Supply Chain Risk Management in competitiveness
Indications of Small and Medium Entrepreneurs (SMEs) in Thailand

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The paper aims to study and analyse supply chain risk management of Small and Medium Entrepreneurs (SMEs) in Thailand. The SMEs involved supply chain management were reviewed to evaluated on risk and impacted to organization. The top three of risk factors include the risk of inaccurate demand forecasts, production capabilities and capacity and inability to handle volume cannot delivery not fulfilling the customer demand and we can categorize of risk are manufacturing risk, demand risk and supply risk based on the Analytical Hierarchy Process (AHP). Also we will manage risk effected to efficiency of supply chain reduce or eliminate waste by apply Engineering management and Industrial engineering tooling technique to we implement in the competition improvement in SMEs.

Keyword. Supply chain risk management (SCRM) Small and Medium Enterprise (SMEs) Entrepreneurs Competitive Analytical Hierarchy Process (AHP)

1. Introduction
Supply chain management competence and performance of Entrepreneur Anari (2013) described that in order to gain competitiveness fives steps such as innovativeness risk taking, pro-activeness, relational capital and coordinate capacity. Fenollera (2011) described that the adaptation of the SMEs to the project management institute (PMI) standard for project management and specifically for risk management. The risk management approach undertaken is described with the characteristic feature of a SMEs stage of the process people implied with their roles and responsibilities.
implemented activities used metrics conducted monitoring and control. Supply chain risk management (SCRM) has become an essential issue for supply chain management. Tummala (2011) described that the supply chain risk as comprised of demand risk delay risk disruption risk inventory risk manufacturing risk breakdown risk physical plant (capacity) risk supply (procurement) risk system risk sovereign risk and transportation risk. For example, the flood of Thailand in 2011 caused serious damage to material of suppliers. These suppliers were unable to fulfill all customers’ order on time during the floods. This was a typical supply chain risk cause by natural disaster. This research considers the SCRM in the SMEs in evaluation and selection. In order develop a SMEs risk selection this research propose a modified risk management process which integrated the AHP methods to construct a weight of risk and their effects on the system in risky supply chain environment. This research will assist SMEs in improving. The operation to eliminate selecting and evaluating SMEs. Finally the SME can plan the prevent strategies to risk factors are identified and the result are discussed and summarized.

2. Conceptual Research Framework
Risk management concept in the supply chain can be defined as exposure to the risky event that have negative impact to the supply chain operability and performances such as delivery on time cost service level, order fulfilment or possibility of the quick or fast responsiveness to customer. The risky event that can affect supply chain operability is very large going from external risk factors (e.g. Nature Political system competitor and market risk) to inter-organization or intra-organization internal risk factors (e.g. Available capacity internal operation and information system risks) (Olson and Wu (2010)) Form the logistic point of perspective, the interaction among supply chain members becomes more and more complex due to the growing uncertainly as a result of the new business model applied to increase logistic efficiency and competitiveness.

Therefore, with main risk sources in the supply chain the following types of interaction can be identified:
1. Occurring between supply chain members and the environment
2. Occurring between individual members inside the supply chain

The traditional method of supply chain risk management requires the engagement of addition material and time. However, what the SMEs really need in the supply chain proactive of risk management. When considering of risk management making decision on appropriate
measures for risk treatment and performing their implementation among member. They become obvious complex tasks even though within the supply chain a consistent risk management policy is present. In the supply chain an inspect entity can develop and appropriate risk management program providing risk assessment by continual monitoring and mitigation. However, before SMEs can set methodology for risk mitigation Entrepreneur have to understand the risk categories events the conditions the generate supply chain risks categories (Table 1). Therefore using knowledge about the risk factors the SMEs can choose the most efficiency risk mitigation strategy. The mitigate risks by intelligent positioning and dimensioning without profit reduction is a great challenge for Entrepreneur’s management.

**Supply Chain Risks Categories and their Drivers**

Before Entrepreneur can devise effective means of reducing supply chain risks, Entrepreneur must first understand the universe of risk categories as well as the events and categories as well as the events and conditions that drive them. Then armed with clear specific knowledge about these crucial risk can processed to selected and tailor mitigation strategies likely to be most effective.

