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Production Risk Mitigation Strategies In Small-Scale Goat Milk Industries

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Abstract

The purpose of this research is to identify the causes and impacts of production risks and develop appropriate mitigation strategies to deal with risks at Abah Farm dairy goat farm. The data analysis design used is the House of Risk (HOR) analysis. The results of the study showed that the causes and impacts of goat milk production risks consist of the process of doe/nanny rearing, the milking process, and the packaging and distribution process. Risk mapping of goat milk production in the rearing process five activities cause the risk of goat milk production, including feeding activities, animal sanitation, cage sanitation, livestock reproduction, and livestock animal health. Furthermore, in milking goat milk, five activities are causes, namely the milking place (cage), determining the intensity and time of milking, milking preparation, the way during the milking process, and the completion of milking. In the completion and packaging of milk, two activities are caused, namely the handover stage and the goat milk packaging stage. Several mitigation strategies can be carried out, including in the process of raising mothers, the main priority of the mitigation strategy is to adjust the composition of high-protein green feed. Furthermore, in the milking process, the top priority mitigation strategy is to supervise the implementation of the goat milking standard procedure by the supervisor and in the milk packaging and distribution process, the top priority mitigation strategy is to back up goat milk production data in a separate notebook or soft file data storage on a computer or email.

Key words: dairy goat; goat milk; house of risk; production risk

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INTRODUCTION

Livestock farming is a significant business sector in the process of meeting food needs, especially animal protein requirements. The demand for animal protein continues to increase in line with population growth and public awareness of the importance of nutrition (Liang & Paengkoum, 2019). Livestock in Indonesia is divided into (1) poultry, with products including meat and eggs; (2) slaughter and working livestock, with main products including meat and the use of livestock power to lift heavy equipment; (3) dairy livestock, with main products including milk (Susilorini et al., 2008). The goat population in Indonesia in 2022 was 19,397,960, an increase of 2.5 percent from the previous year (Badan Pusat Statistik, 2022). West Java is one of the provinces with the fourth largest goat population after Central Java, East Java, and Lampung. The goat population in West Java is 1,430,214 heads, or 7.37 percent of the total goat population in Indonesia.

One of the products of animal husbandry is milk. Based on Food and Drug Administration Regulation No. 34 of 2019 concerning Food Categories, milk is defined as a liquid from the udders of cows, buffaloes, horses, goats, sheep, and other dairy animals, both fresh and pasteurized, Ultra High Temperature (UHT) or sterilized. The majority of milk consumed by humans comes from cows. Based on data from the Directorate of Livestock and Animal Health of the Ministry of Livestock, the demand for milk in Indonesia reached 4.4 million tons in 2022. Meanwhile, data from the Badan Pusat Statistik (2022) shows that fresh cow's milk production in Indonesia reached 968,980 tons. This indicates that domestic dairy cow milk production is unable to meet demand, so the shortfall will be met through imports (Asmara et al., 2016). Goat milk can be a strategic alternative in meeting Indonesia's milk demand (Sumarmono, 2022). According to Nuriyana et al (2016), goat milk has a higher protein content than cow milk and is a source of minerals.

Based on data from the Livestock Division of the Tasikmalaya City Food Security, Agriculture, and Fisheries Agency, the largest dairy goat farm in Tasikmalaya City is CV. Abah Farm, which has a population of 56 goats and has been operating since 2018. This farm is located in Cibeuti Village, Kawalu District, Tasikmalaya City. The types of dairy goats raised are Saanen goats, Etawa goats, and their crossbreeds (Sapera). Saanen goats originate from the Saanen Valley in Switzerland. Physically, Saanen goats have predominantly white fur with black spots on their ears and noses. Female Saanen goats have straight ears that stand upright, small legs, and short tails (Mulyono & B. Sarwono, 2009). In several studies, Saanen goats have shown superior milk production during lactation, as well as a longer lactation period and higher milk yield compared to other breeds, making them an ideal choice for small and large farms (Nicory et al., 2023; Ruvuga & Maleko, 2023; Zykova & Chamurliev, 2024).

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The owner of CV Abah Farm said that goat milk production at CV Abah Farm fluctuates, with an average yield of 10-14 liters of goat milk. There are several factors that can influence fluctuations in goat milk production and potentially lead to a long-term decline in goat milk quantity at CV Abah Farm. This can be caused by risks in production that affect goat milk production. The causes of production risks vary and can arise from genetic factors, temperature and weather conditions, disease, and others (Maimunah et al., 2020). These risks can occur in the process of goat husbandry, milking, and milk packaging, which can cause fluctuations in goat milk production. Ultimately, this fluctuating production can affect the income received by farmers. If not addressed immediately, it will cause significant losses. This is supported by Nyoman Pujawan & Geraldin (2009), who state that proper risk management is very important for companies to survive in a business environment full of risks. The presence of risk in agriculture has a significant influence on farmers' production and investment decisions, thus requiring a sound risk management concept (Villacis et al., 2023). The risks that arise cause losses for the company from goat milk production activities at CV Abah Farm. This requires farmers to determine the most appropriate attitude and strategy in dealing with these risks, because risks can affect the amount of production, thereby affecting prices and income. According to (Lawalata, 2017), the amount of income is influenced by the level of production, production prices, and costs incurred for the production process. In addition, the amount of income is also influenced by the risks that will be faced. To prevent the continuation of losses, research is needed on the identification of risk agents and their impacts, so that appropriate steps can be taken to prevent production risks that could reduce the amount of goat milk produced by the company.

