

Risk identification of supply chain system in coffee processor: A case of Indonesia

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ABSTRACT

Coffee is among Indonesia's top agricultural commodities, contributing US\$ 1,136 million in export revenue, with 15.88% (68,916 tons) of the total production coming from East Java (Indonesian Central Bureau of Statistics, 2022). Coffee processors face many uncertain conditions in the supply chain, such as post harvest loss, quality damage during logistic and processing, and a non-standardized processes condition which are commonly referred to as risks. Risk management is important in any business process to optimize, monitor, evaluate and maintain the continuity of business strategy and resources. This research aims to analyze and mitigate risks in the coffee processor's supply chain system. HOR is one of the tools used to identify, analyze, and mitigate risks in activities. Aggregate Risk Potential (ARP) score of HOR can determine the correlation strength between the risk occurrences and severity. Moreover, once the brainstorming process was done to find the way to mitigate the risk, Effective to difficulty (ETD) score reflects the correlation between the effectivity of mitigation idea and its difficulty to be implemented. Therefore, the risk will be able to be mitigated in an effective and efficient ways. This study have found that the risk agents have significant relationship with the 28 listed risk events. Although, these risks agents are able to be mitigated by 10 approach of mitigation strategies which is effective and less difficult.

Key words: Agroindustry; cost efficiency; HOR; risk management; integrated supply chain.

1 INTRODUCTION

Coffee is one of Indonesia's leading agricultural products, generating US\$ 1,136 Million in export revenue, with 15.88% (68,916 tons) of production originating from East Java (Indonesian Central Bureau of Statistics, 2022). There are four types of coffee cultivated in Indonesia namely Arabica, Robusta, Liberica, and Excelsa. Arabica is the most cultivated type of coffee in Bondowoso, one of the largest coffee-producing regions in East Java, due to its superior taste and higher market value (Rahardjo, 2017). Arabica is cultivated at elevations ranging from 700 to 1700 meters above sea level. Arabica plant has a weakness to HV (*Hemileiavastatrix*) disease. There are some methods of coffee processing, such as dry, wet, and half-wet method (Mulato; Widyotomo; Sharyanto, 2006). However, most Arabica coffee processors in Indonesia use a wet method which starts from sortation, cleaning, pulping, fermentation, cleaning post-fermentation, drying, hulling, final sortation, and inventory (Najiyanti; Danarti, 2006).

East Java province as a large production of coffee in Indonesia, particularly Bondowoso district which is symbolically known as the greatest coffee producer produced 10,420 tons (Indonesian Central Bureau of Statistics, 2022). Bondowoso coffee has its original name Java IjenRaung Coffee. Bondowoso coffee processors involved many entities on the supply chain to support the business process such as farmers, collectors, processors, retailers, and customers. To deliver the best products and services, they must understand customers' demands in terms of quality, quantity, price, and time. However,

the Bondowoso coffee processor has faced many uncertain conditions within the supply chain which are commonly known as risks. The quality issue that has affected Bondowoso Coffee Processor is the shelf life of the inventory goods which is only 6 months (Selmor; Bytof; Knopp, 2008). Where Bondowoso Coffee Processor used to keep the product in inventory for more than 6 months. Moreover, it has been reported for the past 3 years the extensification increase does not align with the yields. In this case, those are caused by the disability of industry risk management on the farm and processor chain. While, risk management is very important in any business process to optimize, monitor, evaluate, and maintain the sustainability of business strategy and resources (Ennouri, 2013).

Those risks are considered to be mitigated through integrated supply chain risk management to prevent the risk happens in the future. Supply chain risk is determined as an exposure to the activities (inadequate forecasting and planning, inventory management problems, technology failures, transportation and logistics issues) that cause disruption and influence the efficiency of the supply chain (Ghadge; Dani; Kalawsky, 2012). Deficiency of information within the supply chain will complicate the risk management in terms of prediction, which is why supply chain risk management must be done as a form of risk handling strategy within the organization to prevent worse cases happening (Vorst; Beulens, 2002; Williams; Lueg; LeMay, 2008). Based on ISO:31000 (Queensland Government, 2011) there are 3 main steps in the risk management approach, risk identification, risk analysis,

and risk evaluation. The final step of risk management is risk treatment which must be well considered. Specifically, risk identification involves breaking down the process to identify the sources of risk. Risk analysis then shows the type of risk whether it is included in short or long-term risk. The risk then being evaluated and reconsidered as to what are treatment will be approachable to solve the uncertainty. In the end project performance scenario is where the industry picks the strategy with the safest consequences. Boeing, Cisco, and Pfizer are some industries that fail in risk management (Hult; Craighead; Ketchen, 2010). Boeing as an airplane manufacturing company had a US\$ 2 billion loss caused by the impact of failed risk management, while Cisco as a telecommunication company had a US\$ 2,5 billion loss, and Pfizer as a medicine manufacturing company had a US\$ 2,8 billion loss. This is proof that risk management is very important to a company to manage the efficiency and effectiveness of business processes.

