Mitigation of Supply Chain Risk using HOR Model at PT. Sumber Karya Indah

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Mitigation of Supply Chain Risk using HOR Model at PT. Sumber Karya Indah

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Abstract, In supply chain activities has always been a potential risk arising, therefore risk management is very necessary for the handling of risk. In the company that produces women handbags such as PT. Sumber Karya Indah, in its supply chain activities, has the opportunity to arise risk. Therefore, it is necessary to do risk analysis and design of mitigation action, to reduce the risk of interference that is likely to arise in its the supply chain. The research was conducted using a house of risk model consisting of 2 phases. The first phase is risk identification and risk agent, which is then done a measurement of severity and occurrence level as well as a calculation of aggregate risk priority (ARP) value. The second phase is risk mitigation planning. Data retrieval methods are performed by interviews, observations, and historical data as supporting data. After the research has been obtained results that there are 28 risk events and 32 risk agents. There is 7 mitigation action that can be used and expected to mitigate risk in its supply chain. The result is the House of Risk Assessments Management Template using VBA Macro Excel.
Keywords: Supply Chain, ARP, HOR, Risk Mitigation

1. Introduction

Supply Chain Management is a complete cycle chain management that starts from raw materials, to operational activities in the company, continues to distribution to consumers who use the product. SCM is an approach or method that integrates with collaborative foundations. Companies that are in a supply chain, in essence, want to satisfy the same consumers, they must work together to make products that can be received by customers, both in terms of price, quality, and accuracy of the send time. Cooperation between elements in the supply chain must be done well so that the objectives can be achieved. Managing the supply chain is not easy. Some of the challenges that can pose risk to the supply chain are the complexity of supply chain structure and uncertainty.[1]

Risk is often interpreted as uncertainty that can cause problems and also bring profitable opportunities for the company and people per person. The risk is associated with possible (probability) losses especially those that cause problems. Risk becomes an important problem if the losses it causes are not known for sure.[2]

Risk management is a field of science that discusses how an organization applies measures in mapping the various problems that exist by placing various management approaches comprehensively and systematically.[3] Supply Chain Risk Management (SCRM) is a combination of Supply Chain Management and Risk Management concept, where Supply Chain Risk Management collaborate with an existing company in the supply chain to apply Risk process Management.[4]

PT. Sumber Karya Indah has problems in supply chain activities, such as suppliers and consumers who are erratic and do not have contracts. The risks that occur from these problems are the uncertainty of the number of stock raw materials, the change in the quality of raw materials and the quality of different products, as well as demand uncertainty. The risks arising from supply chain problems hurt the company both in terms of cost and time. From the above problems, it is necessary to analyze existing risks and draft the risk mitigation strategy to prevent and mitigate the risks that may arise in the supply chain at PT. Sumber Karya Indah. To identify and measure the potential risks involved in the supply chain at PT. Sumber Karya Indah uses the House of Risk (HOR) method.

The method of HOR developed by Pujawan and Geraldin (2009) is an innovative model for supply chain risk management. HOR1 is used to rank each risk agent based on their aggregate risk potentials. HOR2 is intended to prioritize the proactive actions that the company should pursue to maximize the cost-effectiveness of the effort in dealing with the selected risk agents in HOR1. For illustrative purposes, a case study is presented.[5] This method is used because of the focus on preventive actions such as reducing the likelihood of possible risk agents for more proactive supply chain risk management.[6]

Based on the explanation above, the purpose of this research is to mapping supply chain activity at PT. Sumber Karya Indah to determine risk agent and risk event prioritized to be handled using HOR1 and the erection of risk mitigation actions that can minimize risk occurrence by using HOR2.

2. Methods

The identification stage is the first step in this research that is observing directly the problem at the research location. After identification the problem formula is created and then set research objectives. Furthermore, library studies and field studies to support research to run well and correctly.

The second stage is the mapping stage of supply chain activity, where supply chain activity is divided into three parts of procurement activity, production process activities, and distribution activities. The mapping of supply chain activities is obtained by interviews and observations.