LITERATURE ANALYSIS AND METHODOLOGY

Research on goat milk production risk analysis was conducted at CV Abah Farm Goat Farm. The farm is located in Kampung Cijeruk, Cibeuti Village, Kawalu District. The location was chosen deliberately (purposively) because CV Abah Farm is one of the highest goat milk producers in Tasikmalaya City. The research technique used was a case study. The research used primary and secondary data sources, both quantitative and qualitative data. Primary data was obtained from direct observation of goat milk production activities at CV Abah Farm, with information sources coming from the owner and workers in the barn, as well as those involved in the packaging and distribution of goat milk at CV Abah Farm. Secondary data was obtained from literature studies and supporting sources, namely the Central Statistics Agency, Open Data Jabar, and the Agriculture Office data, as well as other supporting literature sources.

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The data obtained was analyzed quantitatively using the House of Risk (HOR) method through two phases. Phase 1 was used to assess the severity of the impact of risk events and risk agents, as well as to determine the risk agents that were the top priority. Phase 2 was used to assess proactive actions (PA) or mitigation strategies that were the priority.

HOR Phase 1 (Risk Identification Phase)

HOR phase 1 is the initial stage in the House of Risk (HOR) method, in which risks are identified to determine which risk agents should be prioritized for preventive measures. The following are the stages in HOR phase 1 (Nyoman Pujawan & Geraldin, 2009).

Stage 1. Identification of business processes/standard operating procedures for goat milking. The division of these business processes aims to identify where risks may arise (where are the risks). In addition to business processes, this first stage also identifies the departments/bureaus responsible for these business processes (risk owners) and the risk specifications for each business process.

Stage 2. Identification of risk events for each business process identified in the previous stage. These risks are all events that may arise and cause disruption to the achievement of company objectives.

Stage 3. Identify the severity of a risk event on the company's business processes. This severity value indicates the extent of disruption caused by a risk event on the company's business processes. The scale used to determine the severity of a risk is a scale of 1-5.

Stage 4. Identify the consequences (potential causes) of a risk event on the company's business processes. These risk consequences indicate the disruptions that may arise if a risk event occurs.

Table 1. Qualitative Scale for Severity (Impact of Risk Events)

Severity	Level	Criteria
Very Low	1	No impact
Low	2	Impact, but very low influence
Moderate	3	Moderate impact
High	4	High impact
Very High	5	Very high impact

Source : (Stamatis, 1995)

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Stage 5. Identify risk agents, which are factors that can cause the identified risk events to occur.

Stage 6. Identify risks based on major risks, then conduct further analysis based on the transmission of impactful risks in a table.

Stage 7. Identify the correlation between a risk event and risk agents. If a risk agent causes a risk to arise, then there is said to be a correlation. This correlation value is denoted by the notation Rij where: Rij ∈ {0,1}, for Rij = 1 there is a correlation between risk event I and risk agent j and Rij = 0 if the opposite is true. This correlation value also has a weight (w), where the greater the correlation between a risk agent and a risk event, the greater the value on the scale. This weight indicates the extent to which a risk agent causes a risk event to occur.

Table 2. Risk Event and Risk Cause Correlation Scale

Correlation Value	Criteria
0	No relationship between risk events and risk causes
1	Slight relationship between risk events and risk causes
3	Moderate relationship between risk events and risk causes
9	Strong relationship between risk events and risk causes

Source : (Nyoman Pujawan & Geraldin, 2009).

Stage 8. Identify the occurrence probability of a risk agent. This occurrence indicates the probability of a risk agent occurring, resulting in one or more risk events that could disrupt business processes with a certain level of impact. The scale used to determine the occurrence probability of a risk agent is 1-5.

Table 3. Qualitative Scale for Occurrence (Probability of Risk Agent Frequency)

Occurance	Level	Criteria
Very Low	1	Never occurs
Low	2	Rarely occurs, only under certain conditions
Moderate	3	Occurs under certain conditions

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High	4	Occurs frequently under all conditions
Very High	5	Always occurs under all conditions

Sumber : (Stamatis, 1995)

Stage 9. Calculation of the risk priority index (Pj) value, commonly known as ARP (Aggregate Risk Potential). This priority index will be used as a consideration in determining the priority of risk agents for which mitigation strategies need to be designed. The risk priority index (Pj) value of a risk agent is determined using the following formula: ARP = RPN (Risk Priority Number) x correlation weight between risk event agent j and risk cause agent i.