So that, there are many alternatives to manage risks during business process. One of a kind is House of Risks (HOR). HOR is a tool of risk which started from risk identification to risk mitigation (Tama; Eunike; Hamdala, 2019). Basically, HOR has 2 phases. First, risk identification aims to define the Aggregate Risk Potential (ARP) from the relation of risk agent and probability which calculated quantitatively. Second phase aims to prioritize risk mitigation to solve the risk agent based on its. In this phase the treatment will be considered based on its difficulty and effectivity. Most of the time, HOR collaborated with SCOR to depict the supply chain. SCOR depicted five basic activities on the supply chain, plan, source, make, delivery, and return. Those will describe what are activities and who's involved within the commodity supply chain. This method will prioritize which are the risks shows the most severe and occur, as well as the correlation. At the end of the day, HOR method will produce all risks preventive action which has the greatest

correlation to the risks and lowest difficulties to be approached. This research aims to identify, analyze, and mitigate risk which exist in Bondowoso Arabica Coffee processor supply chain system using HOR method.

2 MATERIAL AND METHODS

This research involved both qualitative and quantitative data processing. Qualitative data was obtained from observation process and interview with experts related to the business and understand what the risks are, while the quantitative is the conversion of quality data to scale. In specific, HOR in Bondowoso Arabica Coffee processor depicted by the flow process below (Figure 1).

The process starts with observing supply chain activities to identify the risks that appear in each process. Next, is where the identification and analysis process happen with the help of risk agent and probability data to calculate the ARP score as formulated and depicted below equation 1 (Tama; Eunike; Hamdala, 2019).

$$ARP_j = O_i \sum S_i R_{ij} \quad (1)$$

Where:

O_j : The occurrence score for risk agent O_i

S_i : The severity level of risk event S_i

R_{ij} : The correlation between risk agent j and risk event R_{ij}

ARP score will define the level of risk agent must be prioritized to be mitigated in the future. Then, brainstorming will be needed to decide what are actions or treatments (PA_k) appropriate to prevent the risks.

The treatments/strategy which considered to mitigate the risk agent will be evaluated whether it is correlated to the prioritized risk agent or no through Total Effectiveness score equation 2 (Tama; Eunike; Hamdala, 2019).

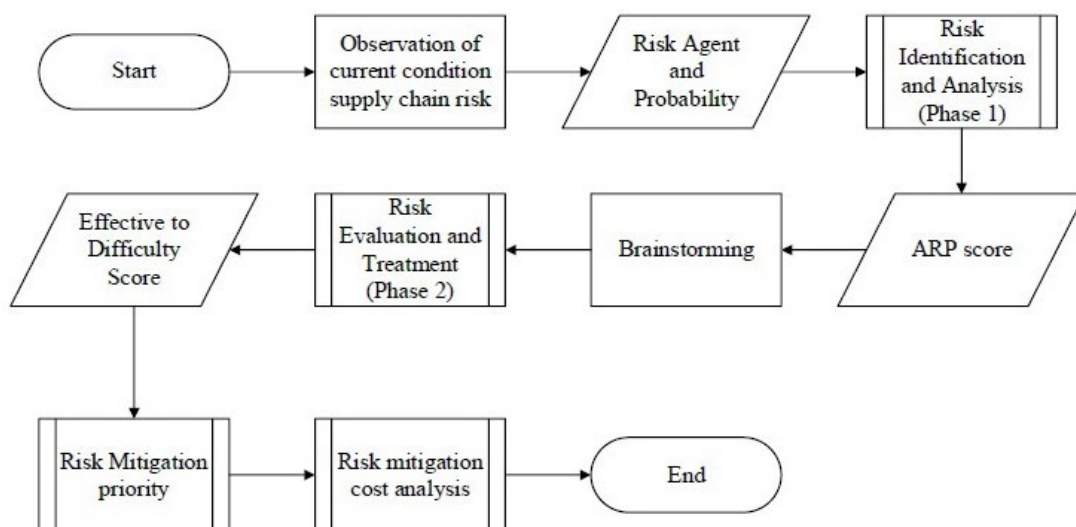


Figure 1: Risk management process.

$$TE_k = \sum ARP_{j-k}$$

Where:

TE_k : Total Effectiveness

ARP_j : ARP score based on A_i risk agent.

