# Supplier Risk and Risk Mitigators at Supplier Selection Stage

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## Abstract

The present-day manufacturers do not manufacture all the components and tend to purchase key components from suppliers. In some cases, they outsource the entire manufacturing to contract manufacturers. Supplier risk is the anxiety felt by the manufacturer on whether the supplier selected would perform in sync with the purposes of the organization. The risk mitigators are circumstances that aid the decision makers in reducing the risk and focus on the supplier selection process. The scale developed will help industries to make a meaningful assessment of risk in the process of supplier selection. The risks once ascertained will keep the manufacturer vigilant for the necessary precautionary action. The study is focussed on the auto sector and can be extended to industries in other sectors.

***Keywords:*** *Sustainability factors, supplier credibility, Supplier joint work credential, supplier workforce*

## Introduction

The present-day manufacturers do not manufacture all the components and tend to purchase key components from suppliers. In some cases, they outsource the entire manufacturing to contract manufacturers. Van Weele and Rozemeijer, (1996) state that the snowballing complexity of products, smaller product lifecycles, globalization, and developments in logistics, made companies concentrate on their core business alone. The role of the managers responsible for supplier selection is very complex as a failure on the part of a supplier can turn out to be a costly affair. Supplier risk is the anxiety felt by the manufacturer on whether the supplier selected would perform in sync with the purposes of the organization. The risk mitigators are circumstances that aid the decision makers in reducing the risk and focus on the supplier selection process. Bowersox (2002) stated that the amount consumed in the acquisition of goods is the largest single expenditure for manufacturers in their business operations. This paper is concerned with the risk in supplier selection process alone and not the whole supply chain, and looks at the possible risks that one should evaluate before making the choice of supplier. The risk mitigators are conditions that should take care of the risks and act as a protective mechanism in the choice of supplier. Hamdi, Ghorbel et al. (2018) stated that supplier risk procedures need to be demarcated and combined into the supplier evaluation and selection procedure to mitigate supply risk. The central idea is the understanding that there is a probability of risk in the supplier selection process. The risk mitigation factors ensure that there is a trade-off to the perceived risk factors.

The present trend towards world-wide sourcing ensures that companies view the whole world as a probable source for components. Handfield et al., (2011) stated that the present trend towards opting for long term contracts limits the supply base to a limited level and hence, curtails the ability to switch suppliers. This is a critical factor to be understood in the supplier selection process. The supplier risk should not blindfold the company to focus on risk mitigators alone as there can always be a new company with new product developments that can be far better than the well-entrenched suppliers. The risk mitigators must serve more of a guideline to positively aid the supplier selection process. Fisher (1997) found that supply risks can be lowered through enhanced processes and buffer tactics. However, manufacturers still need to be cautious against unexpected events as risk cannot be totally eliminated. Faez (2009) found that risk mitigation in supplier selection process can considerably lower the supply chain risk. The major interest in the study is fuelled by the supplier risk faced by many companies and wherein those companies not only suffered a financial loss but also reputational loss. Vanteddu (2011) inferred that appropriate supplier selection is a critical feature that affects the competitiveness of products. Supplier failure does not mean the role of being a supplier is easy. Kushan (2009) stated that it took McCain nine years to get the right kind of potato as it had to supply to McDonalds, the world's largest consumer of potato fries that serves across two hundred countries.

## Supplier risk history

In 2002, there was a situation for Land Rover to suspend their production of Discovery vehicle as their single supplier for chassis UPF-Thompson (Lahmar et al., 2016) became insolvent. UPF-Thompson supplied 70,000 chassis per year and had been a supplier since the 1950s. The situation appeared grave and would necessitate the lay-off of hundreds of Land Rover workers. The problem was resolved after Land Rover paid to take control of the supplier company. Airbus A 380, soon after its launch, had to ground a few planes as cracks began to erupt in brackets connecting the internal rib structure with the exterior of the wings. The part called rib feet was supplied by a manufacturer located in Broughton, North Wales and the failure was attributed to stress in the manufacturing process. Adidas was not appreciated for purchasing its packaging paper from Asia Pulp and Paper, a company blamed for harming valuable habitat in Indonesia's rainforest. Ford in 2001, decided to replace 13 million tyres supplied by its supplier Firestone (O'Rourke, 2001) after tyre-related accidents claimed more than a hundred lives. The companies decided to end their ninety-five-year relationship with Firestone, with Ford accusing the supplier of faulty tyre design while Firestone accused Ford of faulty vehicle design.