HOR Phase 2 (Risk Management Phase)

HOR Phase 2 focuses on managing the risks that have been identified and analyzed in HOR Phase 1.

The following are the steps in conducting analysis in HOR Phase 2.

Stage 1. Select agent numbers or risk sources with a high priority level.

Stage 2. Identify preventive actions that are considered relevant to prevent the risk source. One risk source can result in more than one mitigation action.

Stage 3. Then determine the relationship between the preventive action and each risk source. The values used to determine these relationships (E) are {0,1,3,9}, where 0 indicates no relationship, 1 indicates a low level of relationship, 3 indicates a moderate level of relationship, and 9 indicates a high level of relationship.

Stage 4. Calculate the total effectiveness of each action using:

$$TE = \sum ARP \times E$$

Stage 5. Assess the degree of difficulty (D) in performing each action. The degree of difficulty is represented by a scale. According to Pujawan and Geraldine (2009), the degree of difficulty is classified into three categories: low with a score of 3, moderate with a score of 4, and high with a score of 5.

Stage 6. Calculate the ratio between total effectiveness and difficulty using the formula:

$$ETD = TE / D$$

Stage 7. Prioritize each mitigation action, where the highest ETD value is the top priority.

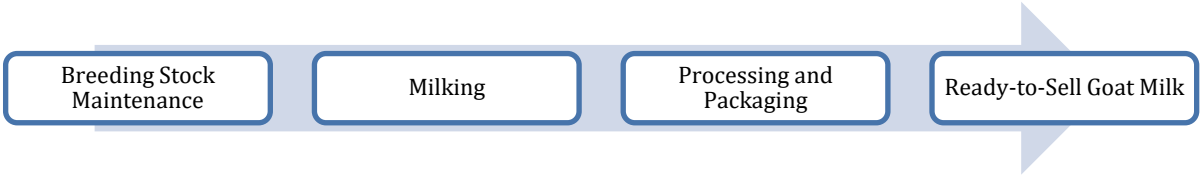
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RESEARCH AND RESULTS

Goat Milk Production Process at CV Abah Farm

The goat milk production process carried out at CV Abah Farm consists of three activities, including the maintenance of breeding stock, the milking process, and the processing and packaging of goat milk. Figure 1 shows the goat milk production process flow at CV Abah Farm.



Picture 1. Goat Milk Production Process Flow at CV Abah Farm

Risk Identification

The possible risks that arise are the result of the identification process. In this study, risk identification was carried out based on the Standard Operating Procedure (SOP) for dairy goat maintenance, goat milk milking, and goat milk processing and packaging carried out by CV Abah Farm.

Risk Identification in the Breeding Process

The risk identification process in breeding was carried out using an interview method based on the applicable SOP for breeding. The following are risk events in the breeding process.

Table 4. Risk Events in the Breeding Stock Maintenance Process

Code	Risk Event	Severity
E1	Sick goats	2,00
E2	Goats lacking minerals	2,00
E3	Disease contamination from goat feces	1,67
E4	Goats easily slip in the pen and suffer from hoof rot	1,00
E5	Goat milk produced has a 'sour' smell called '*prengus*'	1,00
E6	Goat udders are dirty, goats are prone to mastitis	2,00
E7	Milk that has been milked is prone to contamination from dirt and dust	1,33
E8	There are disease-carrying insects in the feeding area	1,33
E9	Goat milk production has decreased	2,67

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E10	Disease transmission to other goats	1,33
E11	Goat death	1,00
E12	Goat milk contaminated with odor from mothers with endometritis	1,67

Source : Primary Data

Based on Table 4, there were 12 risk events in the goat milk business conducted by CV Abah Farm. Risk events were assessed according to a predetermined scale, namely the level of severity caused; the higher the severity value, the greater the impact. The results of the study show that the risk event of a decline in goat milk production has the greatest impact on the maintenance process of the breeding stock. In line with the results of Annisa (2017) study, which states that the highest impact on the maintenance process of the breeding stock is a decline in goat milk production.

Based on the results of the study, it was found that risk factors included infrequent hair trimming around the udder of female goats, no hair trimming of the rear of female goats after giving birth, and disinfectant spraying only once every 1-3 months. Risk factor A7, namely infrequent hair trimming around the udder, can interfere with the milking process, especially during lactation, when hair falls out and gets into the milk that has been milked. In addition, if goat hair is not cleaned regularly, it can carry disease and contaminate the milk that has been milked. Risk factor A8, namely not shaving the hair on the back of female goats after giving birth, can cause blood residue from the birth to stick to the hair, which can cause an unpleasant odor that can give the milked goat's milk a “sour” smell. The next risk agent is disinfectant spraying, which is carried out once every 1-3 months (A10). Irregular disinfectant spraying can cause the pen to become unsterile and lead to the emergence of germs and diseases that can contaminate the goats' bodies.