The data processing stage is the next stage after the data has been collected. Data processing aims to determine the severity of a risk event and the event of a risk agent. This risk analysis is then mapped to the House of Risk 1 (HOR1). Identification of risk events and risk agents is conducted by an interview with the General Manager who has worked from the beginning of the company. In addition to business processes are also identified parts that are responsible for the business process for each business process.

In such models, the risk event and the source of risk are given the value of its correlate, and then calculated the aggregate risk priority (ARP) value of each risk source. From these results, it is then recorded by using the principle 80/20 of the Pareto diagram to determine selected risk agent. After HOR1 is mapped, mitigation actions are identified that are mapped on HOR2. in this phase the total value of the effectiveness of mitigation actions (TEk) is calculated, the level of difficulty in mitigation actions (Dk) and the total effectiveness of the level of difficulty in carrying out mitigation actions (ETDk). [7] [8]

3. Results and Discussion

3.1. Supply Chain and Mapping supply chain

Supply chain PT. Sumber Karya Indah consists of suppliers, company, retail, and customer. The following can be seen supply chain as a whole from PT. Sumber Karya Indah works in Figure 1.

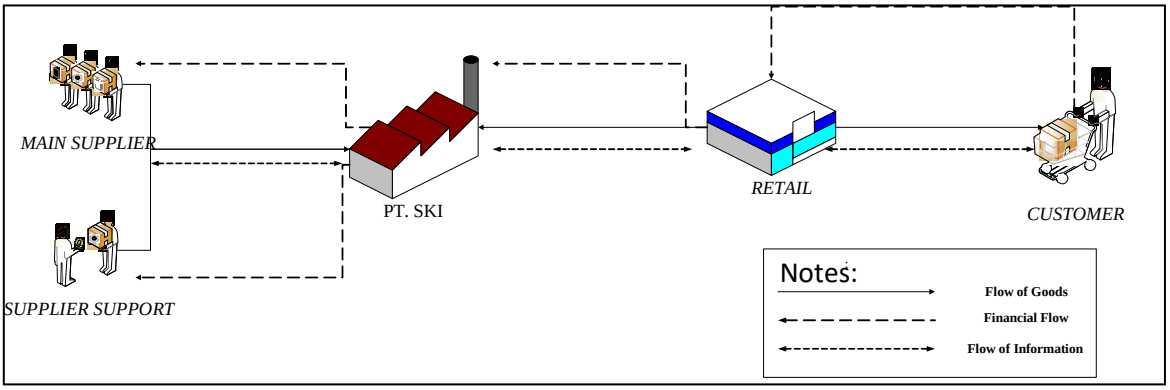

Figure 1. Supply Chain PT. Sumber Karya Indah

The procurement activity of this company is influenced by its production type. The make to stock production type begins with the stock checking in the PT. Sumber Karya Indah retail warehouse. When the remaining stock has reached the minimum limit (approximately five to six bags), then the retail part will contact the general administration of the factory will be known by the general manager. General Manager will convey to the head of the production type of goods to be produced. Retail PT. Sumber Karya Indah will deliver the order to the factory General Administration. The administration conveyed to the general manager of product ordering specifications. General Manager considers the model and quality of materials. Then the general manager will inform the sales price range in retail to be delivered to the customer.If the price has been agreed, then the retail part will contact the administration of the factory will be known by the general manager. General Manager will convey to the head of the production type of goods to be produced. Then, the head of the production will divide the task into the design supervisor, and production supervisor. If the raw material is available, the production process can be started, but if the stock of raw material is less or unavailable, then the general Administration will order the raw material on the supplier.

Based on the classification the company's supply chain activity description is shown in Table 1.

Table 1. Mapping supply chain activity in five business processes

Process	Sub Process
Plan	1. Demand forecasting 2. Calculation of Material needs 3. Production Planning 4. Material Planning and control
Source	1. Delivery scheduling from Supplier 2. Accepting, checking and storing raw materials 3. Choosing a Supplier
Make	1. Production Scheduling 2. Production process a. Draw a pattern b. *Cutting* c. *Assembly* 3. Product Inspection
Deliver	1. Delivery selection 2. Sending bills to customers
Return	1. Return scheduling 2. Making a return

3.2. Risk Event and Risk Agent

From the process of mapping the supply chain activity in Table 1, further identifying and measuring risk events and risk agents. These measurements are performed to determine the severity of a risk event and determine the occurrence (level of probability occurring) of the risk agent. This measurement was done by an interview with a General manager who has worked in the company from the beginning of the company and the General Administration that has been working for more than 10 years. The results of the measurements are shown in Table 2 and Table 3.