![Supply Chain Risk Management Process (SCRMP)](image)

**Figure 1. Supply Chain Risk Management Process (SCRMP)**

### 3. Literature Review

Supply chain management (SCM) has been a major of competitive strategies to enhance organization productivity and profitability. In 1999, (Beamon, 1999) suggested a system of three dimensions: resource (i.e. efficiency of operations) output (i.e. high level of customer service) and flexibility (i.e. ability to respond to a changing environment). (Persson and Olhanger (2002)) follow up to this three dimensions system again. Based on result of a simulation model they concluded that good quality and short lead times in integrated and synchronized supply chains lead to superior performance. The pay-off in terms of total cost is more than proportional to the improvements in quality and lead times. (Gunasekaran et al, (2001) reviewed the literature of performance metric of supply chain and concluded

### Table 1: Supply Chain Risks Categories (Adapted from William Ho (2015))

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk Type</th>
<th>Impact</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>Shortage</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Material shortage</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Suppliers</td>
<td>Inability to deliver</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Financial</td>
<td>Overhead costs</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Security</td>
<td>Theft</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

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the there is still a lack of a balanced approach with regards to financial as well as non-financial indicators and the number of performance indicators to be used. Furthermore, no distinction is made between indicators of operational, tactical and strategies level. In their work, (Gunasekaran et al, (2001)) developed a conceptual model for supply chain performance at three levels: strategic, tactical and operational. There seems to be consensus about the fact that no supply chain measurement system exist that is inclusive, universal and measurable as well as consistent. (Gunasekaran et al, (2004)) developed framework to promote the better understanding the importance of SCM performance measurement and metrics four major supply chain activities process (plan, source, make/assemble and delivery). These metrics were classified at strategic, tactical and operational to clarify the appropriate level management authority and responsibility for the performance. (Kumar et al, (2015)) developed successful of supply chain management (SCM) to Indian SMEs for over their competitors. SMEs found problems lack of resources and direction. The purpose of 13 critical of success factors (CFSs) for implementation of SCM in SMEs and studies their impact on performance of SMEs.

**Table 2**: Critical Success Factors (CSFs) impacted on SME performance (Adapted from Kumar et al, (2015)).

<table>
<thead>
<tr>
<th>Ability</th>
<th>Critical Success Factor (CSF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical adequacy (T1)</td>
<td>High (H1), High (H2)</td>
</tr>
<tr>
<td>Managerial adequacy (S1)</td>
<td>High (H1), High (H2)</td>
</tr>
<tr>
<td>Information (I1)</td>
<td>High (H1), High (H2), High (H3)</td>
</tr>
</tbody>
</table>

Risk management is important step in supply chain risk management (Fenollera, 2011). For example (Wu et al, (2006)) use the analytical hierarchy process (AHP) to assess supply risk. They considered six factors of risk : internal controllable internal partial controllable external partial controllable external partial controllable. Through the supply evaluation SMEs could understand its supply risks based on each factor and decide which SMEs was the most preferred. The research adopted the AHP method to evaluate the weight of its main objectives (such as demand risk manufacturing risk and supply risk). Based on the weight of the three risk factors. Therefore the risk management could help assess the risks and provide the Entrepreneurs with guideline for improvement.

**Table 3**: Supply Chain Risks Categories (Adapted from Kilubi & Haasis (2015))

**Table 4**: Supply chain risk types identified by researcher (Adapted from William Ho (2015))
3. Research methodology and the case company

This paper put forward the experience gathered from adaptation of the risk management to SMEs from Thailand. It specifically deals with the different risk management. The researcher object of study is SMEs for 4 steps detail as bellows,

**Step 1 : Identifying the needs of SMEs group**

In the process of SMEs selections, SMEs need and risks need to be considered. This Research proposes five-step SMEs selection framework (Figure 2) This project begins when the researcher consider selecting reduce the supply chain risk of the case SMEs and case study for 3 SMEs-A, B and C in the market.

SMEs – A was established in the 1970s . It was subsidiaries in Nakhon Pathom. The main products of SMEs are automotive parts such as clutch and disc brake. Where its productive unit and head office stand on a large area of 20,800 m2

SMEs – B was established in the 1990s . It was subsidiaries in Bangkok. The main products of SMEs are stamping for electric parts.

SMEs – C was established in the 2000s . It was subsidiaries in Samut Prakarn. The main products of SMEs are produce screw bolt and nut for support all markets.

**Figure 2. A decision-making framework of SMEs selection**

**Step 2 : Setting tool for SMEs selection**

Once the needs of the SMEs have been identified the case company by select from supply chain risk assessment.

**Step 3 : Determining criteria for SMEs selections**

This case SMEs considers risk in Supply chain such as Demand risk, Manufacturing risk, Supply risk, Transportation risk, Information risk and financial risk. Questionnaire for asking SMEs can categories of risk 6 risks or criteria and 112 sub-criteria.