## Applicability

This study is based on the auto industry of Chennai called the Detroit of Asia, and comprising the automobile manufacturing belt starting from Maraimalai Nagar to Sriperumpudur. Though the study was based on the problems faced by decision makers in this belt, the applicability of this study is pan-India as there might not be much variability in supplier issues across the country. Moreover, this constitutes the major auto manufacturing belt in the country. This study is, in particular, significant to auto manufacturers because of their dependence on key suppliers and with initiatives like just-in-time, logistics, in addition to quality, is the key to the success of any manufacturer. Gopal (2018) indicated that 87% of the needs of the automobile industry was being met by the local auto ancillary industry. Out of this, organized industry accounts for 80% while the unorganized sector, with ten times more players, accounts for the rest 20%. This brings out the fact that every automobile manufacturer has to deal with the organized and unorganized sector and needs to make studied decisions.

## Review of literature

Er & Oktay (2017) defined supply risk as an umbrella term to include the factors affecting the inward flow of shipments such as failure of suppliers, delayed deliveries, quality issues and an erratic supplier relationship strategy. Beil and Ross (2009) stated that erratic supplier selection criteria can incur the firm a huge loss in terms of product recalls, warranty costs, and impose untold damage on the reputation and forthcoming sales potential of the firm. Mentzer (2001) indicated that global supply chain necessitates highly synchronized movement of goods and service information inside and across national borders. Thun & Hoenig (2011) revealed that the significance of disturbance in the chain goes beyond instantaneous financial loss and includes negative impacts on the image of the firm and its reputation. Sasha, Ali, Poorva & Magnus (2013) found risk management as crucial to supply chain because of the present trend towards increase in outsourcing, globalisation, dependence on specialised capabilities of suppliers and innovation. Zsidisin et al., (2004) stated that risk is supposed to exist when there is a relatively high chance that a harmful event can occur and such an event has a noteworthy allied impact or cost. Kahraman, Cebeci & Ulukan, (2003) identified that the main intention of supplier evaluation is to ensure whether the supplier is capable of providing the inputs that meet the goal of the firm on a continual basis and not specifically meant to select the vendor who supplies the products at the lowest cost. Imran & Tuqureer (2019) identified supplier preference for those organizations that contemplate significant importance to environment as such enterprises maintain high repute in the market that in turn, reflect in increasing customer retention and loyalty. Kali & Bala (2018) stated that companies, by being environmentally friendly, can differentiate their products from their competitors and make their output preferential for their customers.

## Objective

- ✓ To identify the perceived supplier risks and develop a scale to measure supplier risk as perceived by manufacturing company personnel at decision making level.
- ✓ To identify the risk mitigators and develop a risk mitigator scale suitable to reduce the perceived supplier selection risk.

## Data Collection Method

The research instrument was constructed using the conceptual base of the factors of supplier risk and probable risk mitigators, and the contextual sources of focus group outcomes. The ensuing questionnaire comprised 31 Likert scales representing the different dimensions of supplier risk and risk mitigators. The questionnaire comprised 15 Likert scales reflecting the different dimensions of supplier risk, and 16 Likert scales reflecting the risk mitigators. Supplier risk components and risk mitigation

statements were measured on a five-point scale measured as I, 2, 3, 4 & 5 and coded as highly important, important, moderately important, mildly important and not important respectively. A total of 100 personnel employed in the purchase and production division of different automobile companies in Chennai were taken for the study. Exploratory factor analysis with a varimax rotation was conducted on the 31 questions, which were categorized as three dimensions for supplier risk and three factors for risk mitigation, and the loading value greater than 0.5 alone was taken.

The Kaiser-Meyer-Olkin test and Bartlett's test of sphericity were done to evaluate the factorability before applying EFA. The KMO measure of sampling adequacy was 0.874 and 0.794 for supplier risk and risk mitigator respectively, and the significance of Bartlett's test of sphericity in both cases were less than 0.001, denoting that EFA can be applied.