E_{j-k} : Risk correlation score E_j with PA_k strategy.

However The strategy with the highest score is not yet the final decision. One of the advantages HOR method offers is to apply the best practice risk mitigation. That is why the risk mitigation will be leveled by its Effectiveness to Difficulties (ETD) score with the following formulation. The highest ETD score will be prioritized as the best strategy to be applied equation 3 (Tama; Eunike; Hamdala, 2019).

$$ETD_k = TE_k / D_k$$

Where:

ETD_k : Ratio score ETD of PA_k strategy.

TE_k : Total Effectiveness score of PA_k strategy.

D_k : The difficulties level score of PA_k strategy.

3 RESULT

3.1 Supply Chain of Coffee Processor

There are three entities involved in Bondowoso Arabica Coffee Processor: Coffee Farmer, Arabica Coffee Processor, and

(2) Distributor/Retail. Those three entities have their own function (plan, source, make, deliver, return). The function of coffee commodity supply chain is showed in the figure below (Figure 2).

Figure 2 explained that farmer make plan of planting, cultivation, and harvesting delivery plan. Most of the times, farmer would stock fertilizer and coffee seed at their inventory before planting time come. Then, they stock the harvest yield at their warehouse. The arabica coffee processor who have their own land, they will immediately process the coffee fruit. For farmers who supply their coffee to large coffee processors, there is a provision allowing customers to return the coffee if it does not meet quality standards. However, it may bring up higher risk to coffee quality.

(3) 3.2 Risk Identification and Analysis (HOR Phase 1)

Risk identification is being done in the first place before the analysis is started. It started with identifying the process risk from SCOR component (Plan, Source, Make, Deliver, Return) (Tama; Eunike; Hamdala, 2019). Through this stage, it is found that there are 59 risks exist in Bondowoso Arabica Coffee Processor. From those risk event, it is analyzed there are 28 risk agents. It is all listed in the table below (Table 1).

Once the risk event and agent have identified, then score the strength of relation between risk event and risk agent (ARP). The scoring and calculation result is visualized in Pareto chart (Figure 3).