Table 5. Risk Agents in the Maintenance Process of Breeding Stock

Code	Risk Agent	Occurence
A1	Inappropriate composition of forage feed	2,33
A2	Forage feed is provided in wet conditions	3,00
A3	Shortage of tofu pulp as supplementary feed	2,33
A4	Goats are not given water	4,00
A5	Irregular mineral supplementation	3,67
A6	Goats are bathed approximately once a month	4,33
A7	Rare hair trimming around the udder of female goats	5,00
A8	Hair on the back of female goats after giving birth is not trimmed	5,00
A9	Staff forget to trim female goats' hooves	2,00

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A10	Disinfectant spraying is done once every 1-3 months	5,00
A11	Only the outside of the pen is swept	1,00
A12	Feed residues are not cleaned up every day	1,00
A13	Lactation pens are adjacent to male pens	2,33
A14	Lack of observation of goats in heat	1,67
A15	Goat mating times do not comply with SOP	1,00
A16	No livestock data records	1,33
A17	There are goats that have not been mated for more than 7 months after giving birth	2,00
A18	Lack of medical personnel and pen attendants, resulting in suboptimal activities related to mother care, such as livestock sanitation, pen sanitation, animal reproduction, and especially observation and examination of goat health	1,00
A19	Barn staff delayed reporting a goat mother suffering from postpartum endometritis	2,00
A20	Delayed administration of medication when goats were sick	1,00

Source : Primary Data

Based on the results of the identification of risk events and risk agents, an assessment of the correlation between the agents and risk events was then carried out. The correlation values are contained in the Phase 1 HOR matrix and the Aggregate Potential Risk (ARP) value is calculated to determine the risk agents that are priorities for handling. The following are the results of the assessment of risk events and agents using Phase 1 HOR.

Based on the Phase 1 HOR Matrix in the breeding stock maintenance process (Table 6), the ranking of each agent is known. Visually, the priority risk agents are shown using a Pareto diagram. The priorities shown in the Pareto diagram will later become the basis for formulating a management strategy so that the risks that may occur can be properly addressed. This Pareto diagram illustrates a comparison with the 80/20 principle, meaning that 20 percent of the important parts of the problem account for 80 percent of the impact (Kristanto & Hariastuti, 2014)). The use of this Pareto diagram is expected to select risk agents that represent 80 percent of the impact of the occurrence of risk.

Risk Identification in the Milk Extraction Process

Based on the results of the identification in the milk extraction process, there are risk events with the highest severity value. A high severity value is considered to have a major impact on the company. Table 7 shows the severity value of each risk event in the milk extraction process. Table 7 shows that goats being uncomfortable during milking and

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unclear milk production and milk production data in the farm or ranch have the greatest impact on the company. The level of comfort of goats in the milk production process can affect milk productivity, so it is necessary to adjust the environment and create a comfortable atmosphere for goats during the milking process. Furthermore, unclear milk production data causes a lack of milk production data obtained in each milking process carried out.

Table 7. Risk Events in the Milk Extraction Process

Code	Risk Event	Severity
E13	Goat udders become dirty	1,00
E14	Goats are uncomfortable during milking and milk production	3,00
E15	Goats suffer from mastitis	2,00
E16	Suboptimal milk production	2,00
E17	Milk contamination	1,00
E18	Infection in the inner part of the udder	1,00
E19	Suboptimal milk production because the goat is uncomfortable during milking due to a sore or injured udder	1,67
E20	Milk spills onto the goat's feet	1,67
E21	Milk not filtered cleanly	1,00
E22	Milk spills more easily when transported in jars	1,00
E23	Milk outlet in udder is open, udder infected	1,67
E24	Milk production data at farm or ranch unclear	3,00

Source : Primary Data

Based on Table 8, the highest occurrence value of risk agents in the milking process is in the washing of equipment using only soap and rags used to bathe goats, as well as a lack of supervision from management in terms of record keeping. When washing equipment, attention must be paid to the method of washing and drying the various equipment used in the milking process. The washing process can affect the sterility level of the equipment used to minimize goat milk contamination. In addition, milk measurement is very important to determine the exact amount of milk produced in a day. This requires firmness on the part of the manager as well as supervision of the measurement and recording of the milk produced.