**Table 1 Components of Supplier Risk**

| Summary Statistics | | F1 | F2 | F3 |
|---|---|---|---|---|
| Eigen Values | | 5.58 | 5.28 | 3.01 |
| % of variance explained | | 37.19 | 35.17 | 20.08 |
| Cum % of variance explained | | 37.19 | 72.35 | 92.44 |
| N =100 | Sample = All respondents | | Unit = Factor loadings | |

| | Components of Suppler Risk | Dimensions | Loadings |
|---|---|---|---|
| SR4 | The risk of intellectual property theft in supplier plant | Sustenance factors | .983 |
| SR2 | The fear that the supplier will get into legal or ethical issues | | .978 |
| SR1 | The vendor may source from unprincipled suppliers | | .955 |
| SR15 | The fear that the supplier may dictate terms with the manufacturer over a period of time | | .938 |
| SR3 | The risk that the supplier is indifferent to ecological damages | | .934 |
| SR14 | Supplier plant is located in natural disaster-prone areas | | .911 |
| SR10 | The fear that the supplier's product may create a lower quality perception with consumers | Production factors | .975 |
| SR12 | The fear that the blemishes of the vendor can incur a high replacement cost for the company | | .965 |
| SR9 | The fear that the vendor's product may fail during the period of usage | | .956 |
| SR11 | The fear that the supplier might not spend in product development | | .953 |
| SR13 | The fear of lack of visibility and control measures inside supplier plant | | .930 |
| SR8 | The risk that the plant has poor industrial relations | Labour and Financial factors | .977 |
| SR6 | The vendor plant is situated in a labour sensitive area | | .970 |
| SR5 | The fear that the supplier can flop due to financial crisis | | .955 |
| SR7 | The fear that the supplier plant can, in future, be controlled by a competitor | | .951 |

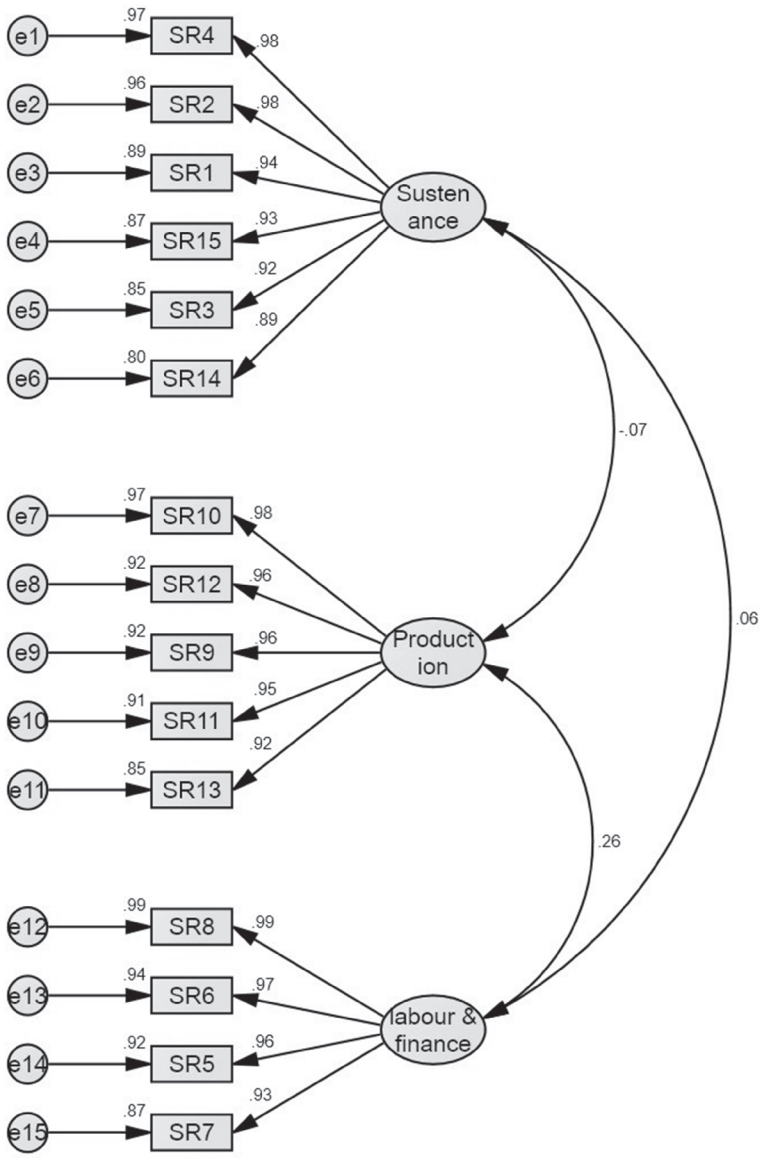
The first factor measuring 37.19 percent variance was labelled sustenance factors and included factors concerning choice of sub-contractors by suppliers, environmental concerns, legal issues, intellectual property theft and so on. This dimension is basically concerned about issues that are beyond the immediate control of the manufacturer. Harland et al., (2003) acknowledged that supplier risks can expose the firms to litigation from different sources like customers, vendor, shareholders, and workers. Giunipero and Eltantawy, (2004) recognized that increased dependence on outsourcing produces a loss of control and the risk of losing proprietary information known to both the parties. Consumer activism ensures that companies that are weak in sustenance factors cut a remorseful image with customers. This can be seen as when in 1998, Nike product became