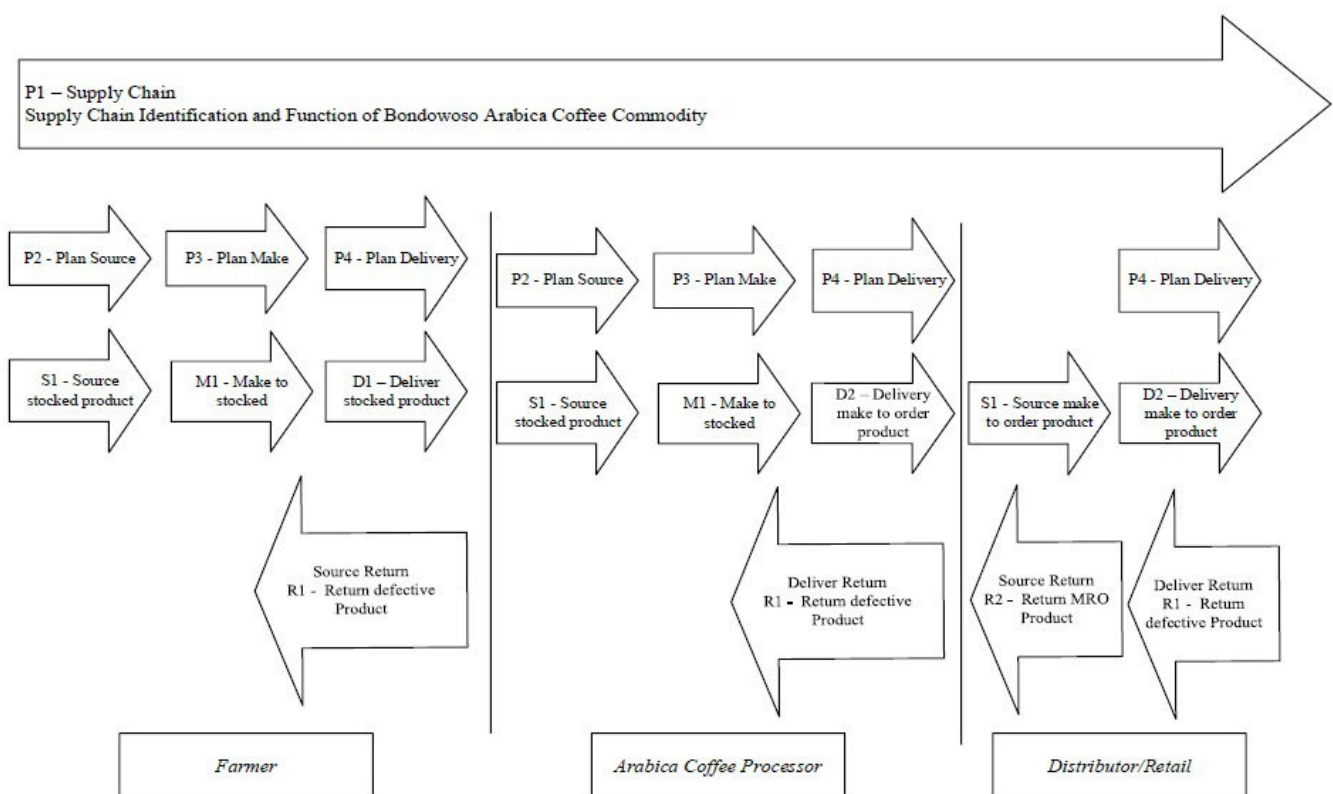


Figure 2: Supply chain of arabica coffee processor.

Table 1: Risk agent analysis.

No.	Risk Agent
A1	Worker less initiative
A2	Low of farmer and processor competence
A3	Human error during process
A4	Administration system is not proper
A5	Less communication with farmer
A6	Transportation facility is not proper
A7	Production facility is not proper
A8	Tough access to the farm
A9	Production time does not meet the target
A10	Internal communication is not proper
A11	Workers do not use personal protective equipment
A12	Packaging availability
A13	Dependent condition to packaging supplier
A14	Non-proper communication with packaging supplier
A15	Less communication with customer
A16	Unplanned cultivation maintenance
A17	Unplanned preventive tool/machine maintenance
A18	Inadequate production preparation
A19	No inspection in coffee receiving
A20	No inspection during packing
A21	Busy traffic during delivery
A22	Transportation tools is less maintained
A23	Building condition is not well
A24	Expired product
A25	Damaged product packaging
A26	Parasite involvement
A27	Disobeyed standard operating procedure
A28	Product quality does not meet the standard

Based on the Pareto chart, take the top 5 risk agents which have strongest correlation with risk event to focus on the mitigation. Here the result of ARP calculation (Table 2).

Based on the result, it is proven that Bondowoso Arabica coffee processor mention that they never do a preventive maintenance with production tools and machine. As example the broken washing container which impacting the process because the fruit keep falling away from the container and the pulper machine shuts down suddenly during production. From these incidents, generally we can define the losses such as production time, and defected product which on process. It implicates to un-achieved production quantity, quality, and time target.

3.3 Risk Evaluation and Mitigation (HOR Phase 2)

Brainstorming is the first stage for HOR phase 2. For each risk agent, there must be a strategy to mitigate its occurrence. It is done by discussion with experts (representative of Indonesian coffee and cacao research center) and Bondowoso Arabica coffee processor owner. After brainstorming is done, then score the relation strength to get which are mitigate action effective to solve risk agents within the supply chain. The calculation result which shows the 10 top mitigation is listed in the table below (Table 3).

Based on Table 3, there are 10 priority mitigation strategy. Those mitigation have a strong effectivity value to mitigate risk agents.

3.4 Risk Mitigation Cost

Based on the mitigation strategy discussed above, the cost must be spent will be explained below (Table 4).

Risk mitigation costs are details of the costs required to realize the mitigation plan and recommendations from the result of efficiency analysis.

**Figure 3:** ARP pareto chart.

Table 2: Risk Agent Analysis.

Risk Agent	Rank	Skor ARP	Cumulative (%)
Unplanned preventive tool/machine maintenance	1	2790	7,8
No inspection in coffee receiving	2	2432	6,8
Workers do not use personal protective equipment	3	2325	6,5
Unplanned cultivation maintenance	4	2045	5,7
Inadequate production preparation	5	1980	5,5

Table 3: Mitigation strategy priority.

Rank	Mitigation Code	ETD SCORE	Mitigation Strategy
1	PA 4	23000	Provide PPE for operator
2	PA 8	18072	Use pest trap during cultivation
3	PA 10	16787	Perform briefing before production start
4	PA 9	16456	Set up time prior production
5	PA 5	15408	Establish and apply machine operation SOP
6	PA 12	14626	Tighten supervision during production
7	PA 2	14054	Perform inspection prior coffee receiving
8	PA 17	14021	Perform inspection prior packaging receiving
9	PA 1	13409	Perform preventive machine maintenance and replace the broken tools
10	PA 15	12944	Perform preventive transportation vehicle

Table 4: Risk mitigation cost.