**Step 4 : Conducting the risk management method**

Before conducting the risk management method, the researcher will send questionnaire to SMEs and get feedback from them about risk criteria and cause weighting each criterion based on its importance: This research adopts the AHP method (Saaty, 1990) to determine the weight of each criterion. The AHP method is developed by Thomas L. Saaty in the
1970s and can be applied to solve complex decision making problems. For the other 6 criteria, $\lambda_{\text{max}}$ is calculated by Eqs. (2) and (3). Consistency index (C.I.) is calculated by Eq. (4) where $n$ is the number of criteria. The value of random index (R.I.) is based on the number of criteria. Consistency ratio (C.R.) is calculated by C.I. divided by R.I. The value of C.R. must be less than 0.1, which means the consistency of comparisons among criteria. Further, the results of the AHP method are shown in Table 4.

$$w_i = \frac{(\prod \lambda_i)^{1/n}}{\sum (\prod \lambda_i)^{1/n}} \quad \forall i = 1, 2, .. n$$  \hspace{2cm} (1)

$$\lambda_{\text{max}} = \frac{\sum \lambda_i}{n}$$ \hspace{2cm} (2)

$$C.I. = \frac{\lambda_{\text{max}} - n}{n-1}$$ \hspace{2cm} (3)

$$C.R. = \frac{C.I.}{R.I.}$$ \hspace{2cm} (4)

Figure 3. Hierarchy model to prioritize risk assessment tools

Sorting each criterion by weight : for all sub-criteria , a higher weight means the higher priority of the criterion need to be improved questionnaire for comparison matrix of the main criteria of risk factors as shown in table 7.

Table 5 : Pairwise comparison matrix of the main criteria of risk factors

5. Discussion

5.1 Categorization with SMEs

Base the above analysis (Table 5) the research the case Entrepreneurs selected SMEs C which has the highest supply chain risk? Although SMEs B and A is lower than SMEs C. This indicator that collaborating with SMEs A and C enables the case SMEs operate in the low-risk supply chain environment than SMEs B.

Table 6 : Weight of top 3 criteria of SMEs A, B and C

5.2 Selection SMEs management

Step 5 : Categorizing high risk SMEs

When the case SMEs selected by 3 mains criteria and 3 criteria need to be considered. Since each criterion is related to the others traditional risk management cannot predicted the total supply chain risk and difficult to evaluation and set rank of priority of risk. Therefore, this research integrates the risks of each criterion and sub-criterion into the AHP method. More specifically this SMEs selection system considers each elements of criterion has several to be measured each criterion as well as weight of criteria and sub-criteria. In this research SMEs B is categorized as a high risk and SMEs A and SMEs B performance should be reviewed periodically and
poor performance need to be encouraged must need improvement of supply chain risk management and must be warned or eliminated of risks.

Table 7: The comparison among three SMEs

<table>
<thead>
<tr>
<th>SME</th>
<th>Risk factors</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Risk</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>B</td>
<td>Risk</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>C</td>
<td>Risk</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

5.3 Practical SMEs management

With the design of the supply chain risk management plan described, the following activities have been targeted: risk management planning by identification qualitative analysis and quantitative analysis of risk planning of response of risk management has been implemented obtained diverse template and deliverables application. This has led to avoid and minimize those of event with negative impacted on the current and to take advantage of positive. The results obtained based in the currents previous considerations are shown in table below:

Table 8: Recommendations for the SMEs

<table>
<thead>
<tr>
<th>SME</th>
<th>Recommendations for sub-criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Recommended for improvement</td>
</tr>
<tr>
<td>B</td>
<td>Recommended for improvement</td>
</tr>
<tr>
<td>C</td>
<td>Recommended for improvement</td>
</tr>
</tbody>
</table>

Table 9: Results

As it can be verified in Table 9, the sub criteria need to method for risk treatment after improvement. This methodology also provides many of the tools and technique needed to manage successful of apply risk management to supply chain.

6. Conclusion

Supply chain is one the most important and critical factors within different industries such as manufacturing of SMEs therefore, investigating its risk in supply chain risk anagement has been considered as important subject. First it develops a SMEs selection framework (Fig. 2) with incorporates the risk and AHP methods. The proposed AHP method selects 6 criteria and 112 sub-criteria to assess the weight of three lead SMEs. Then this study applies the AHP method to determine weight to each criterion and sub-criterion. As a result SMEs selected categorized as need for improvement such as quality delivery and cost. On the other hand AHP ranking Lean manufacturing tool such as using Value stream mapping (VSM) Toyota Production Systems (TPS) or all simulations are some kinds of common and popular practices that are employed in supply chain risk management.

Finally, this result suggestion three directions for future research:

1. SMEs evaluate criteria play important roles in the SMEs selection process. How to choose appropriate SMEs’s criteria complicated. Future
research should pay more attention to the criteria of SMEs selection for different industries.

2. Other than The AHP method other approach such as the fault three analyze or another method are offend used for SMEs selection. Other approach for the risk assessment can be applies to see if they can generate similar result in the future.

3. Risk assessment selection now I making software risk management tool using in Supply chain risk management for quick and easy to summarized criterion and sub-criterion. It can show color for high weight will show in red and more it will have comparing between same industries or other industries. Next it will show by graphic and dashboard for easy to understand and improvement.

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