Table 8. Risk Agents in the Milk Extraction Process

Code	Risk Agent	Occurance
A21	Milking is carried out in dirty pens	1,67

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A22	Noisy and crowded environment	3,00
A23	Milking is only done once in the morning	1,00
A24	Equipment is only washed using soap and a cloth used to bathe goats	4,67
A25	Milking equipment is stored in a dusty pen	1,67
A26	Goat udders are not dipped (10% iodine)	1,00
A27	Milking staff milk in a rough manner	1,00
A28	No check is performed before milking goats with mastitis	1,00
A29	The filter used is not suitable	1,00
A30	Milk cans are dried using towels placed anywhere	1,00
A31	When there are no empty milk cans, milk is stored in large jars	1,00
A32	Workers are not skilled at pouring milk during filtering	1,00
A33	Udders are not dipped (in 10% iodine)	1,00
A34	Lack of supervision from management in terms of measuring milk that has been milked	1,67
A35	Lack of supervision from management in terms of record keeping	4,67

Source : Primary Data

Based on the results of the identification of risk events and risk agents, an assessment of the correlation between the agents and risk events was then carried out using the Phase 1 HOR matrix to determine the Aggregate Potential Risk (ARP) value for determining the risk agents that are a priority for handling. The following are the results of the assessment of risk events and agents using Phase 1 HOR in the milk extraction process.

Table 9. Phase 1 HOR Matrix in the Milking Process

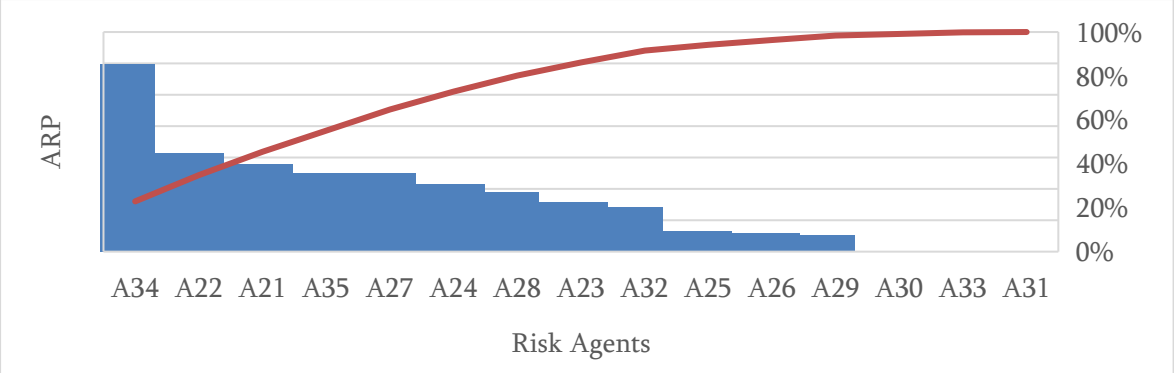
	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	A34	A35	Sj
E13	9				3	3								9		1,00
E14		9	9				9	9				9		9		3,00
E15	9		9	3	1	9	9	9					3	9		2,00
E16	3	9	9				9	9				1		9		2,00
E17	9			9	9	1	9	9	9	9	3	9		9		1,00
E18	3		1		3	3	9	9					3	9		1,00
E19	9	3	9				9					9		9		1,67
E20		1					9							9		1,67
E21	9			3	3				9			9		9		1,00
E22		1							9			9		9		1,00
E23	9			3		3	9	9						9		1,67
E24														9	9	3,00
Oj	1,67	3,00	1,00	4,67	1,67	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,67	4,67	
ARP	140,00	158,00	79,00	107,33	33,33	30,00	126,00	96,00	27,00	9,00	3,00	71,00	9,00	300,00	126,00	
Ranking	3	2	8	4	10	11	5	7	12	13	15	9	14	1	6	

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Based on Table 9, the ranking of each risk agent in relation to risk events can be determined. The priority of risk agents is illustrated in a Pareto chart, which forms the basis for formulating a risk management strategy to address potential risks. Figure 3 shows a Pareto chart for the milk extraction process.

Based on this Pareto diagram, the priority percentage of risk agents that need to be prioritized for handling can be determined. Risk agents with a percentage of ≤ 80% are risk agents that need to be prioritized for risk management strategies, namely six risk agents, namely A34, A22, A21, A35, A27, and A24.



Picture 3. Pareto Diagram of the Milk Extraction Process

Risk Identification in the Packaging and Distribution Process

The next identification was carried out on the packaging and distribution process of goat milk at CV Abah Farm. There were several risk events with the highest severity value, indicating the greatest impact on the packaging and distribution process. The following are the risk events in the packaging and distribution process.