No.	Recommendation	Cost
1.	Machine maintenance/year	Rp200.000 (US\$ 13.41)
2.	Pest trap	Rp150.000 (US\$ 10.06)
3.	Establish SOP	Rp100.000 (US\$ 6.71)
4.	Personal protective equipment	Rp200.000 (US\$ 13.41)
5.	Transportation maintenance/year	Rp300.000 (US\$ 20.11)
Total Cost		Rp950.000 (US\$ 63.71)

Note: US\$ 1 = Rp14,500.

4 DISCUSSION

4.1 Supply Chain of Bondowoso Coffee Processor

Other than that, Bondowoso Arabica Coffee Processor plays an important role to transform/process the coffee fruit to

green bean. Most Bondowoso Arabica coffee processors create a plan for sourcing raw materials, optimizing processing, and determining the best distribution strategy to minimize sales risks. In this case, Arabica Coffee Processor get their material from their own cultivation, therefore it is already stocked in their raw material inventory. They also produce the product to stock since they must process all the material they have earned. Green bean as their product will be delivered once they have order from customer. Therefore, it may bring up the inventory risk if they do not have proper selling plan and strategy. Moreover, they also let the customer return the product only if the product customers receive is defected during delivery.

Finally, the distributor, as a customer of the coffee processor, will distribute the coffee or the retailer will display the coffee product on its behalf. Most of the customers are coffee shop owners who process the coffee and coffee resellers. They usually have a plan of who they are going to deliver to, as they deliver based on the customer's order. Distributors tend to avoid inventory risk, so they only receive their material based on the order. Distributors also provide a product guarantee to the customer only if the product is defective during delivery or requires repair related to packaging.

The supply chain requires good communication, otherwise it will create problems within the supply chain and make the process unsmooth. Ikhwana (2018) states that for the coffee commodity supply chain to be effective, each unit in the supply chain must be interdependent and able to provide accurate information. Torres and Ortiz (2014) dan Wu and Hsu (2014) also mentioned that factors that affect the smoothness of the supply chain flow are the ability of the entities to share necessary information and work together.

4.2 Risk Identification and Analysis (HOR Phase 1)

The study identified unplanned preventive maintenance, lack of inspections, and inadequate production preparation as the most critical risk factors impacting the Bondowoso Arabica coffee supply chain. Inspection during receiving process plays an important rule to ensure the quality of incoming Arabica Coffee. So far, Arabica coffee processor never inspect the quality of coffee they receive. The result is wasted effort in producing high-quality products, as the end product will inevitably fall short of the desired standards. Moreover, the poor quality of the raw material requires special treatment which might affect the time efficiency and not worth the price.

Otherwise, the use of PPE (Personal Protective Equipment) must be applied to ensure the safety of the operator. Any work that lacks safety will bring up the risk of work accident. Work accidents also cost money and are harmful to the operator. In addition to safety, PPE can reduce the risk of hygiene exposure. Ahmad, Abokhashabah and Rehan (2019) mention that the use of PPE is a preventive way to maintain product quality, reduce the risk of exposure to unexpected

microorganisms and is part of safety requirements. In addition, ensuring product hygiene during COVID-19 will bring more value.

It is not only the risk within the factory that affects the quality of the product, but also what happens during cultivation. There are several risks, including climate and disaster uncertainties, as well as issues related to farmer competence. All cultivation risks will affect the continuity of production. Some of them said that their land has high fertility rate. However, Winarni et al. (2013) stated that fertilizer can accelerate the cultivation process. The more quantity of good quality coffee is produced, the lower the price will be set. As the production cost will also be optimal and continuous.

The last risk factor that has a strong relationship with the risk event is inadequate production preparation. Based on the process observation, Bondowoso Arabica Coffee Processor start to set up the production when the coffee fruit is received which cause delay to next process after receiving. As the set-up is done to ensure that the production process goes smoothly, therefore the set-up process should be done properly before receiving. Allahverdi and Soroush (2006) mentioned that set up time has a crucial role in current production as well as the service environment that can be delivered effectively and efficiently to consumers.

These findings highlight a common challenge in agricultural supply chains: the need for systematic risk management practices to prevent operational disruptions. The Bondowoso case study illustrates how relatively simple interventions, like regular maintenance and improved worker safety protocols, can significantly enhance supply chain resilience. The proposed mitigation strategies, such as the use of personal protective equipment (PPE) and preventive maintenance, showed high effectiveness with relatively low implementation difficulty.

