Risk mapping and mitigation design of small and medium enterprises clothing products using supply chain risk management

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Abstract. To ensure the supply of clothing product from SMEs as the object of research in this article, efforts are made to anticipate the failure of supply chain activities so that future losses can be avoided. All causes of risk must be identified and measured so that risk mitigation can be developed. A House Of Risk approach (HOR) is used to identify risks at each stage of the Supply Chain Operation Reference (SCOR). Further identified the possibility of occurrence of risk (occurrence) and its impact (severity) with Failure Mode Effect Analysis (FMEA) model. Based on the level of risk can then be mapped the risk that ultimately can be determined risk mitigation. The identification process of HOR phase 1 found 24 risk events and 24 risk agents. The implementation of the second phase of HOR resulted in 14 mitigation actions to anticipate the occurrence of risks that would disrupt the supply chain activities of SMEs clothing products.

Keywords: Supply Chain Risk Management, Risk Event and Risk Agent, House Of Risk, Mitigation

1. Introduction
Micro and Small Medium Enterprises (SMEs) is one solution of economic problems in Indonesia, which until now has not been stable. SMEs are expected to reduce the number of unemployed in Indonesia. In terms of turnover generated contribution of SMEs apparel/fashion sector to the overall turnover of SMEs sales amounted to 30.8%, while the other 5 sectors only contributed an average of 14.0% such as food and beverage sector, services, production, and handicraft/craft [4].

There are some problems that the clothing industry of SMEs must face today. Although the government has tried to do the empowerment programs to the SMEs, especially on the issue of managing the supply chain and distribution network, as well as efforts to reduce the risks that may be faced by many SMEs. The role of SMEs clothing industry is very important in absorbing the weaving and knitting industry output. If the clothing market is disturbed, it will also disrupt the upstream industry of weaving and knitting, even fiber producers [6].

Various challenges must be faced by SMEs clothing industry on the one hand as well as the increasing number of clothing companies on the other hand, resulting in intense competition in the industry [6]. The performance of the clothing industry ultimately determines whether SMEs within the industry are well managed.
Thus, the research is interested to conduct mapping and mitigation the supply chain of SMEs clothing products. All the causes of risks that potentially disrupt the supply chain of SMEs can be mapped and mitigated by proactive action so that the cause of risk can be reduced or eliminated.

2. Literature Review

2.1 Supply Chain Management
Supply Chain Management in [3], [5], [16] states that the term distribution, logistics or supply chain management has the same meaning, that is the process by which companies move materials, components and products to customers.

Supply chain management builds upon this framework and seeks to achieve linkage and coordination between the processes of other entities in the pipeline, i.e. suppliers and customers, and the organisation itself. Thus, for example, one goal of supply chain management might be to reduce or eliminate the buffers of inventory that exist between organisations in a chain through the sharing of information on demand and current stock levels [16].

2.2 Supply Chain Risk Management
For other matters relating to risk, as states in [3], [8], [10] risk is an event that results in a loss when it occurs during a certain period. While likelihood is a qualitative explanation of probability and frequency [1]. International journal on Physical Distribution and Logistics Management, states that Supply chain risk management (SCRM) is the implementation of strategies to manage both everyday and exceptional risk along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity [16].

Supply chain risk management is collaboration with partners in supply chains to implement risk management processes to address the risks and uncertainties caused by logistic and supply chain activities [15], [17]. Meanwhile according to Hillman M and Keltz H [8] a common risk management processes of a company consists of four main activities : risk identification; risk assessment; decision making and implementation and risk supervision.

2.3 Supply Chain Operation Reference Model
Supply Chain Operation Reference Model (SCOR) is a reference model of supply chain operations. SCOR is basically a process-based model. This model integrates 3 main elements in management ie business process reengineering, benchmarking, and process measurement into the cross-functional framework in the supply chain [12]. The SCOR-model has been developed to describe the business activities associated with all phases of satisfying a customer’s demand. The Model itself contains several sections and is organized around the five primary management processes of Plan, Source, Make, Deliver, and Return [12].