Table 2. Risk Event Measurement Results

E_i	Risk Event	S_i
E1	Mistake the magnitude of forecasting	5
E2	Error requirement calculation	4
E3	Sudden changes in the production plan	4
E4	Production scheduling does not match	6
E5	Gaps between recorded and available stock	7
E6	Incorrect/accurate inventory parameters	5
E7	Raw material delays from suppliers	7
E8	Specifications of raw materials received are not by booking	6
E9	Received raw materials damaged	6
E10	The raw materials submitted are not inspected by the goods	5
E11	Changes in the quality of raw materials	6
E12	Fault choosing supplier	7
E13	Delayed production schedule	7
E14	Mechanical malfunction	6
E15	Error drawing master pattern	8
E16	Cutting is not perfect	9
E17	Assembly is not perfect	7
E18	Product quality degradation during the process	6
E19	Quantity of repair products exceed standard	6
E20	Not able to meet all requests	7
E21	Fault delivery service selection	7
E22	Delayed delivery of products	5
E23	Product shipped to the wrong destination	7
E24	Cancellation of shipment	6
E25	The difference in the bills recorded by customers and companies	6
E26	System error	6
E27	Return product late	6
E28	Product returns canceled	7

The severity value states how much disruption/impact a risk event can cause. The scale used in severity is a scale level of 1-10 with the sense that the value of 1 means that no failure/disruption effect occurs and the value of 10 means almost certain failure/disturbance effects.

Table 3. Risk Agent Measurement Results

A_j	Risk Agent	O_j
A1	Significant demand increase	4
A2	Seasonal factors	6
A3	Sudden request from a customer	4
A4	Less coordination in the raw material ordering section	3
A5	Transport interference	4
A6	External factors	4
A7	Inspection of unexamined raw materials receiver	5
A8	Interference on raw materials during travel	5
A9	Absence of contracts established with suppliers	8
A10	Supplier can't fulfill orders	2
A11	Technical disruption to the negotiation process with the supplier/customer	4
A12	Enterprise internal factors	4
A13	Limited human resources	6
A14	No maintenance	8
A15	Buildup of raw materials for too long	6
A16	Working procedure production process is less obvious	7
A17	Waiver of work procedure by the production operator	7
A18	Negligence of Labor	6
A19	An Inscrutiny product inspection process	5
A20	Power supply disrupted	2
A21	Overworking Hours	6
A22	Production Target is relatively high	6
A23	The difficulty level of product manufacture	6
A24	Large Product variations	5
A25	Error of identity granting product	4
A26	No Standardized products	7
A27	Distance factor and communication between company and customer	5
A28	Less coordination in the shipping Section	5
A29	Inadequate transportation	5
A30	Natural disasters	2
A31	It system interference	2
A32	Return of returned product does not match specifications	4

After the risk event and the risk agent have been identified, the next step is to determine the value of the inspection between the two. if there is no examination, the value of 0. low examination is represented by the number 1, moderate examination by 3, and 9 represents the high. both data were collected using interviews with managers who had worked at the company since its inception.

3.3. House of Risk 1 (HOR 1)

Activity mapping in this model is done by entering the severity of the measurement of risk events as shown in Table 2. While the events of the risk agent and inspection value can be seen in Table 3. Determination of the ARP value in the following formula can be:

$$ARP_j = O_j \sum_i S_i R_{ij} \quad (1)$$

with ARPj= Aggregate risk potential value from j risk agent, Oj= occurrence from j risk agent, Si= severity of risk event i, and Rij = correlation value between j risk agent and risk event i. The result of the mapping of the HOR 1 was then rendered by using the Pareto diagram shown in Figure 2.