4.3 Risk Evaluation and Mitigation (HOR Phase 2)

The priority is aligned with the safety program that Bondowoso Arabica Coffee Processors have not applied. Currently the safety equipment they have used is the equipment related to work that requires sharp tools and during cultivation (boot). However, it is a mandatory for food industry to produce safe and hygienic product. Dharani, Prabhakaran and Thirumarimurugan (2015) mentioned that commonly used PPE must cover eyes, mouth, hands and legs such as face shield, mask and appropriate gloves. It aims to prevent the transmission of diseases between the operator and the client or customers (Ismail et al., 2016; Aarnisalo et al., 2006).

In addition to the use of PPE, the use of pest traps is also critical to the growing process. Especially reusable pest trap which is easy to make. Sugiarti (2019) mentioned that there is a view of pests affecting coffee cultivation such as *Coccus viridis*, *Planococcus*, *Hemileia vastatrix*, *Capnodium* and

Cercosporacoffeicola. The use of bottle pest traps was claimed to be able to prevent pest infestation, preventative pruning to reduce humidity, burning or burying infested leaves, ensuring farm cleanliness, and using the correct pesticide. Harni et al. (2015) proved that the use of bottle pest trap covered with red paint and spray organic pesticide made from *Azadirachta indica*, *Tephrosia* sp. *Derris elliptica*, *Nicotiana tabacum* or *Ageratum conyzoides* material.

Briefing plays an important role in the production process. Previously, briefing was only done 2 days before harvesting for the harvesting process, but not for the handling afterwards. However, it is important that the briefing is done immediately before the start of the process in order to refresh the work. Prodea et al. (2019) even mentioned that briefing has a great impact on the productivity of the operator/worker. When briefing has become a cultural habit, workers will automatically work more effectively and efficiently (Sagita; Susilo; Cahyo, 2018). In addition to briefing, set-up time is also significant. Esa, Rahman and Jamaludin (2015) proved that short and planned set up time could increase industrial productivity.

There are other ways to develop productivity by creating an effective and efficient process. One of them is to establish and implement SOP for each job during production. It aims to avoid human errors that occur due to the incompetence of the operator and work accidents (Amare, 2012). Hongdiyanto (2017) adds that it is important to establish and implement SOP to improve the effectiveness of production, through the understanding of the operator about the work for each stage of production. Moreover, if it is supported by strict supervision. Pasigai, Asdar and Mayanti (2017) said that supervision during production is necessary to ensure that the production process goes smoothly and the best quality is produced. Therefore, supervision should be tight to reduce the probability of damage to machinery, human resources, natural resources and work environment (Sihombing; Sumartini, 2017). Sihombing and Sumartini (2017) provide evidence that through tight supervision, quality costs are reduced.

In addition to close monitoring, process inspection is also critical. Until now, the inspection process has only been carried out during the fermentation and drying processes. However, we know that the supervision must fully approach the whole production process from harvesting to packing to achieve maximum result of product quality and process. Raw material inspection has a strong influence on product quality and become the competitiveness of the company to continue to grow (Reepu, 2017). In addition, there are few things to pay attention to that can affect the inspection process such as the competence of labour, machine capability and effective inspection procedure (Ngadiman et al., 2017).

The last step to be taken is the preventive maintenance of the production machine and the logistic transport. The

machine was never checked. The machine is only repaired when it breaks down or stops working. In this case, the possibility of machine breakdown during production is unpredictable and can affect the effectiveness and efficiency of the production process. Mushavhanamadi and Selowa (2018) emphasised that machine maintenance should not be a burden for the company, but should become a routine investment to maintain production performance and improve competitiveness. Not only the production machine, but also the logistics equipment must be properly maintained. Tseng, Yue and Taylor (2005) found that an effective logistics strategy will not be realised if it is not balanced by a means of transport that supports it. Therefore, machine and transport maintenance must be carried out.

4.4 Risk Mitigation Cost

The recommendations have been discussed with related coffee processors and it is applicable. In terms of recommendation cost accumulation, it shows that the biggest cost comes from the transport maintenance of US\$ 20.11. In total, the required recommendation cost or risk reduction cost is US\$ 63.71 (Table 4).