2.4 Failure Modes and Effects Analysis
To help in identifying where the priority should be placed in supply chain risk management a useful tool is failure mode and effect analysis (FMEA). According to [12] FMEA is a qualitative analysis of risk identification and can be universally applied to various industries. FMEA is a tool that can be used by management in managing risk, especially for execution of the analysis phase, ie risk identification, risk assessment and measurement, and risk prioritization. Furthermore state by [12] risks in FMEA are evaluated in three components : severity, occurrence, and detection. These three components then are used in calculating the Risk Priority Number (RPN). FMEA uses the RPN to determine the risk priorities of failure modes [14].

3. Methodology

3.1 Design of Risk Mitigation Strategy
Standard framework of risk management is a modification of existing standards with the main reference standard AS/NZ 3460 [1]. While for the process of strategy design, it is done by developing
the House of Quality matrix (HOQ) to develop mitigation actions in dealing with potential risks arising from the supply chain. Risk Priority Number (RPN) calculation by FMEA method is to conduct risk Assessment in the House of Risk (HOR).

3.2 Risk Identification
The data input stage into the first phase HOR model is as follows:
1. Identification of business process/supply chain activity based on SCOR model.
2. Identify risk events for each business process identified in the previous stage.
3. Identify the level of impact (severity) of an occurrence of risk to the company's business process, the scale used is 1 – 10.
4. Identify the consequences (potential causes) of an event risk to the company's business.
5. Identification of risk-causing agents, i.e., what factors are causing the occurrence of identified risk events.
6. Identify the correlation between a risk event and the risk-causing agent. This correlation value is denoted by \( R_{ij} \), where \( R_{ij} \in \{0,1\} \), for \( R_{ij} = 1 \) then there is a correlation between the occurrence of risk to the agent risk \( i \) with risk agent \( j \) and \( R_{ij} = 0 \) then there is no correlation. This correlation value has a weight \( w \), where the greater the correlation between a risk agent and the risk event will be marked by a larger value scale. This weight represents how much a risk agent causes the occurrence of risk events. The scale used is 9 (the strong correlation), 3 (the correlation moderate), 1 (the correlation is weak) and 0 (when there is no correlation).
7. Identify opportunities for the occurrence of a risk agent. Opportunities for the occurrence of a risk agent state the magnitude of the probable value of an agent of risk which may cause disruption to a business process with a certain degree of impact. Scale 1 - 10 is used to indicate the probability of occurrence of an agent of risk.
8. Calculation of risk priority index value \( (P_j) \). This priority index will be used as a consideration for determining which risk agent priorities need to be designed for mitigation strategies. Determining the value of the risk priority index \( (P_j) \) from the risk agent using the following formula [6] :

\[
P_j = O_j \sum_{i=1}^{n} Si \times (R_{ij} x W_{ij}) \quad \forall j
\]

where:
\( j = 1, 2, ... m \); \( i = 1, 2, ... n \)
\( R_{ij} \) = correlation between the risk agent \( j \) and the risk event \( i \);
\( R_{ij} \in (0,1) \); is a binary function for \( R_{ij} = 1 \) if there is a correlation between the risk agent \( j \) and the risk event \( i \).
\( W_{ij} \) = the correlation weight between the risk agent \( j \) and the risk event \( i \).
\( O_j \) = Occurrence level of risk

\[
O_j = k \sqrt[O_j1 x O_j2 x ... O_jk} \quad \forall j
\]

where:
\( j = 1, 2, ... m \), \( k = \) assessment of person to \( k \).
\( S_i \) = Level of impact of a risk (severity level of risk).

