A CASE STUDY OF RISKS PRIORITIZATION USING FMEA METHOD

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Abstract

Nowadays, Customers are placing tremendous pressure on vendor companies for high quality, reliable products. The rising capabilities and functionality of many products are creating it additional complex for producer to keep up the quality and reliability, which not only satisfies him but also delights him. Considerable research has been carried out and literature available in the field of Supply Chain Management since 1990. Successful supply chains use integrated measurement systems as a tool to achieve their organizational objectives. A comparative analysis of various risks factors reduces the chance of its occurrence. It indicates that validity of many of the measurement frameworks need to be established through further study. The process of choosing appropriate supply chain performance measures is difficult as a result of the complexity of these systems. The main motive of this paper is risk Prioritization using FMEA method, which are more severe for the Company.

The vital motive of this analysis to review the literature in the field of various risk factors for supply chains to understand current practices and to help Industry to sustain its continue win in flat market where the competition is slit throat in current market.

To accomplish this objective following steps have been performed:

1) Literature review on supply risk as well as FMEA Method

2) SMEs (Subject Matter Experts in industry) inputs

3) A Failure Mode and Effects Analysis (FMEA) method is being used for getting risks Prioritizations.

Index Terms- Supply Chain, FMEA, RPN, Risk, Supply Chain Management, Prioritization

FMEA= Failure Mode and Effects Analysis

RPN= Risk Priority Numbers.

I. INTRODUCTION

Risk management is a critical component of strategy development and execution, and a driver of firm success. A survey of researchers found that 74.2% of respondents believe supply chain risk management (SCRM) is a subset or extension of ERM (Sodhi et al., 2012). While there has been an increasing amount of SCRM research, there is no consensus on the definition or scope of SCRM (Sodhi et al., 2012). For example, a three-step SCRM process has been proposed: (1) specifying sources of risks and vulnerabilities, (2) assessment, and (3) mitigation (Kleindorfer and Saad, 2005). Other researchers proposed a four-step processes (Hallikas et al., 2004; Juttner et al., 2003), while others propose a five-step process (Manuj and Mentzer, 2008). Though common elements appear across all these frameworks, there is not yet agreement on what components and definitions constitute a "standard" SCRM process.

Failure Modes and Effects Analysis (FMEA) is a technique for evaluate possible reliability troubles in the early hours at the progress cycle where it is simpler to acquire actions to overcome these matters, thereby improving consistency through design. FMEA can be apply to recognize probable failure modes, conclude their effect on the process of the product, and categorize actions to diminish the failures. A vital step is anticipating what might go incorrect with a product.

Whereas anticipating each failure mode is not possible, the improvement squad ought to invent as extensive a record of likely failure modes as probable.

Near the beginning and steady use of *FMEAs* in the design process let to the engineer to drawing out failures and manufacture dependable, protected, and customer satisfying goods. *FMEAs* also carry chronological information for use in upcoming product development.

In this paper, presenting a model for prioritizing risk in supply chains based on the Failure Mode and Effects Analysis (FMEA) method. The FMEA supports managers in prioritizing the risks, put all the risk on severity scale to identifying risk optimization requirement. It is followed by the discussion of FMEA methodology and prioritization of factors for coordinated supply chain. Eventually, it discusses results and conclusion.

II. METHOD AND PROCEDURE

In this Paper, FMEA (Failure Mode and Effects Analysis) methodology has been applied to the evaluation of risk related to supply chain management in a manufacturing firm. Five risks for the company are evaluated and defined. The criteria weights can be more precisely defined in a scale of 1 to 5.where 5 is highest and 1 is lowest.
FMEA is the methodology designed to identify potential failure modes for a product or process before the problems occur, to assess the risk. Ideally, FMEA's are conducted in the product design or process development stages, although conducting an FMEA on existing products or processes may also yield benefits.

For calculating the risk Prioritization in *FMEA* method, Risks have been evaluated by set of Questionnaire respond from SME (Table 1).Risks have been evaluated in three components which are multiplied to produce a Risk Priority Number (*RPN*):

1) Severity (*S*): Severity is described on a 5-point scale where 5 is highest.
2) Occurrence (*O*): Occurrence is described on a 5-point scale where 5 is highest.
3) Detection (*D*): Detection is described on a 5-point scale where 5 is highest.

RPN= S*O*D.

Note: All the Calculations/Tables are below in Appendix

III.RESULT ANALYSIS

The FMEA method in this study is formed to prioritize the various risks within the organization. As per this method first priority considers the severity of risk and then Occurrence of that risks comes in precedence, last but not least is Detection of risk. Higher the RPN value, higher the priority of risk. Thus the firm has Risk Priority by the use of FMEA method (see table 3) Here the most critical risks are industrial risk and then Decision Making risk according to their RPN value (see in table 2) that require optimization at maximum level. The industrial risk must be dealt with to reduce the losses to the supply chain management. The sub factors associated with the industrial risk should be solved according to their ranking.

