1), sugar canes are sent to other sugar mills (A4)
		The production of sugar cane is below the Work Plan and Corporate Budget (WPCB) (C1), the total production of sugar is below the WPCB (C3)
	Establish a good relationship with partners	Sugar cane is sent to other sugar mills (A4)
		The total production of sugar is below the WPCB (C3)

Source: Primary Data Analysis, 2018

V. CONCLUSION

The conclusions of this study are as follows:

1. The risk of sugar production in Mojo Sugar Factory, Sragen has a CV value of 0.74 (>0.5), which means that there is a high risk in the production of sugar in the factory.
2. The existing risks in the process of sugar production in Mojo Sugar Factory are as follows:
   a. Plant risks such as low sugar cane quality, broken sugar cane (falling from a crane), damaged trucks, and sugar cane being sent to other sugar mills;
   b. Installation risks such as steam drop, unskilled operation of new machines and tools, and tools and machines encountering problems while grinding;
   c. Processing risks such as the production of sugar cane that is below the RKAP, losses, and the total production of sugar that is below the RKAP; and
   d. AFG risks such as miscalculation of yield distribution to partner farmers and late receipt of funds that have been proposed to the directors of PTPN IX.
3. The strategies implemented at Mojo Sugar Factory to manage risks based on their status are as follows:
   a. Risk management strategies for low risks include giving strict sanctions to partner farmers who send sugar cane in broken conditions and performing more regular and scheduled maintenance activities;
   b. Risk management strategies for medium risks include involving technology in calculating the yield and managing the finances of Mojo Sugar Factory wisely according to priority;
   c. Risk management strategies for high risks include assisting and escorting the operations of new tools and machines by experts; and
   d. Risk management strategies for very high risks include holding regular meetings intensively between each division head and the Mojo Sugar Factory manager to discuss and evaluate the performance of each division, conducting an education and training program for Mojo Sugar Factory employees regarding the operation of tools and machines for producing sugar, benchmarking with other sugar mills that perform better than Mojo Sugar Factory, collaborating with research institutes to conduct research and development on sugar cane cultivation in the Sragen Region and surrounding areas, and establishing good relationships with partners.

Suggestions that can be given from this research are as follows:

1. Mojo Sugar Factory should pay more attention to the quality and quantity of raw materials from partners by establishing good relationships with them, assisting the sugar cane cultivation from land preparation to sugar cane harvesting, helping partners in terms of supplies for sugar cane cultivation such as fertilizer, seedlings, and funding and always conduct research and development related to sugar cane to better the yield.
2. PG Mojo should pay more attention to the revitalization of machines and tools by escorting, educating, and training employees in the installation and processing, in order for them to operate the new tools and machines properly. This can be done by bringing in employees from the vendors of the new machines and tools.
3. Mojo Sugar Factory should pay more attention to the work spirit of Mojo Sugar Factory employees. This can be done by benchmarking with other sugar factories that have been performing better, resulting in employees being more motivated to improve their performance and producing the expected output. Glenmore Sugar Factory in Banyuwangi can be a benchmark for Mojo Sugar Factory.

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