\[
S_i = k \sqrt[Si1 x Si2 x ... x Si_k} \quad \forall i
\]

where:
\( i = 1, 2, ... n \), \( k = \) assessment of person to \( k \).
\( E_i \) = Risk Events (Risk Events) where \( i = 1, 2, ..., n \).
\( C_i \) = Potential causes of risk;
\( A_j \) = Risk agents (Risk agents) where \( j = 1, 2, ..., m \)
9. Aggregate calculation of potential risk agent \( j \) (ARP\(j\)).
Since a risk agent can induce or cause a number of risk events, it is necessary to quantify potential risk agents, or Aggregate Risk Potential (ARP). If \( O_j \) is the probability of the occurrence of the risk agent
j, Si is the severity of the impact if the risk event i occurs, and Rij is the correlation between the risk agent j and the risk event i (which is defined as how likely the risk agent induces/causes the risk agent i, ARPj (potential aggregate risk agent j) can be calculated as follows:

$$\text{ARP}_j = O_j \sum_i S_i R_{ij}$$  \hspace{1cm} (4)

3.3 Second Phase HOR

Stage of second phase HOR model process (HOR-2) of risk handling is as follows [6]:
1. Select a number of high priority ranking risk agents using Pareto analysis of ARPj.
2. Identify actions deemed relevant to prevent risk agents or Preventive Action (PA).
3. Determining the relationship between each precaution and each risk agent, Ejk. The values can be {0, 1, 3, 9} representing each, 0 = none, 1 = low, 3 = medium, and 9 = high relation between action k and agent j. This relationship (Ejk) can be considered as the level of effectiveness of action in reducing the likelihood of risk agent j.
4. Calculate the total effectiveness (TEk) of each action as follows [6]:

$$\text{TE}_k = \sum_i \text{ARP}_j \cdot E_{jk} \hspace{1cm} \forall k$$  \hspace{1cm} (5)

5. Assess the difficulty level (Dk) in performing each action, and place the values in a row below the total effectiveness. The degree of difficulty, which can be represented by a scale (such as Likert or other scale), must reflect the funds and other resources needed to take action.
6. Calculate the ratio of total effectiveness to difficulties (ETDk) [6], ie:

$$\text{ETD}_k = \frac{\text{TE}_k}{\text{D}_k}$$  \hspace{1cm} (6)

7. Establish a priority ranking for each action (Rk) in which the first rank is awarded for the highest ETDk action.

3.4 Risk Mapping and Assessment

A Sample Risk Matrix (Risk Map) introduced by the Airport Handling Manual in its 33rd edition in January 2013 shows an overview of Likelihood or Probability of an Accident or Damage on the impact of Severity or Scope of Damage. Risk Map describe the Likelihood or Probability of an Accident or Damage given levels such as; often, occasionally, possible, unlikely and practically impossible, whereas on Severity or Scope of Damage is given a level like; insignificant, minor, moderate, critical, and catastrophic.

After risk mapping is done, the next step is to analyze or determine the level of risk identified. Efforts taken to define the risk level are as follows:
1. Determine the possibility of risk occurs with the following standards:
   - The likelihood is enormous: it is certain that it will be possible to affect a strategic objective with a potential risk value ranging above 80%.
   - Most likely: most likely to affect a strategic goal with a potential risk value occurring in the range of 60% to 80%.
   - Moderate possibility: the likelihood of risk occurring to affect a strategic goal with a potential risk value occurring in the range of 40% to 60%.
   - Possibilities are small: a small risk may occur to affect a strategic objective with a potential risk value occurring in the range of 20% to 40%.
   - The likelihood is very small: the possibility of very little risk can occur to affect a strategic goal with a probable risk value of less than 20%.
2. Determine the impact of risk with the following benchmarks:
   - The impact is insignificant: the risk has very little effect on a strategic goal, but strategic objectives can still be achieved.
   - Minor impact: risk has little influence on a strategic objective and requires little handling.
   - Medium impact: risk has a moderate effect on a strategic objective and requires considerable effort to deal with it.
• Large impact: risk has a major impact on a strategic goal and requires serious handling
• Disaster impact: risk has the effect of not meeting a strategic goal and requires very serious effort to deal with it.

4. Results and Discussion

In the design of supply chain mitigation of SMEs Clothing, HOR tool model applied for strategic planning which is divided into 2 (two) process: the first phase of HOR-1 is to conduct a risk identification and Assessment process and the second phase HOR (HOR-2) is to mitigate/manage risk.

