A Decision Support Model to Select Suppliers in Apparel Industry in Sri Lanka

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1. Introduction

Within the competitive supplier base environment, firms are more conscious about selecting the right supplier at the right time by considering a wide range of qualitative and quantitative criteria [1].Supplier selection is an essential part of the procurement process and it is common for any industry. In the current situation of the trade, selecting the right supplier is far more than analysing the price lists and how to cope up with dynamic situations like unpredictable market where there are changes in customer demand with the changing taste, consciousness of quality, price and the delivery time [2].

This research work devises a mathematical algorithm for selecting suppliers and develops the decision support model for apparel industry in Sri Lanka with the incorporation of Pareto analysis and Analytic Hierarchy Process (AHP). The main focus of this research is to address the research problem "How to select supplier in a dynamic situation (order changing)" while achieving two research objectives, to identify the prominent criteria for selecting a supplier for apparel industry in Sri Lanka and to model the supplier selection process in a dynamic situation.

2. Methodology

The summary of the research methodology is as shown in figure 1. Both primary data and secondary data were used. Top 15 most-used supplier selection criteria were identified by using 30 literature reviews. Sixty-five companies registered under Export Development Board and having valid email addresses were chosen to constitute the population. Sample of 30 responses were selected based on those having a supplier pool. Afterwards, five procurement professionals were interviewed for the pair wise comparison. In order to stimulate the decision support model, one company was incorporated.
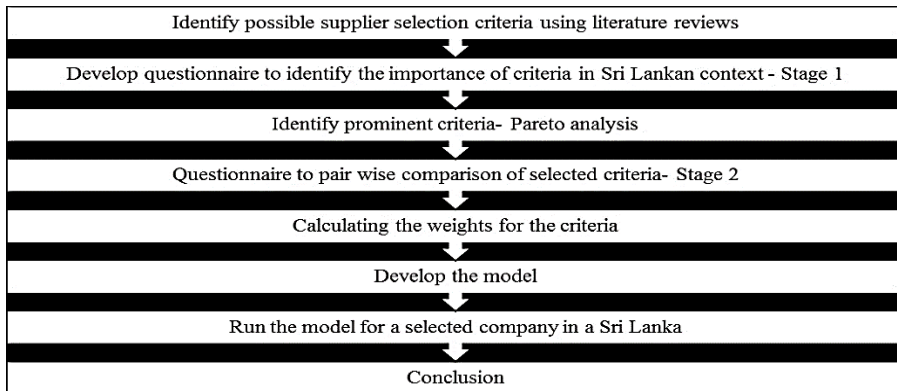
| Identify possible supplier selection criteria using literature reviews |
| Develop questionnaire to identify the importance of criteria in Sri Lankan context - Stage 1 |
| Identify prominent criteria- Pareto analysis |
| Questionnaire to pair wise comparison of selected criteria- Stage 2 |
| Calculating the weights for the criteria |
| Develop the model |
| Run the model for a selected company in a Sri Lanka |
| Conclusion |

Figure 9: Research Methodology

3. Data Analysis

The research problem was solved according to five stages. At the first stage, descriptive analysis was conducted. In order to ensure the significance of the research, whether the supplier selection process is crucial was analysed. All the respondents have answered that supplier selection process is crucial for their company. So it is 100% sure that there should be a proper and organized way for this process. 73.3% of 30 valid respondents have said that they have separate department for procurement. Even though the other 26.6% do not have separate departments, there are special responsible professionals such as merchandisers and supply chain advisors to handle the process. From the 26.6% of respondents, 37.5% handle procurement process in merchandising department, 25% supply chain and rest has not particular department for take responsibility for the procurement process.

It is well known fact that procurement cost accounts for about 60% of average total cost. It is identified that the procurement cost percentage of apparel industry in Sri Lanka in almost all the companies in the population exceeded the 40% limit with the 93.3% agreement. 66.7% respondents have said that the average procurement cost as a share of total cost lies between 40%-60%. It is important to highly consider about this as a logistician. Even though firms have separate departments for procurement process, there is high procurement cost due to complexity. No reduction of procurement cost was observe in those companies having separate departments for procurement, where the procurement cost was found ranging between 40%- 80%.

Before developing the supplier selection model, it is important to identify the current scenario of the apparel industry in Sri Lanka. 43.3% of respondents have not answered this question. 23.3% of the respondents have said that they select

suppliers based on past experience. It is proven that demand uncertainty is a dynamic situation which makes the supplier selection process costly and time consuming. 45.5% of the respondents have agreed with that. By considering all the demographic factors, it is proven that there is an opportunity for the research "Developing Decision Support Model for Supplier selection of Apparel industry in Sri Lanka at the dynamic situation of order changing".

At the second stage, using the rankings that respondents has given to the top most used fifteen criteria and the Pareto analysis, the prominent criteria, quality, per unit cost, delivery lead time and supplier service level were identified. Then using pair wise comparison for the prominent criteria were conducted at the third stage. The respective relative weightages for quality, per-unit cost, delivery lead time and supplier service level were calculated. The respective weights for prominent criteria are 0.2510, 0.3298, 0.2285 and 0.1908. The consistency of responses in pair wise comparison is 16.11%. Even though consistency ratio value is more than 10%, it is acceptable up to 20%, because of the procurement professionals' non-familiarity with pair wise comparison. It is identified that there is high probability of selecting a supplier when the quality and service level increase, and there is a lesser probability of that selecting supplier when cost and lead time decreases. The maximum quantity that a supplier can supply and the lead time were identified as constraints. Considering all these factors, at the fourth stage, an algorithm was developed to calculate the supplier score.

Constraints:

Supplier maximum quantity ≥ Required Raw material Quantity

Supplier' s delivery lead time ≤ Required lead time for raw material

Equation 1 Proposed supplier selection algorithm

$$\frac{(0.2510 * C1 \quad (0.1908 * C4}{(0.3298 * C2 \quad (0.2285 * C3}$$

Where, Y_i = relevant supplier score

$C1_i$ = Supplier's quality

$C2_i$ = Supplier's per unit cost

$C3_i$ = Supplier's delivery lead time

$C4_i$ = Supplier's service level

The highest scored supplier is the most suitable supplier according to the scenario. At the fifth stage, the model was stimulated using real time information gathered by a company in apparel industry in Sri Lanka. As the final tangible outcome, a mini

software program was developed with the incorporation of the developed model. The intention of the mini software was to reduce the time, calculation errors and the human hours taken for the supplier selection process.

4. Conclusion

Lack of previous literature in the Sri Lankan context and the context of the apparel industry is the main limitation of this study. In order to overcome this limitation, research design was developed to suit the Sri Lankan context. The proposed model with decision support system framework helps procurement professionals in the apparel industry in Sri Lanka to make sound decisions when selecting suppliers in dynamic situations of order changing. Future research can be conducted for another industry in Sri Lanka and considering more criteria.

References

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