Minimization Risk Product Quality of *Stolephorus* Sp. Fish in Supply Chain Activities

Kukuh Winarso¹, Moh. Jufrianto^{2*}, Rifky Yusron¹, Hidayat², and Wasiur²

¹Industrial Engineering, University of Trunjoyo Madura, Bangkalan, Indonesia.

²Industrial Engineering, University of Muhammadiyah Gresik, Gresik, Indonesia.

Abstract. In supply chain activities, there is always the potential for risk to arise, therefore risk management is needed for risk control. PT. Marinal Indorima Kapedi is a manufacturing company engaged in fisheries, which processes raw materials of *Stolephorus* Sp. fish where supply chain activities have the opportunity to pose risks that cause a decrease in product quality. The purpose of this study is to identify quality reduction risks and risk agents that occur in supply chain activities then design mitigation strategies that can be used to reduce the emergence of risk agents. The method used to determine priorities and mitigation strategies is House of Risk (HOR). From the results of the study 7 proposed mitigation strategies were proposed to reduce the possibility of the emergence of risk agents in the company's supply chain activities, namely conducting routine training for all workers, setting a standard time for each process on the production line, implementing production machinery instead. workers, oversee every tighter work activity, coordinate with suppliers, apply a system of violations to contract workers if the working mechanism is not in accordance with the SOP, and take *Stolephorus* Sp. fish only for trusted suppliers

Keywords: Supply Chain, Risk Management, , HOR (House of Risk), Mitigation, Risk Agents

1 Introduction

PT. Marinal Indorima Kapedi is a manufacturing company engaged in the fisheries sector, namely processing raw materials for Teri fish located in Sumenep Regency, East Java. The final products are almost entirely exported and marketed to foreign countries such as Japan, Singapore, China, Hong Kong, and Thailand. Problems faced by PT. Marinal Indorima Kapedi currently includes complaints from consumers about the quality of *Stolephorus* Sp. fish products because cases of refusing class fish are rejected, it is alleged that the case of rejection is not only caused by a production process error, but there are other factors outside the production process that increase the risk of rejection. In the production process the risk of process failure in the form of undercooked fish because the boiling temperature is not optimal, the fish is damaged due to excess production, the fish is damaged due to damage to the tools and machines, and the fish is damaged due to handling errors.

Risk can cause damage which may affect the company's goal [1]. The existence of some sort of risk needs to be identified to map the characteristics of the risks that will have an impact on the performance of Supply chain [2]. If a company does not have a risk management, then the risk can have an impact on the company's performance [3]. HOR (House of Risk) was

chosen because it has a set of proactive which is considered effective in managing the risk of supply chain companies. A method HOR is a method that focuses on formulating the strategy of prevention, response and handling of risk factors potentially cause risk of more than one [4]. Model HOR used to prioritize which dealt first and to choose the most effective action to reduce the risk of potentially appear by agent risk. A method HOR had used to analyse risk on leather raw materials in a company [5] and to manage risk the quality of the frozen shrimp in the supply chain [6].

The Focus this study to identify and analyze risks in the supply chain then design appropriate mitigation strategies to deal with risks so that the company can minimize losses and achieve the purpose to identifying and measuring risks potential that exist in supply chain activities of PT. Marinal Indorima Kapedi can use the House of Risk model which is the development of Failure Modes and Effect Analysis (FMEA) and Quality Function Deployment (QFD) methods.

2 Literature Review

2.1 Risk Management

According to [7][8][9], risk management is the process of identifying, measuring, and ensuring risk and

* Corresponding author : jufriyanto@umg.ac.id

developing strategies to manage those risks. The aim is to continue to make or add maximum value to all activities in an organization.

Fig. 1. Risk Management [10].

2.2 Supply Chain Risk Management

According to [11][12], Supply Chain Risk Management is a tool that's might be minimize possibility of things that can cause failure in one aspect of the supply chain so that the overall performance of the supply chain cannot function properly.

