Supply Chain Risk Analysis in Interior Design SME in Indonesia

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***Abstract*— At present, interior design SME in Indonesia is one of the most rapidly developing SMEs in Indonesia, but this great potential is also accompanied by a high risk, especially in supply chain. The purpose of this study is to analyze risks, find out the causes of the risk, and recommend the best mitigation strategies that can be done in the supply chain of SME interior design. The method used for this research is mixed research method and the type of research used is descriptive research. Data analysis was carried out using SCOR level 1 method with HOR approach. Level 1 SCOR is used for activity mapping. The House of Risk (HOR) approach is divided into 2 stages, in which phase 1 begins with identifying the risks of the problems that have been experienced by interior design SMEs in Indonesia. After obtaining the ten cause of risks that exist, measures of severity and correlation will be carried out. Finally, Aggregate Risk Potential (ARP) is calculated to find out the most dangerous cause of risk, which is distance traveled. HOR stage 2 begins with the evaluation of the most dangerous cause of risks from the results of ARP calculations. This stage focuses on choosing the most effective handling strategy, which is to encourage the efficiency of shipping by only making one delivery of goods.**

***Keywords*—** *Supply Chain, SCOR Level 1, HOR Method, Aggregate Risk Potential, Mitigation*

1. Introduction

The increasing ease of doing business in Indonesia has made many new companies stand up. Supported by presidential regulation number 6 of 2015, the government is currently establishing a new non-ministerial institution called BEKRAF. Which aims to assist the president in formulating, establishing, coordinating and synchronizing economic policies in around 16 fields in Indonesia (example: Architecture, Interior Design, Visual Communication Design, Fashion, Application & Game Developer, etc.). For Indonesia, the interior design SME is one of the creative industries that has become one of the creative economy subsectors which has the largest contribution to the Indonesian economy. The interior design sector is the second largest sector among the Architecture, DKV and Fine Arts sectors, as many as 798 interior design businesses spread across several regions of Indonesia.

Property consultant Jones Lang LaSalle mentioned that the demand for flexible offices including Co-Working and Serviced Office is growing faster in the Asia Pacific than anywhere else in the world. Even the availability in the Asia Pacific region exceeds markets in the United States and Europe. By looking at the growth prospects of the interior design SME and the need for development, thus the need for interior design services is increasingly needed. But with the increase in demand from the client, there are problems in the supply chain. There are several risk events and the risk agents faced by companies in the interior design SME. Delay in delivery causes the work process to be delayed from the planned time, the lost property onsite has an impact on the delayed project. Then additional costs are needed to secure the work location and buy back lost items.

With the current supply chain process, it's still has a high probability that a risk event will occur due to the risk agent, for example, delays in delivery can be caused by several risk agents such as congestion in travel or enough mileage far [1]. The lost onsite property can be caused by a risk agent such as a human error on workers and a lack of supervision of workers. If the overall risk event and risk agent continue, it will cause less effective work activities of the company.

Based on the problems faced by companies in the interior design SME, the need to research to overcome these problems. The method of scientific approach used to overcome these problems is Supply Chain Operation Reference (SCOR) with

the House of Risk (HOR) approach which aims to identify risks that occur in supply chain activities such as planning (Plan), procurement (Source), manufacturing (Make), shipping (Deliver), and return (return). After that, the House of Risk (HOR) method is used to calculate the Aggregate Risk Potential (ARP) value. Then it is used to determine and prioritize the risk agent using the Pareto approach to determine the risks that have a large impact on the supply chain and mitigation actions can be carried out to eliminate or minimize losses for the company. Thus, this study will know what risks that have the highest level and that have the potential to disrupt supply chain activities. After that mitigation actions can be carried out.

2. Literature Review

According to Ref [2] one way to identify risk events and risk agents (triggers or causes of risk) in the procurement of imported materials and components and mitigation strategies using the House of Risk (HOR) model. HOR is the development of the QFD (Quality Function Deployment) method and FMEA (Failure Modes and Effect Analysis) that are used to develop a framework for managing risk. The HOR model is used because this model is different from the existing model [3]. The HOR model chooses the highest Aggregate Risk Potentials (ARP) which means that the specific risk agent has the highest risk occurrence and cause many risk events with severe impact. Then mitigation measures for selected risk agents are prepared based on the ratio of total effectiveness to the level of difficulty and mitigation actions which can reduce many risk agents with high ARP values [4].

The Model Supply Chain Operations Reference (SCOR) is a supply chain language [5], which can be used in various contexts to design, describe, reconfigure various types of business commercial activities[6]. SCOR is used by companies to identify, measure, regulate and improve supply chain processes [7]. Ref [8] argues the SCOR Model can be used as a tool to diagnose standard supply chains between companies for the use of supply chain management. The process in SCOR consists of 3 levels of detail and 1 level not covered in the detail process.

The House of Risk (HOR) method is a supply chain risk management model that uses the concept of the house of quality (HOQ) and failure modes and effect of analysis (FMEA) which aims to develop a framework for managing supply chain risk [9]. HOR is a method for managing risk proactively, where the risk agent identified as a cause of risk events can be managed by determining priorities based on the magnitude of the impact that might be caused.