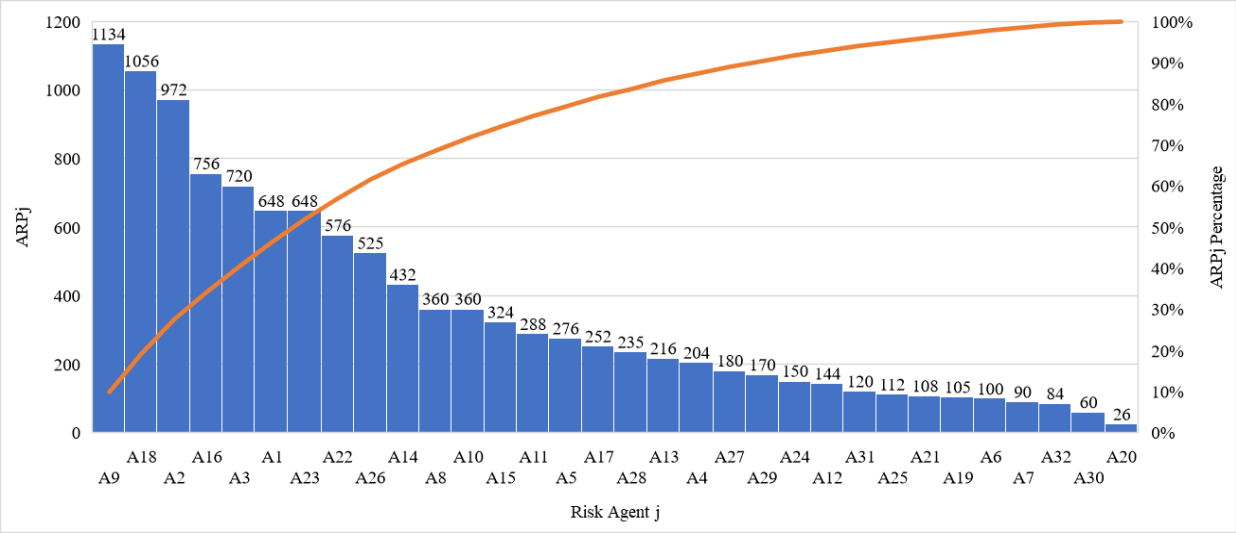

Figure 2. ARP Diagram

Based on the ARP diagram in Figure 2 and using the 80/20 principle from Pareto, risk agents will be chosen as a basis for consideration in choosing risk mitigation actions. From Figure 2 it can be seen that the risk agents A9, A18 and A2 are the highest with each ARP value shown in Table 4.

Table 4. Risk agent and ARP value

A_j	Risk Agent	ARP	ARP Percentage	Cumulative ARP Percentage
A9	Absence of contracts established with suppliers	1134	9,9%	9,9%
A18	Negligence of Labor	1056	9,2%	19,2%
A2	Seasonal factors	972	8,5%	27,7%

These risk agents will be included in the HOR 2 model to determine mitigation actions. Mitigation actions are taken to reduce the impact of risk agents. Recommended mitigation actions are shown in Table 5

Table 5. Recommended Mitigation Actions

Aj	Risk Agent	Mitigation Action	MA_k
A9	Absence of contracts established with suppliers	Planning procedures for procurement of raw materials	MA1
		Perform performance evaluation with supplier	MA2
A18	Negligence of Labor	Conducting personal training in production section	MA3
		Assess work results every month	MA4
		Improve coordination between sections	MA5
A2	Seasonal factors	Looking for a supplier that has different characteristics	MA6
		Coordination with similar industries for collaborative work	MA7

3.4. House of Risk 2 (HOR 2)

Measuring the effectiveness of the level of difficulty is a step that must be determined in the next stage by dividing the total value of effectiveness (TEk) by the level of difficulty through action. The level of effectiveness of the difficulty is aimed at ranking the priority of all mitigation actions, using the following formulas. the results of the calculation can be seen in table 6.

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

$$ETD_k = TE_k / D_k \quad (3)$$

with TEk = Total effectiveness of the mitigation action k, ARPj = Aggregate Risk Potential value of risk agent j, Ejk = the value of the collation between j risk agent and mitigation action k, ETDk = ratio of effectiveness to the difficulty of implementing a mitigation action k, and Dk = value difficulty in the application of k.