tantamount with slave wages and obligatory overtime (Bob, 1998) the share prices started to drop and product sales became weak (John, 1998).

The second dimension to sort out was identified as production factors that comprised cost of recall, component failure, and slower new product development factors. Cousins, Lamming & Bowen (2004) identified that the consequences of supplier error can create financial and reputational loss and move right across to loss of life and a hazard to individual safety. Wagner and Bode (2006) identified that the failure of suppliers to acclimatize with technological or product design modifications can have a negative impact on customers' costs and competitiveness. This factor accounted for 35.17 percent of variance. Harland et al., (2003) identified Production risk as undesired consequences in the production process, with the possibility of danger, loss or injury.

The final factor was characterized as labour and financial factors, and accounted for 20.08 percent of variance. The dimension was characterized by statements on labour and financial conditions at supplier plants. Zadek (2004) specified that negative publicity like labour abuse can harm brands and erode market positions considerably. Christopher and Lee (2004) found that financial risks happen due to the risk of adjusting stock and penalties for non-delivery of commodities.

## Confirmatory Factor Analysis with the three dimensions of supplier risk



The objective of confirmatory factor analysis is to assess if the data fits a hypothesized measurement model. Hence, it can be studied if the relationship exists between the set of manifest variables and the causal constructs.

Model fit: This diagram portrays a satisfactory data fit. The CMIN/ DF ratio was 2.39, and is well within the approved range of less than 3 and is suggestive of a satisfactory fit between the sample data and hypothetical model. The values of the fit indices are represented in Table 3 and the values represent the model as acceptable. Hu and Bentler (1999) identified that a CFI value above 0.95 cut-off identified a good model fit. The values of TLI and NFI above 0.95 indicate a good fit.

**Table 3 Model fit indices for the three dimensions of supplier risk**

| Index of fit | CMIN | DF | CMIN/DF | GFI | IFI | NFI | IFI | CFI | RMSEA |
|---|---|---|---|---|---|---|---|---|---|
| Value | 208.29 | 87 | 2.39 | .85 | .967 | .948 | .967 | .969 | .097 |

Exploratory factor analysis was made with varimax rotation on the total sixteen questions representing the risk mitigators.