According to [13][14], Supply Chain Risk Management is a risk that occurs in the flow of products, information, ranging from raw materials to delivery of the final product. This risk threatens overall supply chain from suppliers to consumers.

2.3 House of Risk

Model House of Risk is one of framework by doing the development methods of Failure Modes and Effects Analysis and Quality function Deployment [15]. FMEA is a method used to identify the potential of a failure of a product or service as well as performing an act which aimed to eliminate or minimize the risk of failure [16][17][18].

While the QFD is a process set the customer's wishes (what is "desirable" customers) and translates it into "how" attribute so that each functional area can understand and execute it[19][20].

3 Methods

The method of completion in this study using the House of Risk method which is a development of the Quality Function Deployment method and Failure Modes and Effect Analysis.

3.1 House of risk.

The following are the stages of House Of Risk (HOR)

3.1.1 House of Risk phase 1

From each risk event and risk agent, then it is followed by mapping Aggregate Risk Potential (ARP) value with phase 1 HOR matrix. This matrix maps the correlation of risk events with each risk agent. a scale of 0, 1, 3, 9

where 0 indicates no correlation and 1, 3, 9 shows successively low, medium and high correlation.

$$ARP_j = O_j \sum SiR_{ij} \quad (1)$$

3.1.2 Make Pareto diagram

Make a Pareto (Aj) diagram for priority selection. Pareto diagram is used making rank of data indication based on the percentage order. left for lowest value of ARP Aggregate Risk Potential in HOR and right for highest value. The biggest percentage will be improved by conducting phase 2 HOR, which is looking for strategies for the proposed risk mitigation steps

TEk values are calculated by the formula:

$$TEk = \sum ARP_j E_{jk} \quad (2)$$

ARPj= Aggregate Risk Potential from risk agents

Ejk= Correlation between mitigation strategies and risk agents

The ETDk value is calculated by the formula:

$$ETDk = TEk / Dk \quad (3)$$

TEk = Total effectiveness

Dk = Degree of Dificulty

3.1.3 House of Risk phase 2

In phase 2 HOR or risk handling phase which aims to determine the priority of actions with TEk calculation (total effectiveness) and ETDk (Ratio between Total effectiveness and level of difficulty).

4 Result

4.1 Risk Evaluation

The purpose of risk evaluation is to make which risk decisions are categorized as critical and need to be addressed. A tool that can be used to decide which risks need handling first, including Pareto chart.

4.1.1 House of Risk phase 1

The following results from House of Risk phase 1:

Table 1. Setting Word's margins.

Code	Risk / Risk agent	ARP
A1	Sudden demand from consumers	102
A2	Delay in information from consumers	14
A3	Request forecast error	65
A4	Anchovy capacity from fluent suppliers	200
A5	Misinformation between marketing and purchasing	27
A6	Less careful in writing contract agreements	72

A7	Lack of communication between companies and suppliers	18
A8	Less careful in writing order specifications	95
A9	The occurrence of transportation accidents	36
A10	Packing the wrong anchovy	147
A11	Lack of ice cubes	486
A12	Nonstandard shipping handling (heat/rain protection)	54
A13	Management of post-caching anchovy is not standard	144
A14	Misinformation between suppliers and the procurement department	30
A15	The temperature in cold storage is not according to the standard	128
A16	Waiting time in the process is too long	504
A17	The amount of anchovy capacity exceeds production capacity	96
A18	The material storage mechanism is not standard	92
A19	Material overload warehouse	81
A20	Work equipment is not supportive	75
A21	Operators work outside the SOP	402
A22	The process storage temperature is not standard	138
A23	The capacity of anchovy in boiling vessels exceeds the limit	45
A24	Boiling process is too long	432
A25	Error checking water content by the operator	42
A26	Natural factors (rain, cloudy)	288
A27	The drying process is not long enough	144
A28	Lighting in the room	25
A29	Damage to tool/sizing machine	225
A30	Operators cannot operate machines	29
A31	There is no maintenance/calibration of the scale	8