The degree of difficulty (Dk) is 3 (easy-to-implement mitigation action), 4 (rather easy to implement mitigation actions), or 5 (hard-to-implement mitigation actions). The priority of all mitigations can be seen in Table 6 and Figure 3. The priority based on the largest ETDk value.

Table 6. House of Risk 2 (HOR2)

Aj	Mitigation Action							ARPj
	MA1	MA2	MA3	MA4	MA5	MA6	MA7	
A9						3	3	1134
A18	9	1	1					1056
A2				9	3	3		972
TEk	9504	1056	1056	8748	2916	6318	3402	
Dk	5	5	3	4	4	4	5	
ETDk	1900,8	211,2	352	2187	729	1579,5	680,4	
Rk	2	7	6	1	4	3	5	

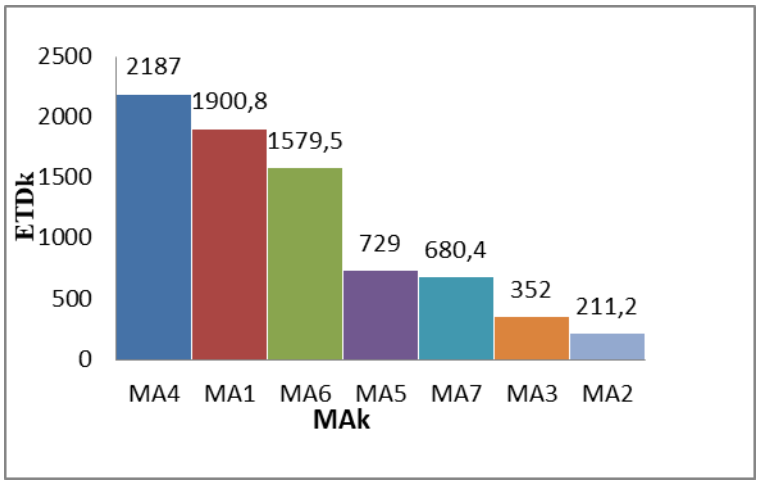

Figure 3. Priority of Mitigation Action

Table 3 shows mitigation actions carried out in sequence in accordance with ETDk values. it can be seen that the highest ETD value is MA4 (evaluating work results every month) of 2187, where mitigation actions are most likely to be done first to prevent A8 (labor negligence). The most difficult mitigation action to take is MA2 (evaluating performance with suppliers) which has an ETD value of 211,2. This mitigation action is carried out to overcome A9 (no contracts are formed with suppliers).

3.5. HOR Assessment Management Template

Once the HOR model is calculated, the next step is to provide accessibility for PT. SKI by performing risk recording. This entry will help PT. SKI to make future decisions. Researchers use VBA Macro Excel to create the House of Risk Assessments Management Template. The result of this template refers to the result of a HOR model that is mitigation action. Using this template automates the calculation of HOR, making it easier for PT. SKI to identify and analyze the risk agent occurring in the company. This template is based on the risk events that occur in the company and the risk agents

causing the risk events to occur. both of these can change from time to time, because of several factors that influence. These two factors are the main variables in making templates.

4. Conclusion

From the supply chain activities of PT. Sumber Karya Indah has identified 28 risk events and 32 risk agents. From the results of the mapping in HOR 1, it is known that three selected risk agents are considered in mitigation actions, namely: A9 (absence of contracts formed with suppliers) with an ARP value of 1134, A18 (negligence of Labor) with an ARP value of 1056, and A2 (seasonal/seasonal factor) with an ARP value of 972.

From the mapping result of HOR 2, obtained 7 draft risk mitigation action, namely: MA1 (planning of raw material procurement activity procedure) with an ETD value of 1900.8; MA2 (conducting supplier performance evaluation) with an ETD value of 211.2; MA3 (conducting personal training) with an ETD value of 352; MA4 (Assess work every month) with ETD value of 2187; MA5 (improves coordination between parts) with an ETD value of 729; MA6 (looking for a supplier that has different characteristics) with an ETD value of 1579.5; and MA7 (coordination with similar industries to collaborate on work) with an ETD value of 680.4.

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