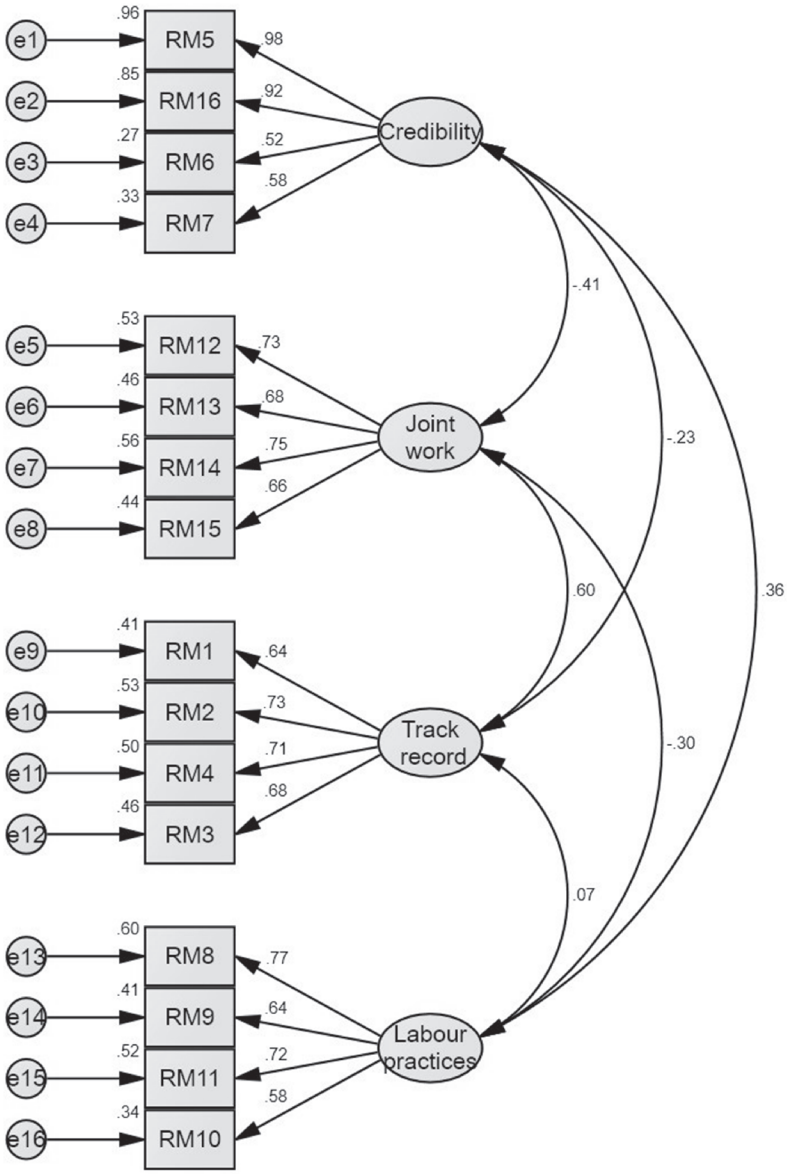
**Table 4 Components of Risk Mitigators**

| | | | |
|---|---|---|---|
| RM5 | Supplier product is quite popular among end users | Credibility | .880 |
| RM16 | Supplier presently is a favoured supplier to many competitors | | .874 |
| RM6 | Supplier has won recognition and awards from certain manufacturers | | .723 |
| RM7 | Supplier is a reputable player in the market | | .693 |
| RM12 | Supplier is willing to allow manufacturer to inspect its product facilities | Joint work credentials | .761 |
| RM13 | Supplier is amenable for joint product development | | .756 |
| RM14 | Supplier is willing to have a dedicated plant once the size of the order increases | | .732 |
| RM15 | The supplier is open for joint training of workers with manufact urer's employees | | .715 |
| RM1 | Supplier is recognized for quick development of new products | Management | .799 |
| RM2 | The supplier has to its credit the needed accreditations | | .765 |
| RM4 | The supplier has a strong corporate governance procedure | | .720 |
| RM3 | The company has an environment focus and has a green management practice | | .712 |
| RM8 | Supplier has a diverse workforce | Labour practices | .847 |
| RM9 | Supplier has a labour friendly attitude with incentives for performance | | .737 |
| RM11 | The supplier has a well-organized work force | | .712 |
| RM10 | The possibilities of choosing alternative suppliers is limited | | .701 |

| Summary Statistics | F1 | F2 | F3 | F4 |
|---|---|---|---|---|
| Eigen Values | 4.636 | 2.746 | 1.644 | 1.135 |
| % of variance explained | 28.976 | 17.165 | 10.276 | 7.096 |
| Cum % of variance explained | 28.976 | 46.142 | 56.417 | 63.513 |

N =100 Sample = All respondents Unit = Factor loadings

**Confirmatory Factor Analysis with the four dimensions of risk mitigators concerning supplier risk**




The first dimension sorted was identified as credibility that included factors such as being favoured by customers, having won recognitions and being a reputable manufacturer. Gonzalez and Quesada (2004) identified supplier selection as the most influential supply management process intended towards attaining product quality. This dimension accounted for 28.98 percent of variance.