4.1 Risk Events (risk agent)

The results of interviews and questionnaires to identify risks were obtained 24 (twenty four) risk events consisting of (see Table 1):

- In the Plan of SCOR business process: 3 risk events
- In the Source of SCOR business process: 5 risk events
- In Make of SCOR business process: 7 risk events
- In the Deliver of SCOR business process: 5 risk events, and
- In business process Return of SCOR: 4 risk events.

4.2 Impact of Risk Events (Severity)

Each risk event can be identified by estimating the magnitude of the disturbance it generates, assessing the impact of a risk event using a Likert scale of 1 to 10 and converted into the unit of costs/losses incurred when the risk event occurs, and the determination the value of the impact of these risk events is done on the entire business process. The result can be seen at Table 1.

4.3 Correlation (Rij) Risk Occurrence (Ei) and risk agents (Aj)

Furthermore, it is still in the process of identifying the HOR-1 model on the relationship/correlation between 24 risk events and 24 causes of risk. To simplify and accelerate the calculation of all correlation values of risk agents and risk events, a matrix was designed as mentioned before. The values listed in the matrix use a scale of 0, 1, 3, and 9 which states that there is no correlation, weak correlation, moderate correlation, and strong correlation. The results are shown in Table 1.

4.4 Opportunity and frequency of Occurrence

The appearance of each risk agency was identified on 20 SMEs that were sampled. The chance of occurrence of a risk agent on a single SME can vary in frequency or how many times to other SMEs. Let's say the risk agent A1 can appear twice on SME1, whereas in SME3 it can appear three times.

Externally, it may be that market research is inaccurate, and internally SMEs make purchasing planning materials excessive or lack of needs. There is no plan of ordering/purchasing the optimal materials. Such risk agents will certainly lead to other risk events such as excessive material inventory, increased cost of ownership and material storage costs that will eventually increase production costs. While the cost of production exceeds the optimum limit, only losses earned by SMEs business of clothing products.

4.5 Priority Index Assessment

This priority index is calculated in aggregate so it is denoted by ARPj (Aggregate Risk Potential) performed on each risk agent throughout the SME business process of the clothing product. The correlation of Ei and Aj as well as the frequency of occurrence of a previously identified risk agent will complement the calculation of the ARPj value indicating which risk agency priority index will be mitigated in order to reduce the risk of SME supply chain of clothing products, Table 2.
Table 1. Matrix Model HOR-1 Risk Identification