A32	Sealing equipment needs repairs	24
A33	Operators are less careful about marking labels	108
A34	The storage mechanism in cold storage is not standard	168
A35	Storage lead time is too long	40
A36	Storage overload	216

Fig. 1. Pareto Diagram ARP

From the pareto diagram in Figure 3, it can be seen that there are four selected risk agents that will carry out mitigation actions, namely A16 (Prolonged waiting time in process), A11 (Lack of ice cubes), A24 (Boiling process too long) and A21 (Operator works outside the SOP). The four risk agents were chosen because they had the most influence on the decline in product quality which would have an effect on the company's income.

4.2 Mitigation of Risk

The next stage carried out in the risk management process after the risk evaluation is the risk mitigation stage. Where at this stage the chosen risk agents will be included in phase 2 HOR for develop mitigation actions. The mitigation action in question is an action to reduce the impact of a risk agent that appears in future. Mitigation actions are measuring from normalization of the company. The following is a mitigation action that is obtained in accordance with the objectives of the company.

Table 2. Mitigation Risk

Mitigation Action	Code
Establish the standard time for each process on the production line	PA1
Applying a production machine as a substitute for workers	PA2
Take anchovy only to trusted suppliers	PA3
Coordination with suppliers	PA4

Establish the standard time for each process on the production line	PA1
Supervise in every work activity more strictly	PA5
Conduct routine training for all workers	PA6
Supervise in every work activity more strictly	PA5
Applying a system of violations to contract workers when contract violations occur or work mechanisms that do not comply with the SOP	PA7

4.3 2nd phase House of Risk

In phase 2 HOR or risk handling phase which aims to determine the priority of actions with TEK calculation (total effectiveness) and ETDk (Ratio between Total effectiveness and level of difficulty)

Table 3. ETD (Ratio between Total effectiveness and level of difficulty).

Cod e	Mitigation Action	ETD	Priority Rank
PA6	Conduct routine training for all workers	1809	1
PA1	Establish the standard time for each process on the production line	1404	2
PA2	Applying a production machine as a substitute for workers	907	3
PA5	Supervise in every work activity more strictly	834	4
PA4	Coordination with suppliers	729	5
PA7	Applying a system of violations to contract workers when contract violations occur or work mechanisms that do not comply with the SOP	603	6
PA3	Take anchovy only to trusted suppliers	486	7

5 Conclusion

Based on the Pareto diagram analysis obtained four priority risk agents that need mitigation actions, namely A16 (the waiting time in the process is too long with the Aggregate Risk Potential (ARP) value of 504, A11 (Lack of ice cubes) with an ARP value of 486, A24 (process boiling too long) with ARP values of 432 and A21 (Operators working outside SOP) with ARP values of 402 of the 4 selected risk agents, 7 strategies were proposed to the company, the seven strategies were ranked by calculating the value of ETD (Effectiveness to Difficulty).

Authors would like to thank DIPA FT UTM 2020, because this article accessing this foundary. for further

research can take note of any failure of any business processes to make it easier to do risk management. In addition, the identification of the risk starts from means of transport from suppliers because it can also cause a high risk on loss of quality.