The second dimension that emerged was joint work credential and encompassed statements such as joint product development, supplier factory inspection, dedicated plant and joint training for employees. Roy, Sivakumar, & Wilkinson, (2003) found that the supplier's capability to offer product technology, support in product development, provide worldwide reach, and the capacity to forecast and acclimatize to technological changes are valid elements of its ability to provide strategic inputs to a firm. Faisal et al.(2006) identified that supplier risk mitigation is managed through collaboration, coordination and the use of risk management tools among the partners, to warrant continuity and enjoy long term profitability. This dimension accounted for 17.16 percent of variance. Gopal (2018) detailed that manufacturers through long term relationship with suppliers ensured access to supplier's resources, skills and strength to ensure that they secure needed resources and technology of the choicest supplier.

The third dimension was identified as management and included statements such as accreditation, corporate governance procedure, green management practice and continuous innovation. Krause and Handfield (1999) state that the vendor impacts the quality of the buying firm's products. Cole (1998) found that suppliers can use ISO 9000 as a principal tool for signalling quality to their customers. This factor accounted for 10.27 percent of variance.

The last dimension was Labour practices and included statements on diverse and disciplined workforce, labour friendly practices and so on. Frenkel and Scott (2002) stated that the management pattern of vendors affected the quality of social performance. Locke, Kochan, Romis & Qin (2007) identified that the legal procedures of the country where the supplier's factory is located was a major reason for the variation in application of the labour code of conduct. Hoang (2019) reported that Western brands initiated a voluntary-regulatory system to endorse international labour standards in the factories of suppliers through the supplier code of conduct because of concern for labour standards in supplier factories. This factor accounted for 7.1 percent of variance.

The confirmatory factor analysis with four dimensions of risk mitigators in supplier selection is presented above. When the four factors were allowed to correlate, a good model fit was obtained. The output of the model is shown below:

### Table 5 Model fit indices for the four dimensions of supply risk mitigators

| | |
|---|---|
| CFI confirmation fit Index 0.969 | IFI Incremental Fit Index 0.969 |
| GFI Goodness of Fit index 0.845 | AGFI Adjusted goodness of fit index 0.786 |
| NFI Normed fit index 0.948 | Root mean square error of approximation (RMSEA) 0.097 |
| TLI Tucker Lewis Index 0.963 | Relative fit index (RFI) 0.938 |

Hu and Bentler (1999) reported that a CFI value above 0.95 cut-off identified a good model fit. The Tucker Lewis index and NFI value above 0.95 indicate a good fit (Bentler, 1990).

Cronbach's coefficient α was used to calculate the internal consistency coefficients of the items included in the questionnaire. The reliability of the seven dimensions as indicated in Table 3 was considered adequate as Nunnally (1978) recommended a minimum level of .7.

### Table 6 Reliability Analysis

| Dimensions | Cronbach's Alpha |
|---|---|
| Sustenance attributes | 0.979 |
| Production attributes | 0.981 |
| Labour attributes | 0.981 |
| Credibility attributes | 0.842 |
| Joint work attributes | 0.909 |
| Management attributes | 0.782 |
| Labour practice attributes | 0.864 |

## Managerial Inferences and Limitations

Any decision in choice of supplier involves a risk element. Hence, this concept of risk in supplier selection can be of significant importance. Risk mitigator has hence been brought into the study which diffuses the drawback of supplier risk. Hence, supplier risk can be assessed only based on the availability of risk mitigators. This study should be beneficial in decision making concerning choice of suppliers. The study is focussed on the automobile industry in Chennai belt and hence, industries located in other areas may have specific supplier risks that may need mitigators suited to those risks which may need to be covered in future studies These are risk factors studied at supplier selection stage and these need to be closely monitored over the relationship period

## Conclusion

The list of the final set of components that measure the three dimensions of supplier risk at the supplier selection stage and the four dimensions of risk mitigators useful at the supplier evaluation stage are given in Appendix 1 and Appendix 2 respectively. The scale developed will help industries to assess risk in the process of supplier selection. The companies can make use of the mitigators to make a meaningful assessment of the suppliers. The risks once ascertained will keep the manufacturer vigilant for the necessary precautionary action. It is necessary to constantly monitor the risks and the mitigators that would have served as cues in the selection of the suppliers and look for early warnings that there can be problems that may need immediate attention. If one can spot an abnormality at the earliest, the corrective action can be taken immediately before the situation goes out of hand. The study is focussed on the auto sector and can be extended to industries in other sectors.