Table 10. Risk Events in the Packaging and Distribution Process

Code	Risk Event	Severity
E25	No milk data for comparison before and after packaging	1,00
E26	Unclear milk data entering the cold room	1,00
E27	Milk contamination during packaging	1,00
E28	Milk spills when poured into packaging	2,00
E29	Milk that is not packaged in time is damaged and discarded	1,00
E30	Incomplete milk production data	4,00
E31	Loss of softcopy production data	5,00
E32	Leaking milk packaging	1,67

Source : Primary Data

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Based on Table 10, the highest severity value is shown in the loss of softcopy production data. Softcopy data is considered a risk event that will affect the packaging and distribution processes. With production data, companies can calculate and predict the goat milk production. In addition, this data can be used as a basis for packaging and distribution preparations.

Table 11. Risk Factors in the Packaging and Distribution Process

Code	Risk Agent	Occurance
A36	Milking staff only deliver milk every morning	1,00
A37	Milking staff do not fill out milk delivery notes because they do not measure the amount of milk after milking	5,00
A38	Refrigeration officers do not re-measure and record the amount of milk	1,00
A39	Production officers do not wear headgear, masks, and coats for production when packaging	5,00
A40	Milk is not filtered again before packaging	1,00
A41	Production workers were not competent when pouring milk	1,00
A42	Production workers made mistakes when using the packaging machine	2,00
A43	Production workers did not have time to package milk for up to a week	1,00
A44	Production workers did not measure and record packaged milk while the supervisor was on leave	1,00
A45	No backup production data for several years	5,00
A46	Machines are rarely cleaned	1,00
A47	Machines are damaged	1,33

Source : Primary Data

The risk factors presented in Table 11 show that milking operators do not fill out milk delivery notes because they do not measure the amount of milk after milking, even though milk delivery notes serve as records for comparing milk data after packaging. The next risk factor is that production officers do not wear headgear, masks, and coats during packaging, even though these items serve to prevent milk contamination by packaging officers. The last risk factor with the highest occurrence rate is the lack of backup production data for the past several years. Production data can be used as comparative data for the packaging and

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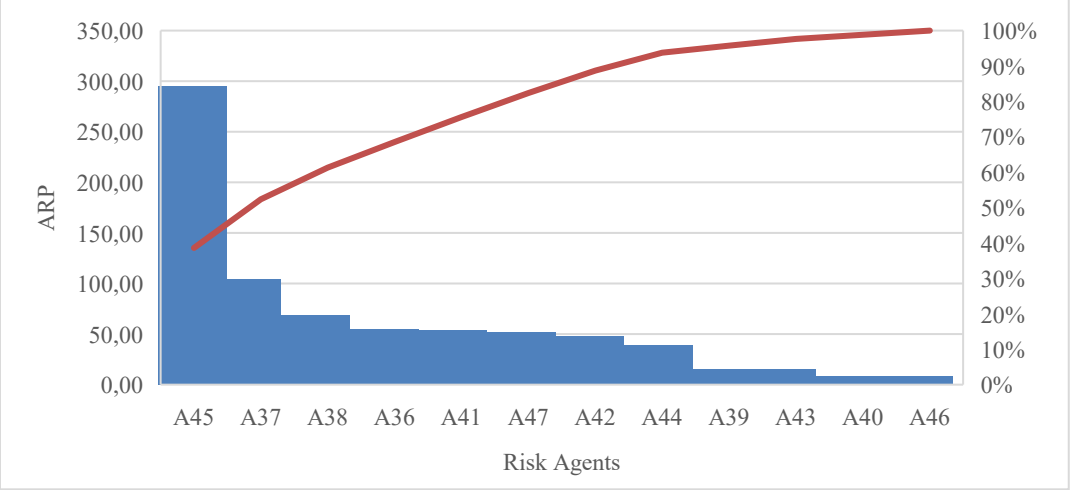
distribution processes that have been carried out during the course of the business. The correlation values generated using the HOR Phase 1 matrix for the packaging and distribution processes are presented in Table 12.

Table 12. Phase 1 HOR Matrix in the Packaging and Distribution Process

	A36	A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	Sj
E25	9	3	9			3		3	3	9			1,00
E26	9	9	9			9		3		9			1,00
E27	1			3	9	9	9	9			9	3	1,00
E28						9						9	2,00
E29												3	1,00
E30	9	3	9						9	9			4,00
E31		3	3							1			5,00
E32						9	9					9	1,67
OJ	1,00	5,00	1,00	5,00	1,00	1,00	2,00	1,00	1,00	5,00	1,00	1,33	
ARP	55,00	105,00	69,00	15,00	9,00	54,00	48,00	15,00	39,00	295,00	9,00	52,00	
Ranking	4	2	3	9	11	5	7	10	8	1	12	6	

Source : Primary Data

Based on Table 12, it shows the ranking of existing risk agents. Furthermore, to determine the priority risk agents, it is illustrated through a Pareto chart on the packaging and distribution process in Picture 4.



Source: Primary Data

Picture 4. Pareto Diagram of the Packaging and Distribution Process

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Based on the Pareto diagram, the priority percentage of risk agents that need to be prioritized for handling can be determined. Risk agents with a percentage of less than 80 percent are risk agents that need to be prioritized for risk management strategies, namely five risk agents, namely A45, A37, A38, A36, and A41.

