Risk identification and prevention in moringa tea factory (Case study: Nurul Jannah, Madura Island)

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Abstract. Nurul Jannah is a business unit that has produced many processed moringa products such as tea and flour that have been marketed nationally and internationally. This study aims to determine the sources of risk and operational risk categories, as well as to determine mitigation actions to minimize operational risk at CV Nurul Jannah. The existence of this research is expected to be used as managerial implications for CV Nurul Jannah in running its business. This research uses fishbone diagram analysis tools to identify risks and FMEA (Failure Mode and Effect Analysis) as a tool to prioritize risks. The results showed the existence of prioritized risks in operational activities including the risk of delays in raw materials with high categories, the risk of using less sterile tools with moderate categories, and the risk of work accidents with low categories. If these risks are left unchecked, it is possible that it will cause a decrease in product quality and can even cause losses in the business. Risk mitigation alternatives that can be done are providing proper care for their own moringa plants and increasing cooperation with moringa farmers in other areas, checking and cleaning tools regularly, and providing K3 (Occupational Safety and Health) training and equipping production sites with danger signs.

1 Introduction

Micro, Small and Medium Enterprises (SME's) are one of the fields that have a role in improving and growing the economy in Indonesia [1]. This can be seen from the number of MSMEs which reached 56,534,592 business units or equivalent to 99.9 percent of the total number of business units in Indonesia [2]. According to the Ministry of Cooperatives and SMEs, MSMEs contribute to GDP (Gross Domestic Product) by 61.97 percent or worth 8,573.89 trillion rupiah [3]. This shows that MSMEs have a huge contribution to the economy. One of the areas that has high business potential is Sumenep Regency, this has been supported by data on the number of MSMEs in Sumenep Regency reaching 313,351 spreads across 27 sub-district areas with a workforce of 486,000 [4].

Moringa (Moringa oleifera) is one of the plants that has many benefits for life. Moringa contains many nutrients located in the leaves, stems, flowers, fruits, even to the roots of plants that are currently well-known as medicinal plants [5]. Moringa leaves can be used as medicinal ingredients for hypertension, diabetes, heart disease, improve erectile function in the body and improve and treat liver and digestive functions [6]. Many business units manage food and beverages made from agricultural products, one of which is the moringa plant. This plant is usually only used as a clear vegetable and fresh vegetables.

Seeing the large contribution of MSMEs and the many benefits of moringa plants, it shows that there is a great opportunity to be developed. One of the businesses engaged in moringa processing activities is CV Nurul Jannah in Bluto District, Sumenep Regency. This business unit has produced many processed moringa products, one of which is moringa tea drink and moringa flour which has been marketed in national and international markets. Moringa tea business development often faces a challenge, one of which must be able to meet the quality and quantity desired by consumers. In addition, this business also still experiences several business risks that can come at any time, one of which is operational risk. Operational risks can be caused by the condition of the internal business environment, human resources, systems and the external business environment [7]. CV Nurul Jannah itself is suspected of not implementing good operational risk management. This can be seen from the frequent occurrence of damage to raw materials for moringa products, engine damage, and work accidents during operational activities such as electrical short circuits in oven machines. This risk arises from the low level of education of the workforce. According to [8] which states that CV Nurul Jannah has problems regarding processing skills caused by the highest level of education of the employees is the upper secondary level and job training has never been carried out on employees [8]. Work accidents caused by low levels of education

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have a major impact on the resulting decline in production[9]. Therefore, it is very important to conduct research on business operational risks at CV Nurul Jannah considering the magnitude of the existing business potential. The same research was also conducted by [10] identify and analyze risk levels and determine risk control strategies in moringa tea production activities which showed that there were 11 risks identified including 6 high-level risks, 3 medium-level risks, and 2 low-level risks[10].

If the risks that arise are left unchecked, it is possible that it will cause a decrease in product quality and can even cause losses in the business, so this study aims to (1) analyze the sources of risk and categories of operational risk at CV Nurul Jannah, (2) find out mitigation actions to be able to minimize operational risks that occur at CV Nurul Jannah. By applying the right mitigation actions in overcoming risks, operational activities can run properly. The existence of this research is expected to contribute as a managerial implication for CV Nurul Jannah and other business actors in running their business especially in measuring the risk.