| SCOR CODE | Causes/Risk Agent (Aj) | Severity of Risk Event (Si x Rij) | Si x Rij |
|------------|------------------------|----------------------------------|----------|
| E1         | 9 9 0 1 3 3 3 9 0      | 1 1 9 1 9 0 3 1 0 1            | 1 3 198  |
| E2         | 9 9 0 3 1 3 9 9 0      | 0 0 0 0 1 1 9 1 3 0 3 1 9 3 6 456 |
| E3         | 0 0 9 0 1 1 1 3 9 3 9 9 0 3 0 0 0 1 1 1 3 1 1 1 1 4 232 |
| E4         | 3 9 1 9 9 3 9 3 1 9 3 1 9 3 0 1 1 3 1 3 3 3 9 6 498 |
| E5         | 1 3 1 3 9 9 9 1 1 0 0 0 1 3 3 3 1 9 1 3 3 1 3 1 3 6 420 |
| E6         | 1 3 1 3 9 9 3 9 3 1 9 1 1 9 3 1 1 3 0 9 3 3 1 3 9 3 285 |
| E7         | 3 3 1 3 9 9 9 9 1 1 1 1 1 1 1 9 3 9 3 3 1 3 9 3 5 460 |
| E8         | 3 9 1 9 9 3 9 9 0 0 0 3 1 0 0 9 1 3 1 3 9 1 3 1 6 528 |
| E9         | 1 1 1 1 1 1 9 1 3 1 0 0 3 1 1 9 0 1 3 9 9 3 201 |
| E10        | 0 0 9 0 0 1 0 0 3 9 9 3 3 1 3 1 0 3 0 9 3 3 0 0 0 2 114 |
| E11        | 1 1 3 0 0 0 0 0 0 0 1 9 0 1 9 1 3 0 9 1 3 1 1 0 0 2 88 |
| E12        | 0 0 1 0 0 0 0 0 0 3 1 3 9 9 3 0 0 0 3 0 0 0 0 0 3 9 6 3 |
| E13        | 1 1 3 1 1 0 1 1 0 0 1 3 9 3 0 0 0 1 3 1 1 1 0 1 3 8 288 |
| E14        | 1 1 3 1 1 1 1 1 1 3 3 9 3 3 9 3 9 1 9 1 3 1 1 1 3 4 296 |
| E15        | 3 1 1 3 1 3 3 3 1 1 3 1 1 1 1 9 3 1 3 1 3 1 1 1 1 3 150 |
| E16        | 1 1 3 1 1 3 3 3 3 3 9 3 3 3 9 1 3 1 3 1 3 1 9 9 5 450 |
| E17        | 3 3 0 3 9 9 9 9 1 1 3 1 3 3 3 1 1 9 3 9 3 3 1 3 0 2 170 |
| E18        | 9 3 1 3 3 3 9 9 0 0 1 3 1 3 1 3 3 3 3 3 3 3 3 9 0 3 6 492 |
| E19        | 1 1 3 1 1 1 1 1 3 3 9 1 1 0 0 3 0 3 9 3 1 9 0 0 2 110 |
| E20        | 3 3 0 1 3 3 3 3 0 0 3 0 1 0 0 0 3 3 1 9 3 3 1 1 2 94 |
| E21        | 1 3 0 1 1 3 3 3 3 0 1 3 1 3 1 3 3 3 1 3 3 3 3 9 3 6 456 |
| E22        | 1 3 1 3 3 9 9 3 3 3 3 3 0 0 1 3 1 3 3 3 3 3 3 3 3 3 3 3 6 492 |
| E23        | 9 9 1 1 1 1 1 1 0 3 3 3 3 9 1 3 3 3 3 3 3 3 3 3 3 3 3 3 249 |
| E24        | 3 3 1 3 3 1 9 3 3 0 1 1 1 3 3 1 3 3 3 3 3 3 3 3 3 3 3 3 225 |

(0j) 3 3 2 3 3 4 4 4 4 3 3 3 4 4 4 3 3 4 3 4 3 3 4 3 3

(ARPj) 594 1368 464 1494 1260 1140 1840 2112 603 456 352 384 664 888 450 1800 680 1968 330 376 1368 972 747 675

Rank 17 6 18 5 8 9 3 1 16 10 23 21 12 11 20 4 14 2 24 22 7 10 13 15

4.6 Risk Mitigation Process

Risks to be mitigated by applying this HOR-2 model are the high-value, pre-calculated risk agents ARPj in the HOR-1 process. The results of the calculation of 24 ARPj items that have been ranked in rank from 1 to rank 24, starting from the largest ARPj value as the 1st rank and the smallest ARPj as the 24th rank.

In order to suppress the risk agent that incurs a risk event, it is necessary to design a Preventive Action step for each selected risk agent (14 risk agents) and determine how strong the correlation is with the designed precautions, then using the 0, 1, 3, and 9 correlation values are obtained. A matrix of HOR-2 model is built so as to make it easier to calculate the total effectiveness of each action using the sum total formula of multiplication between the ARPj value and the correlation value Ejk. Similarly, the assessment of difficulty level (Dk) applying preventive action using Likert scale. From both the total value of effectiveness and the level of witness of the implementation of preventive action can be calculated the ratio of total effectiveness of ETDk.

Then rank the priorities of each action (Rk), the action with the highest ETD is the first rank in this case where the 9th Preventive Action or PA9 (choose qualified suppliers) to the first rank with the value ETDk = 20520 and so on for other PA. Furthermore, this risk mapping is intended for the purpose of identifying various risks that could occur and could potentially threaten for the purpose of the realization of SMEs vision and mission of the apparel product itself.