House of Risk (HOR) Phase 2

The results of the identification and prioritization of risk agents in HOR Phase 1, which consists of parent maintenance, milking, packaging, and distribution activities, show that there are various alternative mitigation strategies that can be implemented. The determination of mitigation strategies is carried out in HOR Phase 2.

Risk Mitigation Strategies for Breeding Stock Maintenance Processes

Based on the results of identifying and prioritizing risk agents in breeding stock maintenance activities in HOR Phase 1, there are eight (8) risk agents that are prioritized for risk management strategies. Table 13 below shows the risk mitigation strategies for parent maintenance activities.

This stage is included in HOR 2 (House of Risk Phase 2). At this stage, the identification of management actions that are considered appropriate to reduce the identified priority risk agents will be carried out. Table 13 shows the mitigation strategies or proactive actions (PA) that can be implemented. Next, an in-depth discussion with the respondents will be conducted.

Table 13. Risk Mitigation Strategies in the Maintenance Process of Breeding Stock

Code	Proactive Action (PA)
PA1	Routinely shave the rear hair of female goats and after giving birth
PA2	Bathe goats routinely once a month
PA3	Adjust the composition of high-protein green feed such as teresede leaves, calliandra leaves, and elephant grass.
PA4	Spray disinfectant in the pen every 3 months
PA5	Sweep the outside and inside of the pen after feeding, then dispose of feed residues in a special disposal area.
PA6	Monitor the administration of 200 grams of minerals per goat every month
PA7	Provide training to pen staff on livestock sanitation, pen sanitation, goat health checks, and routine treatment of sick goats.
PA8	All types of green feed are provided in a dry, fresh condition.

Source: Primary Data

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The next step in HOR Phase 2 is to prioritize mitigation strategies based on their effectiveness and the level of difficulty in implementing them. Table 14 below shows the HOR Phase 2 matrix according to risk agent priorities.

Table 14. HOR Matrix Phase 2 of Breeding Stock Maintenance Process

	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	ARP
A8	1						1		441,67
A6		3					3		213,78
A1			9			1	3	1	184,33
A10				3			1		180,00
A11				1	9				112,00
A5			3			3	1	1	77,00
A18	3	1	1			3	9		75,76
A2			1				1	3	75,00
TE	668,95	717,10	2040,73	652,00	1008,00	642,61	2649,84	486,33	
Dk	1,00	1,00	1,67	2,33	1,00	2,33	2,67	1,00	
ETD	668,95	717,10	1224,44	279,43	1008,00	275,40	993,69	486,33	
Rank	5	4	1	7	2	8	3	6	

Source: Primary Data

Based on Table 14, it can be seen that the priority risk management strategy, as indicated by the ranking of mitigation strategies, is to adjust the composition of high-protein green feed, such as teresede leaves, calliandra leaves, and elephant grass. Currently, goats at CV. Abah Farm are usually fed whatever forage is available in nature, without regard to its protein or nutritional content. In fact, protein is very important for growth as the main raw material for cell formation. In addition, protein is also very important for milk production and milk quality, such as milk protein content. Protein intake through feed should be neither excessive nor insufficient. If intake is insufficient, livestock growth will be suboptimal in terms of metabolic processes in the livestock's body, and conversely, if intake is excessive, it will be wasted. Therefore, the mitigation strategy that is a top priority at the research site for breeding stock maintenance is to regulate the composition of high-protein green fodder.

Risk Mitigation Strategy for Milk Extraction Process

Based on the results of identifying and prioritizing risk agents in milk extraction activities in HOR Phase 1, there are seven risk agents that are prioritized in the risk management strategy. Table 15 below shows the risk mitigation strategy for the

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maintenance of breeding stock. This stage is included in HOR 2 (house of risk 2). At this stage, the identification of appropriate actions to reduce the identified priority risk agents will be carried out. Table 15 shows the mitigation strategy or proactive action (PA) that can be taken.

Table 15. Risk Mitigation Strategies in the Milk Extraction Process

Code	Proactive Action (PA)
PA9	Supervision of the implementation of goat milk extraction SOPs by supervisors.
PA10	Create an ideal barn, i.e., an area located far from residential areas but easily accessible by vehicle.
PA11	Create a special place for milking.
PA12	Officers record the actual amount of milk milked.
PA13	Provide training to officers on the proper and correct procedures for milking.
PA14	Using separate tools and cloths for each piece of equipment used during and after milking.
PA15	Staff checking the health of goats with mastitis by examining the udder (hardness), udder color, body temperature, and the goat's response when the udder is touched, before milking.