2 Material and methods

This research activity applies a mix method approach conducted at CV Nurul Jannah which is located in Bluto District, Sumenep Regency, East Java. This mix method method is a method of combining qualitative and quantitative research that aims to expand the discussion in the research conducted [11]. Qualitative research can be integrated in the identification of emerging operational risks while quantitative research can be integrated in the calculation of risk prioritization in CV Nurul Jannah. In the selection of research locations carried out by purposive sampling or intentionally with consideration (1) there has been no research with the same topic and location regarding business risk management in CV. Nurul Jannah, (2) this business unit has been established for more than 5 years, (3) this business has had a positive impact on the economic conditions of farmers around the place of business. From the criteria that have been mentioned, it shows that this location is suitable for research on the topic of business risk management. This research activity was carried out from August to October 2023.

The type of data used in this research is primary data obtained from direct observation activities at the business location and by conducting interviews with the CV Nurul Jannah business unit. The method of determining key informants in this study using purposive sampling technique with consideration (1) physically and mentally healthy, (2) has worked at CV Nurul Jannah for at least 3 years (3) the person is considered to know the flow of operational activities at CV Nurul Jannah. Key informants who play a role in this research are business owners and workers in the field of business operations. The data obtained is in the form of information about the business profile, risk identification, and field conditions to help determine risk mitigation.

The analysis method used in the identification of risk sources that arise in operational activities is by using a fishbone diagram. The application of the fishbone diagram is considered to be able to explain the cause and effect of each risk factor found. The fishbone diagram used in this study is divided into several categories studied including: process factors, human resource factors, technology factors, and procedure factors applied by CV Nurul Jannah. The four factors mentioned later can show the risks of all operational activities carried out at the place of business. The use of *this fishbone* diagram is used to show the characteristics of cause and effect of the causative factors in Nurul Jannah's CV. This identification activity aims to find out the root causes of risks that arise in business operations. According to Mashabai et al. (2023), there are several advantages in using fishbone diagrams, such as being able to focus research on the main problems that occur, determine the cause of a problem that occurs, help in identifying the cause of the problem, and others [12].

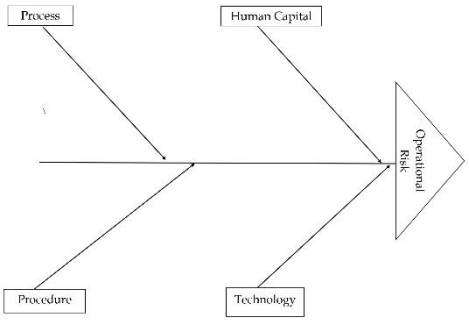

Fig 1. Fishbone diagram.

The data analysis method used in this research is the FMEA (Failure Mode and Effect Analysis) method where this method is one of the data analysis tools used to determine how the possibility of failure, the risk of occurrence, and the impact obtained from ranking priority numbers commonly referred to as Risk Priority Number (RPN). This RPN value is obtained from multiplying the severity, frequency of occurrence, and detection values [13]. According to Indrarespati et al. (2021), FMEA is an analytical technique that is used to identify several things, such as to determine the causes of failures that occur in business activities, determine the impact of a risk, and determine the critical level of impact that has arisen [14]. There are steps in the use of FMEA including: (1) process identification, (2) making a list of potential causes, (3) providing values, probabilities, and discoverability of a problem, (4) calculating the Risk Priority Number (RPN), (5) providing control suggestions [15].

According to [16] states that the RPN value can be obtained by the formula:

$$RPN = Occurrence \times Severity \times Detection \quad (1)$$

This is in line with the research conducted those who mention examples of RPN calculations, namely:
RPN = Severity x Occurrence x Detection
= 9 x 6 x 2 = 108 [16].