### Annexure 1 Dimensions of Supplier Risk perceived at supplier selection stage

| | Risk components | Mean | SD | Dimensions | Mean | SD |
|---|---|---|---|---|---|---|
| RM5 | Supplier Product is quite popular among end users | 3.21 | 1.30 | Credibility | 3.14 | 1.07 |
| RM16 | Supplier presently is a favoured supplier to many competitors | 3.15 | 1.32 | | | |
| RM6 | Supplier has won recognition and awards from certain manufacturers | 3.13 | 1.31 | | | |
| RM7 | Supplier is a reputable player in the market | 3.08 | 1.25 | | | |
| RM12 | Supplier is willing to allow the manufacturer to inspect its product facilities | 3.16 | 1.15 | Joint work credentials | 3.08 | .96 |
| RM13 | Supplier is amenable for joint product development | 2.99 | 1.28 | | | |
| RM14 | Supplier is willing to have a dedicated plant once the size of the order increases | 3.04 | 1.28 | | | |
| RM15 | The supplier is open for joint training of workers with manufacturer's employees | 3.13 | 1.14 | | | |
| RM1 | Supplier is recognized for quick development of new products | 2.82 | 1.14 | Management | 3.12 | .86 |
| RM2 | The supplier has to its credit the needed accreditations | 3.23 | 1.06 | | | |
| RM4 | The supplier has a strong corporate governance procedure | 3.21 | 1.15 | | | |
| RM3 | The company has an environment focus and has a green management practice | 3.21 | 1.08 | | | |
| RM8 | Supplier has a diverse workforce | 2.93 | 1.06 | Labour practices | 3.03 | .82 |
| RM9 | Supplier has a labour friendly attitude with incentives for performance | 3.17 | 1.05 | | | |
| RM11 | The supplier has a well-organized work force | 3.03 | 1.14 | | | |
| RM10 | The possibilities of choosing alternative suppliers is limited | 2.98 | 1.000 | | | |

## Annexure 2: Risk Mitigators used at Supplier selection stage

| | Components of Suppler Risk | | | Factors | | |
|---|---|---|---|---|---|---|
| SR4 | The risk of intellectual property theft in supplier plant | 3.35 | 1.40 | Sustenance factors | 3.36 | 1.34 |
| SR2 | The fear that the supplier will get into legal or ethical issues | 3.35 | 1.40 | | | |
| SR1 | The vendor may source from unprincipled suppliers | 3.35 | 1.41 | | | |
| SR15 | The fear that the supplier may dictate terms with the manufacturer over a period of time | 3.41 | 1.42 | | | |
| SR3 | The risk that the supplier is indifferent to ecological damages | 3.35 | 1.43 | | | |
| SR14 | Supplier plant is located at natural disaster-prone areas | 3.37 | 1.42 | | | |
| SR10 | The fear that the supplier's product may create a lower quality perception with consumers | 3.35 | 1.49 | Production factors | 3.34 | 1.42 |
| SR12 | The fear that the blemishes of the supplier can incur a high replacement cost for the company | 3.35 | 1.44 | | | |
| SR9 | The fear that the supplier's product may fail during the period of usage | 3.35 | 1.51 | | | |
| SR11 | The fear that the supplier might not spend in product development | 3.35 | 1.48 | | | |
| SR13 | The fear of lack of visibility and control measures inside the supplier's plant | 3.29 | 1.45 | | | |
| SR8 | The risk that the supplier's plant has poor industrial relations | 3.11 | 1.33 | Labour and Financial factors | 3.12 | 1.32 |
| SR6 | The supplier's plant is situated in a labour sensitive area | 3.11 | 1.36 | | | |
| SR5 | The fear that the supplier can flop due to financial crisis | 3.11 | 1.36 | | | |
| SR7 | The fear that the supplier's plant can in future be controlled by a competitor | 3.13 | 1.38 | | | |

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