To prepare mitigation actions in handling potential risks in the supply chain, design process is carried out using the second phase of the House Of Risk matrix (HOR-2). Selecting several risk agents from HOR-1 with high values to be handled is using the Pareto Diagram for ARPj to be followed up.

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on HOR-2. A\text{j} risk agents with ARP\text{j} values are each ranked from the largest value to the smallest value, then calculated the percentage value of each ARP\text{j} to the total ARP\text{j} and then the percentage is cumulatively up to 100%. The Pareto Diagram can be constructed as seen in Figure 1 and Matrix Model HOR-2 Risk Mitigation rank, Table 2.

![Figure 1. Pareto ARP\text{j} Diagram of All Risk Agents](image)

**Table 2. Matrix Model HOR-2 Risk Mitigation Rank**

| Code | Cause of Risk (A\text{j}) to be treated | PA 1 | PA 2 | PA 3 | PA 4 | PA 5 | PA 6 | PA 7 | PA 8 | PA 9 | PA 10 | PA 11 | PA 12 | PA 13 | PA 14 | ARP\text{j} |
|------|----------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|
| A8   | Supplier stock is reduced              | 9    | 0    | 9    | 0    | 3    | 9    | 3    | 3    | 3    | 1    | 0    | 0    | 1    | 3    | 2112     |
| A18  | Worker's inaccuracy                    | 1    | 9    | 0    | 3    | 0    | 1    | 0    | 0    | 0    | 3    | 0    | 3    | 1    | 1    | 1968     |
| A7   | Supplier capacity fluctuates            | 3    | 0    | 9    | 0    | 9    | 9    | 1    | 3    | 3    | 0    | 0    | 0    | 1    | 3    | 1840     |
| A16  | Non-standard packaging                  | 0    | 3    | 0    | 9    | 1    | 0    | 1    | 0    | 1    | 3    | 1    | 1    | 0    | 0    | 1800     |
| A4   | Capacity of domestic suppliers          | 3    | 0    | 3    | 0    | 9    | 3    | 1    | 3    | 3    | 0    | 1    | 0    | 1    | 3    | 1494     |
| A2   | Rising material prices                  | 9    | 0    | 3    | 0    | 1    | 9    | 1    | 1    | 3    | 1    | 0    | 0    | 0    | 3    | 3    | 1368     |
| A21  | Information delays                      | 1    | 0    | 1    | 1    | 1    | 9    | 0    | 1    | 0    | 1    | 1    | 3    | 3    | 1    | 1368     |
| A5   | Dependence on one supplier              | 9    | 0    | 1    | 0    | 3    | 9    | 1    | 9    | 9    | 3    | 0    | 0    | 1    | 3    | 1260     |
| A6   | Supplier not qualified                  | 3    | 0    | 3    | 0    | 3    | 9    | 1    | 3    | 9    | 1    | 0    | 0    | 1    | 3    | 1140     |
| A22  | Delivery process error                  | 1    | 3    | 1    | 1    | 1    | 3    | 0    | 0    | 3    | 9    | 1    | 0    | 0    | 1    | 972      |
| A14  | Warehouse condition is not feasible     | 1    | 0    | 0    | 1    | 1    | 3    | 0    | 0    | 0    | 0    | 0    | 9    | 3    | 0    | 1    | 888      |
| A13  | Fire hazard                            | 3    | 9    | 1    | 1    | 0    | 3    | 3    | 1    | 1    | 1    | 1    | 9    | 0    | 0    | 854      |
| A23  | Behind the fashion                      | 1    | 1    | 0    | 0    | 0    | 3    | 9    | 0    | 3    | 3    | 0    | 0    | 9    | 1    | 747      |
| A17  | Late ordering of ingredients            | 9    | 1    | 1    | 0    | 1    | 3    | 1    | 3    | 3    | 3    | 3    | 0    | 0    | 0    | 9    | 680      |