The resulting RPN value will then be ranked according to the highest and lowest RPN values. The highest RPN value means that this type of risk has a failure rate that is serious and significant enough to require proper and immediate handling. A low RPN value means that the type of risk that arises is a minimal risk so that the handling is prioritized on the risk that has the highest RPN value first [17].

After the RPN value is obtained, the next step is to determine the risk scale with high, medium, or low categories using the formula:

$$Scale\ Interval\ (RS) = (m - n)/b \quad (2)$$

Where, m is the highest RPN value, n is the lowest RPN value, and b is the number of classes or answer categories [18]. Furthermore, the determination of the critical value of the risk is carried out so that the priority risk can be known so that it can be handled immediately. According to Suryani (2018) in her research states that the calculation of critical value is obtained from the formula [19]:

$$Critical\ RPN\ =\ (Total\ RPN)/(Total\ Risk) \quad (3)$$

3 Result and discussion

CV Nurul Jannah is one of the business units engaged in moringa processing located in Bluto District, Sumenep Regency which has been established since 2012. This business was founded by Mr. Ahmad Nurdin with a total of 20 employees. Operational activities are carried out on 25 production days with a production scale of 25 kg to 1 ton of moringa per year. The products produced include moringa tea and moringa flour.

Fig 2. CV. Nurul Jannah products.

Moringa tea products offered are packaged in 1 pcs containing 20 tea bags at a price of Rp. 15,000 and 250 grams of moringa flour which is pegged at Rp. 50,000. There are several advantages of moringa tea products offered by CV Nurul Jannah such as products that can last a long time, the materials used are of high quality, and have been licensed by the Health Office, namely the possession of a Home Industry Food Production (PIRT) certificate with the number 5163529021185-20.

Every business will definitely not be separated from what is called risk. Especially with MSMEs which still have a small business level. Uncertainty that can lead to the occurrence of a risk which, if left unchecked, will have a negative impact on business development. The first step to be able to handle risk is to identify the risks that arise first. The risk identification activity itself has the aim of being able to find out the sources of risk that have the possibility of occurring in the CV Nurul Jannah business.

The results of risk identification can be described using the fishbone diagram method. According to Fernandes & Arisman (2022) the fishbone diagram method is one of the tools used in problem identification activities commonly referred to as fishbone diagrams [20]. The following is an identification of the sources of operational risk experienced by CV Nurul Jannah:

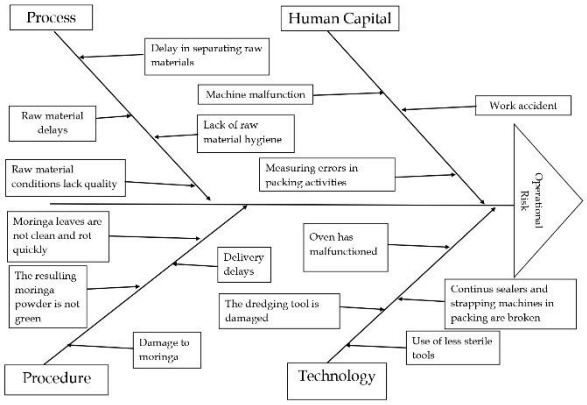

Fig 3. Fishbone diagram of CV Nurul Jannah.

Based on the operational risk identification activities at CV Nurul Jannah, it is divided into four, namely process risk, HR risk, technology risk, and procedure risk. There are four causes of process risk, namely delays in raw materials, poor quality raw materials, lack of hygiene of raw materials, and delays in separating leaf blades. Problems in the delay of raw materials can occur due to the failure to harvest moringa raw materials by moringa farmers. Harvest failure can occur due to the change from rainy to dry season which can interfere with the moringa plant production process. The next risk is the condition of poor quality raw materials caused by pests and diseases during the growth process of moringa leaves in the field. The risk of delays in separating the leaves during the sorting process is also a process risk caused by incompetent employees. Another problem is the risk of lack of hygiene of moringa raw materials that arises as a result of employees not implementing good SOPs and lack of accuracy in the moringa leaf washing process.