In terms of maintenance costs, recommendations for maintenance of tools and machinery were also considered for the coffee processing unit. Maintenance facilities and transport equipment were still important to maintain product quality. Transportation equipment was used more frequently (6 times per year) by farmers in processing activities as a matter of routine. Production machinery needs to be maintained every 2 months per year to prevent damage when the machine is not used in the processing activity. For coffee processors and farmers in Bondowoso, adopting the recommended risk mitigation strategies could lead to more consistent product quality and reduce losses due to operational inefficiencies. Policymakers might also consider supporting these efforts through training programs and incentives for adopting best practices in risk management.

5 CONCLUSIONS

In conclusion, inadequate management, including planning, preparation, and oversight at every level, can lead to an increased occurrence of risks. Therefore, adopting effective and tailored approaches is essential to mitigate the underlying causes of these supply chain risks. By addressing these management gaps, stakeholders can enhance the resilience of the supply chain, ensuring better risk prevention and overall stability in the industry. These recommendations can also be applied to any agroindustry that shares similar supply chain characteristics.

While this study provides valuable insights, it is limited to the Bondowoso region and the Arabica coffee supply

chain. For future research, it would be valuable to conduct a comparative analysis of risk management strategies across different regions and scales of coffee production. Investigating how specific factors, such as local climate conditions, market dynamics, and technological advancements, influence the effectiveness of these strategies could provide deeper insights. Additionally, exploring the role of sustainability practices in mitigating risks within the coffee supply chain would offer a more comprehensive understanding of long-term resilience.

6 AUTHORS' CONTRIBUTION

Conceptual Idea: Suryaningrat, I.B.; Hap Sari, S.S.E.; Methodology design: Suryaningrat, I.B.; Data collection: Suryaningrat, I.B.; Hap Sari, S.S.E.; Data analysis and interpretation: Suryaningrat, I.B.; Hap Sari, S.S.E., and Writing and editing: Hap Sari, S.S.E.

7 REFERENCES

- AARNISALO, T. et al. The hygienic working practises of maintenance personnel and equipment hygiene in the finnish food industry. **Food Control**, 17(12):1001-1011, 2006.
- AHMAD, B.; ABOKHASHABAH, I.; REHAN. Assessment of personal protective equipment use and occupational exposures in small industries in Jeddah: Health implications for workers. **Saudi Journal of Biological Sciences**, 26(4): 653-659, 2019.
- ALLAHVERDI, A.; SOROUGH. The significance of reducing setup times/setup costs. **European Journal of Operational Research**, 187:978-984, 2008.
- AMARE, G. Reviewing the values of a standard operating procedure. **Ethiopian Journal Health Science**, 22(3):205-208, 2012.
- DHARANI, S.; PRABHAKARAN; THIRUMARIMURUGAN, M. A study on prevention of hazard in industry by the use of personal protective equipment and implementing smart technology for personal protective equipment. **International Research Journal of Engineering and Technology**, 2(8):2395-0072, 2015.
- ENNOURI, W. Risks management: New literature review. **Polish Journal of Management Studies**, 8:288-297, 2013.
- ESA, M. M.; RAHMAN, N. A. A.; JAMALUDIN, J. Reducing high setup time in assembly line: A case study of automotive manufacturing company in Malaysia. **Procedia Social and Behavioral Sciences**, 211:215-220, 2015.