The first step, mapping supply chain activities and risk identification, using SCOR [10]. The SCOR method is used because it can measure supply chain performance objectively based on existing data and can identify anywhere that needs improvement [11]. The FMEA method is a risk assessment that can be calculated through the calculation of the RPN (Risk Potential Number) obtained from multiplying three factors, namely the probability of the occurrence of the risk, the impact of damage produced, and risk detection. Unlike in the FMEA model, the HOR method only specifies the probability for the risk agent and the severity of the risk, because one risk agent can induce several numbers of risk events, it is necessary to quantify the potential aggregate risk from the risk agent [12].

There are several advantages and disadvantages to the House of Risk (HOR). The advantages of the House of Risk (HOR) method include the House of Risk method which can take preventive action that can be applied to the company [13], can evaluate reliability by checking failure mode and is one of the systematic techniques in analyzing failures, quite representative in assessing risks in the supply chain [14], besides this method is also considered by practitioners and academics as the most suitable method for assessing risks that arise in a supply chain process [15].

The three drawbacks of the House of Risk (HOR) method are the House of Risk method that cannot be applied to all industries because in mapping activities using SCOR, another disadvantage is that the House of Risk method can only be done in supply chain activities [16]. Besides, this method requires great effort in describing existing business processes [17]. This model is based on alleged supply chain risk and focuses on mitigation actions and the prevention of risks that can arise.

3. Research Methodology

Research is a process in finding solutions to a problem through a study and analysis of several situational factors [18]. This type of research is a

descriptive study. The method used in this study is mixed methods. This is study used the qualitative method when collecting data, while quantitative methods occur when distributing questionnaires and processing questionnaire data.

The first stage begins by identifying the risks that occur in the business process. Concerning risks is obtained through interview sessions with the company, starting with identifying Risk Events and Risk Agents. Then the measurement of the severity of the risks obtained on a scale of 1-10 is measured. After that, the measurement of the level of correlation (correlation) has been measured with a scale of 0, 1, 3, 9. Then the questionnaire results are used to calculate aggregate risk potential (ARP) to know which risk agent will be given precautionary.

After that, the strategy design process is carried out using the House of Risk (HOR) matrix to prepare mitigation actions in dealing with potential risks that arise in the supply chain process.

4. Equations

The validity and reliability test results of the research questionnaire for all valid and reliable questions. Then the supply chain process mapping is done by using process elements in SCOR Level 1 method, namely, plan, source, make, deliver, and return, but at this writing, the author only discusses 3 elements of SCOR, namely plan, source and make which will be described in the table below this.

Table 1. Mapping Supply Chain Activities Using the SCOR Method

No	Element	Activities
1	Plan	Formulate strategies to get clients
		Join tender
		Planning a marketing strategy through social media
		Plan the company's web carefully
		Company meeting
2	Source	Relationship with suppliers
		Professional work agreement
3	Make	The production phase of 3D sketches for various types of client needs
		Sketch interior design for residential homes
		Good exterior interior design sketches for office
		Logo design
		Publish offers and invoices
		Billing reminder

In this stage the determination of the severity of the risk event. The risk possibility to occur and a correlation between risk events and the source of risk obtained from the results of this questionnaire. The scale used is from 1-10 for severity (S), where the value 1 for "Rarely Once" and the value of 10 for "Very Often". The relationship between risk events and risk causes is shown in the table below, as a support for making the House of Risk matrix phase 1.

Table 2. Relationship Between Risk Events and Risk Causes

Code	Risk Agent	Risk Event				
		E1	E2	E3	E4	E5
A1	Human error	3	1	3	1	1
A2	Congestion on the road at the time of delivery	3	1	3	0	0
A3	Late payment	3	0	3	0	1
A4	Error input invoice	3	1	1	1	1
A5	The loss of goods in the process	0	1	3	0	0
A6	Far distance	3	3	9	1	0
A7	The lack of work supervision	3	1	3	0	1
A8	Irresponsible of the sales division	1	0	1	1	1
A9	Environmental factors or natural disasters	3	0	3	3	0
A10	Work request added	3	3	3	3	1

In the table above the scale used is from the numbers 0, 1, 3 and 9 for the relationship between risk events. The causes of risk where number 0 is not related, number 1 is small, number 3 is moderate and number 9 is very closely related.

Table 3. Results of Calculation of HOR 1

Risk Event (Ei)	Risk Agent										The severity of Risk Event (Si)
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	
E1	3	3	3	3	0	3	3	1	3	3	4
E2	1	1	0	1	1	3	1	0	0	3	4
E3	3	3	3	1	3	9	3	1	3	3	5
E4	1	0	0	1	0	1	0	1	3	3	4
E5	1	0	1	1	0	0	1	1	0	1	2
Occurrence of Agents (Oi)	5	6	6	4	5	6	6	6	5	6	
Aggregate Risk of Potential (ARPi)	136	186	174	108	95	438	198	90	195	318	
Priority Rank of Agents (Pi)	7	5	6	8	9	1	3	10	4	2	

The overall potential for risk with the cause of risk (ARP) can be calculated using the formula:

$$ARP_j = O_j \sum S_i R_{ij}$$

Based on the calculation results from HOR 1, a Pareto Diagram can be made to be able to see more clearly the ranking of the most dangerous causes of risk, is A6 Long distance traveled by calculating the ARP value of 438.