Source: Primary Data

The next step in HOR Phase 2 is to prioritize mitigation strategies based on their effectiveness and the level of difficulty in implementing them. Table 16 below shows the HOR Phase 2 matrix according to the priority of risk agents in the milk extraction process.

Tabel 16. HOR Matrix Phase 2 Milk Extraction Process

	PA9	PA10	PA11	PA12	PA13	PA14	PA15	ARP
A34	1							300,00
A22		9						158,00
A21			3		1			140,00
A35	9			3				126,00
A27			1		9		1	126,00
A24					1	9		107,33
A28	1				3		3	96,00
TE	1530,00	1422,00	546,00	378,00	1669,33	965,97	414,00	
Dk	1,00	3,67	3,67	1,33	1,33	1,33	1,33	
ETD	1530,0	387,8	148,9	283,5	1252,0	724,5	310,5	
Rank	1	4	7	6	2	3	5	

Source: Primary Data

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Based on Table 16, it can be seen that the priority risk management strategy, based on the ranking of mitigation strategies, is supervision of the implementation of goat milk extraction SOPs by supervisors. Goat milk is obtained through the milking of goats. A good milking process can produce good milk, and conversely, if milking is done roughly and unhygienically, it will risk causing mastitis (inflammation of the udder), which can reduce the quality and quantity of goat milk production. CV. Abah Farm already has its own milking SOP, but it has not been optimally implemented by barn staff. Therefore, supervision of the implementation of the goat milk milking SOP by supervisors is necessary to maintain the quality of the milk produced.

Risk Mitigation Strategy for Milk Packaging and Distribution Processes

Based on the results of identifying and prioritizing risk agents in parent maintenance activities in HOR Phase 1, there are five risk agents that are prioritized in the risk management strategy. Table 18 shows the risk mitigation strategy for milk packaging and distribution activities. This stage is included in HOR 2 (house of risk 2). At this stage, the identification of appropriate actions to reduce the identified priority risk agents will be carried out. Table 17 shows the mitigation strategies or proactive actions (PA) that can be taken.

Table 17. Risk Mitigation Strategies in the Milk Packaging and Distribution Process

Code	Proactive Action (PA)
PA16	Back up goat milk production data in a separate logbook and store soft copies of the data on a computer or email.
PA17	Milking staff are given a special delivery note and record the amount of milk that has been milked.
PA18	Count and record the amount of milk that goes into the refrigerator.
PA19	Milking staff deliver the milk directly to the packaging staff immediately after milking.
PA20	Train packaging staff in the hygienic, proper, and correct procedures for packaging goat milk.

Source: Primary Data

The next step in HOR Phase 2 is to prioritize mitigation strategies based on their effectiveness and the level of difficulty in implementing them. Table 18 below shows the HOR Phase 2 matrix according to risk agent priorities.

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Table 18. HOR Phase 2 Matrix for Milk Packaging and Distribution Process

	PA16	PA17	PA18	PA19	PA20	ARP
A45	9	1		1		295
A37	3	9		1		105
A38			9		1	69
A36				9		55
A41					9	54
TE	2970,00	1240,00	621,00	895,00	555,00	
Dk	2,67	1,67	1,00	1,00	1,00	
ETD	1113,80	744,00	621,00	895,00	555,00	
Rank	1	3	4	2	5	

Source: Primary Data

Based on Table 18, it can be seen that the priority risk management strategy is based on the ranking of mitigation strategies, namely that milkers are given a special delivery note and record the amount of milk that has been milked. Currently, milk delivery from the barn to the packaging facility is only done verbally without any written documentation. Filling out the milk delivery note is an important task that must be done, with the aim of knowing the amount of milk brought from the farm (Ranadheera et al., 2019). This note can be used as comparative data for milk before and after packaging.

CONCLUSION AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the causes and effects of goat milk production risks at CV Abah Farm consist of the breeding process, milking process, and packaging and distribution process. Mapping the risks of goat milk production at CV Abah Farm in the breeding process, there are five activities that are the causes or agents of goat milk production risks at CV Abah Farm, including feeding, animal sanitation, barn sanitation, livestock reproduction, and livestock health. Furthermore, in the goat milk milking process, there are five activities that cause or pose risks, namely the milking place (pen), determining the intensity and time of milking, milking preparation, the method of milking, and the completion of milking. In the milk completion and packaging activities, there are two activities that cause or pose risks, namely the delivery stage and the goat milk packaging stage.

There are several mitigation strategies that CV Abah Farm can implement, including, in the breeding process, the main mitigation strategy is to adjust the composition of high-protein green feed such as teresede leaves, calliandra leaves, and elephant grass (PA3). Furthermore, in the milk milking process, the main mitigation strategy is to supervise the

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implementation of the goat milk milking SOP by the supervisor (PA9). In the milk packaging and distribution process, the main mitigation strategy is to store backup data on goat milk production in a separate notebook or to store soft files of the data on a computer or email (PA16).

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