- GHADGE, A.; DANI, S.; KALAWSKY, R. Supply chain risk management: Present and future scope. **International Journal of Logistics Management**, 23(3):313-339, 2012.
- HARNI, S. et al. **Teknologi pengendalian hama dan penyakit tanaman kopi**. Jakarta: IAARD Press, 2015. 78p.
- HONGDIYANTO, C. The importance of production standard operating procedure in a family business company. **IOP Conf. Series: Materials Science and Engineering**, 277:1-7, 2017.
- HULT, G. T. M.; CRAIGHEAD, C. W.; KETCHEN, D. J. S. Risk uncertainty and supply chain decisions: A real options perspective. **Decision Sciences**, 41(3):435-458, 2010.
- IKHWANA, A. Supply chain management of coffee commodities. **MATEC Web of Conferences**, 197:14003, 2018.
- INDONESIAN CENTRAL BUREAU OF STATISTICS(BPS). **Kabupaten Bondowoso dalam Angka**. 2022. Jakarta. Indonesia: Central Bureau of Statistics Republic of Indonesia. Available in: <https://jatim.bps.go.id/id/statistics-table/1/MjYwMSMx/produksi-perkebunan-karet-dan-kopi-menurut-kabupaten-kota-dan-jenis-tanaman-di-provinsi-jawa-timur-ton---2021-dan-2022.html>. html. Access in: September, 12, 2023.
- ISMAIL, C. et al. Food safety knowledge and personal hygiene practices amongst mobile food handlers in Shah Alam Selangor. **Social and Behavioral Sciences**, 222:290-298, 2016.
- MULATO, S.; WIDYOTOMO, S.; SUHARYANTO, E. **Teknologi proses dan pengolahan produk primer dan sekunder kopi**. Jember: Pusat Penelitian Kopi dan Kakao, 2006, p. 91-94.
- MUSHAVHANAMADI, K.; SELOWA.; TUMISO, B. The Impact of plant maintenance on quality productivity in gauteng breweries. **Proceedings of the International Conference on Industrial Engineering and Operations Management**, p. 1743-1753, 2018.
- NAJIYANTI, S.; DANARTI. **Kopi udidaya dan penanganan lepas panen**. Jakarta: Penebar Swadaya, 2006, p. 52-54.
- NGADIMAN, Y. et al. Factors that Influenced the quality inspection on the production line in manufacturing industry. **MATEC Web of Conferences**, 97:10007, 2017.
- PASIGAI, M. A.; ASDAR, A.; MAYANTI, T. Analisis implementasi pengawasan proses produksi roti pada chcolicious premium cookies and cake Kota Makassar. **Jurnal Profitability Fakultas Ekonomi dan Bisnis**, 1(2):47-60, 2017.
- PRODEA, H. et al. Pengaruh briefing pagi terhadap motivasi kerja pegawai pada departemen housekeeping pada industri resort di indonesia. **Seminar Nasional Teknik Industri Universitas Gadjah Mada**, p. 50-55, 2019.
- RAHARDJO, P. **Berkebun Kopi**. Jakarta: Penebar Swadaya, 2017, p. 10.
- REEPU. Raw material inspection and its impact over quality supported by production, planning, and sourcing. **International Journal of Science Technology Management**, 6(1):218-224, 2017.
- SAGITA, A. A.; SUSILO, H.; CAHYO, M. Pengaruh budaya organisasi terhadap kinerja karyawan dengan motivasi kerja sebagai variabel mediator. **Jurnal Administrasi Bisnis**, 57(1):73-82, 2018.
- SELMOR, D.; BYTOF, G.; KNOPP, S. E. The storage of green coffee (*Coffea arabica*): Decrease of viability and changes of potential aroma precursors. **Annals of Botany**, 101(1):31-38, 2008.
- SIHOMBING, I. M.; SUMARTINI. Pengaruh pengendalian kualitas bahan baku dan pengendalian kualitas proses produksi terhadap kuantitas produk cacat dan dampaknya pada biaya kualitas (cost of quality). **Jurnal Ilmu Manajemen & Bisnis**, 8(2):34-41, 2017.
- SUGIARTI, L. Identifikasi hama dan penyakit pada tanaman kopi di kebun percobaan Fakultas Pertanian Universitas Winaya Mukti. **Jurnal Agro Wiralodra**, 2(1):15-22, 2019.
- TAMA, Y.; EUNIKE, A.; HAMDALA. **Model supply chain agroindustri di indonesia studi kasus produk singkong**. Malang: UB Press, 2019, 111p.
- TORRES, M.; ORTIZ, V. Collaboration and information sharing in dynamic supply chains: A literature review over the period 2000-2012. **Estudios Gerenciales**, 30:343-354, 2014.
- TSENG, Y; YUE L. W.; TAYLOR M. The role of transportation in logistics chain. **Proceedings of the Eastern Asia Society for Transportation Studies**, 5:1657-1672, 2005.
- VORST, J. G. A. J.; BEULENS, A. J. M. Identifying sources of uncertainty to generate supply chain redesign strategies. **International Journal of Physical Distribution and Logistics Management**, 32(6):409-430, 2002.

WILLIAMS, Z.; LUEG, J. E.; LEMAY, S. A. Supply chain security: An overview and research agenda. **The International Journal of Logistics Management**, 19(2):254-281, 2008.

WINARNI; RATNANI; RIWAYATI. Pengaruh jenis pupuk organik terhadap pertumbuhan tanaman kopi. **Majalah Ilmiah Momentum**, 9(1):35-39, 2013.

WU, C.; HS, U. Information sharing and collaborative behaviors in enabling supply chain performance: A social exchange perspective. **International Journal of Production Economics**, 148:122-132, 2014.

QUEENSLAND GOVERNMENT. **A Guide to risk management. Australia: Financial management framework**. Available in: <https://www.treasury.qld.gov.au/resource/guide-risk-management/>. Access in: September, 2023.