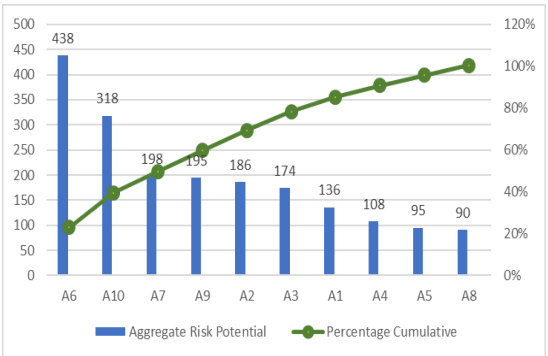

Figure 1. Pareto Diagram HOR 1

Based on the Pareto diagram, the highest risk cause is A6, which is a long distance, with an ARP value of 438, where precautionary measures must be taken. The following are the levels of risk causes from the highest to the lowest in Table 4 below.

Table 4. Level of Causes of Risk

Code	Order of Risk Agent
A6	Far distance
A10	Work request added
A7	The lack of work supervision
A9	Environmental factors or natural disasters
A2	Congestion on the road at the time of delivery
A3	Late payment
A1	Human error
A4	Error input invoice
A5	The loss of goods in the process
A8	Irresponsible of the sales division

To determine the level of effectiveness and realization of prevention, a questionnaire was distributed regarding the difficulty level of each preventive action as shown in Table 5 below.

Table 5. Level of Difficulties in Mitigating Action

Code	Mitigation Action	Difficulties
PA1	Perform shipping efficiency by only doing 1x shipping of goods	4
PA2	Making SOPs shipping so there is no messy delivery	4
PA3	Re-checking items before they are sent so that they are carried away	4
PA4	Using other shipping alternatives	4

At this stage of HOR 2 which contains mitigation actions (Preventive Action) and the level of difficulty of applying the action. The relationship

between mitigation actions and risk causes can be seen in Table 6 below.

Table 6. Relationship Between Mitigation Action and Risk Causes

Code	Mitigation Action	Causes of Risk									
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
PA1	Perform shipping efficiency by only doing 1x shipping of goods	1		3			9	1		1	3
PA2	Making SOPs shipping so there is no messy delivery	1		3	1			3			3
PA3	Re-checking items before they are sent so that they are carried away	3	1	1	1	3	3	3			
PA4	Using other shipping alternatives	1	3				3			1	

In Table 6 the scale being used is from the numbers 0, 1, 3 and 9 for the relationship between mitigation actions. The causes of risk where number 0 is not related, number 1 is small, number 3 is moderate and number 9 is closely related. Following is the overall table of HOR 2:

Table 7. Results of HOR 2

To Be Treated Risk agent (Ai)	*Preventive action (Pak)*				*Aggregate Risk Potential (ARPi)*
	PA1	PA2	PA3	PA4	
A6	9		3	3	438
A10	3	3			318
A7	1	3	3		198
A9	1			1	195
A2			1	3	186
A3	3	3	1		174
A1	1	1	3	1	136
A4		1	1		108
A5			3		95
A8					90
The Total effectiveness of action (Tek)	5947	2314	3069	2203	
Degree of difficulty acting (D)	4	4	4	4	
Effectiveness to difficulty ratio (ETDk)	1487	579	767	551	
Rank Priority	1	3	2	4	

Following is the calculation of HOR stage 2 using the formula:

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

$$ETD_k = TE_k / D_k$$

Based on the results of calculations from HOR 2 above, it can be concluded that the sequence of the most effective mitigation actions to be carried out as in Table 8 below:

Table 8. Level of Mitigation Action

Code	Mitigation Action
PA1	Perform shipping efficiency by only doing 1x shipping of goods
PA3	Making SOPs shipping so there is no messy delivery
PA2	Re-checking items before they are sent so that they are carried away
PA4	Using other shipping alternatives

So, the mitigation strategy carried out in the interior design industry especially in the supply chain to minimize the risk, namely PA1, Perform Shipping Efficiency by only doing 1x shipping of goods.

In the calculation phase of HOR 1, it was found that the most influential risk agent in the supply chain is A6, which is far distance, with ARP value of 438. It affects the number amount of shipping costs and the delay in the arrival of goods. After knowing the most influential risk agent, the author figures out some mitigation actions. At the calculation stage of HOR 2, the most effective result is found that PA1, which is doing efficiency on shipping by making only one shipment with effectiveness to difficulty ratio value of 1487.

5. Conclusion

It has been shown that the most influential risk agent in the supply chain is long distance traveled.

To do that in the future, companies should coordinate with suppliers so that they do not make separate shipments that may add the cost of shipping and cause delays in delivery.

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