HR risks have several causes, including the risk of machine damage caused by employees who lack concentration and knowledge about the operation of the machines used. Knowledge in operating the machine properly and correctly has a very big role. This is not

only obtained from schools and classrooms but from daily activities that can generate and expand knowledge [21]. Furthermore, it is caused by the risk of work accidents arising from the absence of OHS training, employees who do not use the right PPE during the production process, and the absence of danger signs. This is in line with Purba & Sukwika's research (2021) which states that low OSH awareness can make workers vulnerable to occupational diseases and accidents [22]. Another operational risk caused by human resources is mis-measurement in packing activities, this is due to employees' lack of concentration.

There are four factors causing the risk of technology used by CV Nurul Jannah, namely ovens and dryers experiencing damage caused by a lack of maintenance and control of the machine, as well as the depreciation of machine tool performance. Another risk is the use of less sterile tools which can be caused by a lack of maintenance on the cleanliness of the tools during operating activities, and the last is the risk of continus sealers and strapping machines in packing activities experiencing damage caused by a lack of maintenance and supervision of the tools. Maintenance and care of tools/machines is an activity that has an important role in running a business. In line with Wahyuni & Widodo's research, (2020) regarding fire detection devices that are poorly maintained can cause damage or malfunction of a tool [23]. If this is allowed to continue, it will cause losses to assets owned by the business unit.

The procedure factor has four causes of risk such as, the risk of moringa leaves not being clean and rotting quickly caused by the washing process using water that is more than a predetermined quantity, then the risk of moringa powder produced is not green due to the process of separating the leaves and stalks for more than 7 hours, the risk of damage to moringa products is caused by not checking the temperature regularly and drying beyond 450C, and the last is the risk of delivery delays caused by delivery obstacles such as big days that make shipments exceed the load limit.

The results of the interval scale calculation obtained a low scale (4-104), medium scale (105-209), and high scale (210-315). The following are the results of the operational risk assessment that occurred at CV Nurul Jannah that has been identified, obtained the following risk values:

Judging from the table above shows that there are 15 highest risks seen from the total RPN value. The highest risk is at an RPN value of 315, namely the risk of delays in raw materials. The risk of delays in raw materials can occur due to crop failure of moringa plants carried out by moringa farmers. Meanwhile, the lowest RPN value is obtained by the risk of damage to moringa products with a value of only 4. The risk of damage to moringa products can occur as a result of not checking the temperature regularly and drying beyond 450C. However, this risk can be overcome by CV Nurul Jannah by using a surveillance system every 5 hours to monitor the temperature in the oven, so that this risk does not hamper the production of moringa tea.

Table 1. Risk assessment.

Type of Risk	S	O	D	RPN	Ranking	Category
Process risk						
Raw material delays	9	7	5	315	1	High
Poor quality raw materials	2	2	2	8	10	Low
Delay in separating the leaf blade	6	3	2	36	4	Low
Lack of raw material hygiene	3	2	3	18	7	Low
Human Capital Risk						
Machine malfunction	9	2	2	36	4	Low
Work accident	9	5	2	90	3	Low
Measurement error in packing activities	3	3	2	18	7	Low
Technology						
Oven has malfunctioned	5	2	2	20	6	Low
Drying equipment malfunctioned	3	2	2	12	9	Low
Continus sealers and strapping machines in packing are broken	6	3	2	36	4	Low
Use of less sterile tools	9	8	2	144	2	Medium
Procedure Risk						
Moringa leaves are not clean and rot quickly	9	2	2	36	4	Low
The resulting moringa powder is not green	8	2	1	16	8	Low
Damage to moringa products	4	1	1	4	11	Low
Delivery delays	8	2	2	32	5	Low

Source: Primary data processed, 2023.

Based on the category classification, the high risk is the delay in raw materials. The medium risk is the use of less sterile tools. While low risks include poor quality raw material conditions, delays in separating leaf strands, lack of raw material hygiene, machine damage, work accidents, dosing errors in packing activities, ovens are damaged, drying equipment is damaged, continuous sealers and strapping machines on packing are damaged, moringa leaves are not clean and rot quickly, moringa powder produced is not green, moringa product damage, and delivery delays occur.