References

1. Z. D. Cahyani, S. R. W. Pribadi, and I. Baihaqi, "Study the implementation of a Model House of Risk (HOR) for risk mitigation of delays in materials and Components Imported in the construction of new ships," *J. Tek. ITS*, vol. **5**, no. 2, pp. G52–G59, (2016).
2. S. Nasution, Y. Arkeman, K. Soewardi, and T. Djatna, "Identification and Risk Evaluation Using Fuzzy Fmea On Shrimp Industrial Agriculture Supply Chain," *J. Ris. Ind.*, vol. **8**, no. 2, pp. 135–146, (2014).
3. G. Acharyulu, "Supply Chain Management Practices in Printing Industry," *Oper. Supply Chain Manag.*, vol. **7**, no. 2, pp. 39–45, (2014).
4. I. N. Pujawan and L. H. Geraldin, "House of risk: A model for proactive supply chain risk management," *Bus. Process Manag. J.*, vol. **15**, no. 6, pp. 953–967, (2009).
5. B. R. Kristanto and N. L. P. Hariastuti, "Application of the Model House of Risk (Hor) for risk mitigation on Leather raw materials Supply Chain," *J. Ilm. Tek. Ind.*, vol. **13**, no. 2, pp. 1–10, (2014).
6. D. Anggrahini, P. D. Karningsih, and M. Sulistiyono, "Managing Quality Risk in a Frozen Shrimp Supply Chain: A Case Study," *Procedia Manuf.*, vol. **4**, no. January, pp. 252–260, (2015).
7. A. Lokobal, "Managing Construction Risk Management In The Province Of Papua (Case Study: Sarimi Regency)," *J. Media Eng.*, vol. **4**, no. 2, pp. 109–118, (2014).
8. R. S. Nugraheni, R. Yuniarti, and R. A. Sari, "The Analysis Of Supply Chain Risk On Ready To Drink (RTD) Product Using House Of Risk Method," *J. Eng. Manag. Ind. Syst.*, vol. **5**, no. 1, pp. 1–17, (2017).
9. M. Ulfah, M. maarif Syamsul, Sukardi, and S. Raharja, "Analysis and Improvement of Supply Chain Risk Management of Refined Sugar Using House of Risk Approach," vol. **26**, no. 1, pp. 87–103, (2016).
10. Standard, Australian New Zealand AS/NZS 4360:2004, "Risk management," (2004).
11. M. N. Masri, D. Satiti, and A. Rusdiansyah, "Identifying research advancements in supply chain risk management for Agri-food Industries: Literature review," in *Materials Science and Engineering*, (2017), pp. 1–8.
12. T. Immawan and D. K. Putri, "House of risk approach for assessing supply chain risk management strategies: A case study in Crumb Rubber Company Ltd," (2018), vol. **1097**, pp. 1–4.

13. I. D. Handayani, "A Review: The Potential Risk In Supply Chain Risk Management," *Spektrum Ind.*, vol. 14, no. 1, pp. 1–18, (2016).
14. P. Ceryno and L. Scavarda, "Supply Chain Risk Management: A Fishbone Analysis Approach," *Int. J. Ind. Eng. Manag.*, vol. 4, no. 3, pp. 141–149, (2013).
15. D. L. Trenggonowati, "Analysis Of Causes Of Risks And Risk Mitigation By Using Methods Of Risk In The Procurement Division," *Ind. Serv.*, vol. 3, no. 1, pp. 1–7, (2017).
16. T. S. Parsana and M. T. Patel, "A Case Study: A Process FMEA Tool to Enhance Quality and Efficiency of Manufacturing Industry," *Bonfring Int. J. Ind. Eng. Manag. Sci.*, vol. 4, no. 3, pp. 145–152, (2014).
17. S. M. Muzakkir, K. P. Lijesh, and H. Hirani, "Failure mode and effect analysis of Bearing," *Int. J. Appl. Eng. Res.*, vol. 10, no. 16, pp. 37752–37759, (2015).
18. J. Doshi and D. Desai, "Application of failure mode & effect analysis (FMEA) for continuous quality improvement - multiple case studies in automobile SMEs," *Int. J. Qual. Res.*, vol. 11, no. 2, pp. 345–360, (2017).
19. D. Premkumar and M. Balamurugan, "Implementation of Quality Function Deployment in Pump Industry," *Int. J. Innov. Res. Sci. Eng. Technol.*, vol. 3, no. 3, pp. 1258–1262, (2014).
20. N. Muda and R. S. N. Mat, "A Quality Function Deployment (QFD) Approach in Determining the Employer' s Selection Criteria," *Ind. Eng.*, vol. 2015, no. 1, pp. 1–10, (2015).