| TE\text{k} | 92928 | 43296 | 75440 | 36000 | 44820 | 46512 | 31464 | 60480 | 41040 | 23328 | 16872 | 28182 | 22410 | 23120 |
| D\text{k}  | 7     | 3     | 8     | 5     | 9     | 7     | 4     | 3     | 2     | 2     | 5     | 4     | 6     | 2     |
| ETD\text{k} | 13275 | 14432 | 9430  | 7200  | 4980  | 6644.6 | 7866  | 20160 | 20520 | 11664 | 3374.4 | 7045.5 | 3735  | 11560 |
| R\text{k}  | 4     | 3     | 7     | 9     | 12    | 11    | 8     | 2     | 1     | 5     | 14    | 10    | 13    | 6     |
In order to map the risk agent to the extent of the level of impact it can cause when the risk agent occurs, it can be seen the result showed at Table 3 as follows:

a. which is included in the extreme impact level are: A8 (supplier stock is reduced) and A16 (non-standard packaging), which is marked in red.

b. which is included in the high impact level are: A22 (delivery process error), A18 (Employee's inaccuracy), A6 (Supplier not qualified), A7 (Fluctuating Supplier Capacity), A4 (Capacity of Domestic Supplier), A21 (Delay Information), and A5 (Dependency on one supplier), marked with yellow.

c. which is included in the small impact level are: A2 (high material prices), A13 (Fire hazard), A17 (Late ordering of ingredient), marked in blue.

d. which is included in the low impact level are: A14 (Warehouse condition is not feasible), A23 (Behind the fashion), marked in blue.

| Table 3. Risk Mapping |
|-----------------------|
| **Likelihood level**  |
| **Level of impact**   |
| 1                     |
| Not Significant       |
| 2                     |
| Minor                 |
| 3                     |
| Medium                |
| 4                     |
| Mayor                 |
| 5                     |
| Disaster              |
| (E) Very Large        |
| A22                   |
| A8, A16               |
| (D) Large             |
| A18                   |
| A6                    |
| (C) Medium            |
| A2, A13, A17          |
| A7, A4                |
| (B) Small             |
| A14, A23              |
| A21, A5               |
| (A) Very Small        |

One of the objectives of this research is to prepare risk mitigation at each risk agency. Risk mitigation is prepared especially in the group of risk agents included in the extreme and high impact levels. Both of these impact levels require risk mitigation prepared to avoid risk occurrence by any risk agent. The recommended series of risk mitigation in the red, yellow, moderate and low groups can be seen in Table 4.

| Table 4. Risk Mitigation Plan |
|------------------------------|
| **Risk**                     |
| **Level of Risk**            |
| **Risk Mitigation Plan and Recommendations** |
| Supplier stock is reduced   |
| Extreme                     |
| Provision of sufficient stock |
| Worker's inaccuracy         |
| High                        |
| Train workers regularly     |
| Supplier capacity fluctuates|
| High                        |
| Ensuring supplier capacity  |
| Non-standard packaging      |
| Extreme                     |
| Application of packaging standardization |
| Capacity of domestic suppliers|
| High                        |
| Increase supplier capacity  |
| Rising material prices      |
| Moderate                    |
| Prepare optimal inventory   |
| Information delays          |
| High                        |
| Improved information system |
| Dependence on one supplier  |
| High                        |
| Increase the number of suppliers |
| Supplier not qualified      |
| High                        |
| Selecting qualified suppliers|
| Delivery process error      |
| High                        |
| Implement SOP submission    |
| Warehouse condition is not feasible|
| Low                         |
| Warehouse layout setup      |
| Fire hazard                 |
| Moderate                    |
| Safety training             |
| Behind the fashion          |
| Low                         |
| Market research periodically|
| Late ordering of ingredients|
| Moderate                    |
| Calculates ROP materials    |

5. Conclusion

After assessing and mapping the risks of SMEs clothing products, the risk mitigation plan is prepared by taking into account the risk agents and their risk levels. The process and outcome of risk mitigation is then discussed with the SME players in the apparel product to verify and validate. Verification and
validation of the risk / reward mitigation plan is particularly important if it is to be implemented. SME players in clothing products can see whether the recommendations can reduce or even eliminate the causes of risk in the supply chain.

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