After the RPN analysis and risk categorization are carried out, the calculation of the critical value of risk is carried out, the value of RPN that is above the critical value can be said to be a priority for improvement that must be taken. If the company has a critical value standard, it can be used as a reference, but if it does not have one, it is necessary to calculate the critical value based on references from machines that have the same characteristics. The calculation of the critical value of this risk is carried out by calculating the total value of the RPN with the number of risks that have been identified[24].

Table 2. Operational risk critical RPN.

Risk Indicators	RPN
Process Risk	377
Human Capital Risk	144
Technology Risk	212
Procedure Risk	88
Total RPN	**821**
Critical Value	**54,7**

Source: Primary data processed, 2023.

The results of the calculation of the critical value of RPN that have been carried out obtained a value of 54.7. So in this case we can conclude that there are three risks that are prioritized in mitigation activities. Table 2 provides information that the critical RPN value of operational risk at CV. Nurul Jannah.

Operational risks that have RPN values above the critical value include: (1) delay in raw materials, (2) use of less sterile tools, (3) work accidents. These results are in line with research conducted by Samsukdin et al., (2022) which states that the risk of raw materials is a risk that is classified as high [18], as well as in the research of Sari & Manda (2021) which states that HR risk is the risk that has the greatest loss value in carrying out operational activities [25].

Judging from the three priority risks, risk mitigation is proposed, namely: (1) providing proper care for moringa plants owned by themselves and increasing cooperation with moringa farmers in other areas, This can be done by providing socialization to workers about the correct care of moringa plants (2) checking and cleaning tools periodically with a certain period of time, by starting to schedule in checking tools and machines at any given time, (3) providing K3 training to employees and equipping production sites with signs that indicate danger, This is done to prevent work accidents that may occur.

The author realizes that every research has its own advantages and limitations, as well as in this research. The limitations encountered include the limited time used in field observation activities due to limited operating hours and the object of research that is only focused on operational activities, which is one of the many activities carried out in running a business. With the limitations of this research, it is hoped that it can be used as a consideration for future researchers to continue to be improved in future studies.

4. Conslusion

This research is expected to be used as a managerial implication for CV Nurul Jannah. The results of risk identification show the existence of priority risks in operational activities including the risk of delays in raw materials (high category), the risk of using less sterile tools (medium category), and the risk of work accidents (low category). These risks have a major influence on operational activities such as delays in raw materials that have an impact on the setback of the production schedule, the risk of using less sterile tools that have an impact on the quality of the products produced, then the risk of work accidents has an impact on threatening the safety of employees.

Risk mitigation alternatives that can be carried out by CV Nurul Jannah are by providing proper care for their own moringa plants and increasing cooperation with moringa farmers in other areas, hal ini bisa dilakukan dengan cara memberikan sosialisasi kepada para pekerja mengenai perawatan tanamn kelor yang benar; checking and cleaning tools regularly, dengan mulai melakukan penjadwalan dalam pengecekan alat dan mesin pada setiap waktu tertentu,; providing K3 (Occupational Safety and Health) training and equipping production sites with hazard signs, hal ini dilakukan untuk tindak pencegahan kecelakaan kerja yang kemungkinan dapat terjadi. The risk mitigation actions that have been carried out then require continuous monitoring and evaluation in order to assess the effectiveness of the actions and make adjustments to the conditions in the business place. In implementing mitigation actions, support from stakeholders, especially moringa farmers from other areas, is needed to collaborate appropriately, as well as support from employees to further increase awareness of the importance of maintaining safety and health while working.

Based on the research activities that have been carried out, there are several limitations experienced and can be several factors of consideration for future researchers in perfecting their research. Some of the limitations in this study such as the limited time carried out in field observation activities due to limited operating hours and the object of research that is only focused on operational activities, which is one of the many activities carried out in running a business. Therefore, it is recommended that further research can be continued not only to discuss operational risks, but also to other risks that occur at CV Nurul Jannah that are being carried out.

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