Therefore it is advised to the company to deal with reducing the most ranked risks so that the supply chain of the firm can function without loss.

* Note: There is no threshold value for RPNs. In other words, there is no value above which it is mandatory to take a recommended action or below which the team is automatically excused from an action.

IV.CONCLUSION

The FMEA concepts in manufacturing supply chain should be considered with meticulousness which is the need of the time, as manufacturing supply chain is becoming less vertically integrated and the manufacturer is focusing on its core competency. Using FMEA method the study of various risks is done here that which risk is more critical here for any industry. Therefore, a structured, simple and efficient proposed decision framework is proposed and has the ability to show the direction to determine the degree of impact level of each RF (Risk Factor). The degree of impact level of each RF of the firm will give idea for optimally allocating the efforts to gain maximum benefit. A case situation is revealed in order to reinforce the salient features of the proposed framework. The results indicate that the industrial risk and then Decision risk have got the highest impact on successful implementation of Supply Chain.

Further research is suggested to develop a decision framework that can able to find out optimal number of solutions for identifying and mitigating the most influencing Risk factors of the supply chain in a specific environment.

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Appendix

Step 1: Structuring the Questionnaire for each risk factor:

This phase involve formulating the questionnaire for each risk factor, the goal of our problem is risk Prioritization and various risk factors as Product ,planning and design risk, environment risk, industrial risk ,product risk and Decision making risk..

Step 2: Collating the inputs from SMEs for each questionnaire:

After creating the questionnaire, the next step is measuring and collecting the data, the risk factors (RF) are identified through literature review and in consultation with expert opinions from managers, senior engineers and engineers from Indian Manufacturing Industries. In order to prioritize the RFs, RFs are sub-divided themselves on the basis of the questionnaire. Therefore, FMEA method is used for prioritization of RFs (See table 1).

Table 1 – Risk Evaluations on the basis of SME (Subject Matter Expert) Inputs

S.NO	PARAMETERS	Severity (1-5)	Occurrence (1-5)	Detection (1-5)
1	PRODUCT PLANNING AND DESIGN RISKS			
1.1	Master planning & scheduling mistakes	3	2	1
1.2	Manpower shortage	2	3	2
1.3	Manufacturing risks	1	1	2
1.4	Quality tools unavailability	1	1	1
1.5	Quality control mistakes	2	2`	1
	AVERAGE	1.8	1.8	1.6
2	PRODUCT RISK			
2.1	Inaccuracy in machining	3	3	1
2.2	Machine fault	2	4	2
2.3	Quality of raw materials	5	3	2
2.4	Faulty Design of product	3	1	1
2.5	Scarcity of raw materials	5	1	1
	AVERAGE (18/5)	3.6	2.4	1.4
3	ENVIRONMENTAL RISK			
3.1	Political uncertainty	1	3	5
3.2	Social uncertainty	2	3	4
3.3	Economic uncertainty	2	3	4
3.4	Natural threats	1	2	3
3.5	Environment laws	1	1	1

	AVERAGE	1.4	2.4	3.4
4	INDUSTRY RISK			
4.1	Input market uncertainty	5	4	4
4.2	Product market uncertainty	5	5	5
4.3	Competitive uncertainty	5	4	5
4.4	New norms of industry	3	4	4
4.5	Direct competition from existing firms	5	4	4
	AVERAGE	4.6	4.2	4.4
5	DECISION MAKING RISK			
5.1	Knowledge/ skills	5	4	5
5.2	Information seeking	1	1	2
5.3	Rules and procedures	1	1	2
5.4	Non feasibility of the decision	4	2	2
5.5	Sudden change in the actual practice	4	1	2
	AVERAGE	3	1.8	2.6

Step3: Calculation of Risk Priority Number (RPN): It derive by multiplication of average of each risk severity, Occurrence and Detection of Defect.

Table 2 - Calculation of RPN

S.No.	Severity (S)	Occurrence (O)	Detection (D)	RPN (S*O*D)
PPR	1.8	1.8	1.6	5.2
PR	3.6	2.4	1.4	12.1
ENR	1.4	2.4	3.4	11.4
INR	4.6	4.2	4.4	88.0
DMR	3	1.8	2.6	14.0

Step 4: Prioritization of Risks: Higher the RPN value of risk mean that risk is very critical and require immediate attention of organization.

Table 3 – Prioritization of Risks

RPN (S*O*D)	Prioritization of Risks
5.2	V (Lowest)
12.1	III
11.4	IV
88.0	I (Highest)
14.0	II