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Review of Analytical Techniques Used in Manufacturing Logistics Decision Making

R N Liyanage and Amal S Kumarage
University of Moratuwa, Sri Lanka

1. Introduction

With the increasing complexity of logistics operations there is a significant need to make accurate and efficient decisions in the manufacturing industry. There are several analytical techniques (ATs) available to make appropriate decisions that optimise the use of resources[1]. The major attempt of this paper is to identify if a gap exists between available ATs and current practice in industry. The main objective of the research is therefore to investigate the use of ATs in decision making in manufacturing logistics[2].

2. Methodology

This research was processed under three steps; the first being a literature survey carried out to identify ATs available for making different types of logistic decisions in manufacturing companies. The second step investigated the current practice of those ATs in Sri Lanka using an online survey and interviews in different manufacturing companies. The specific department dealing with logistics activities was sent the questionnaire to be filled using the Likert Scale method for multiple choice questions, linear scale questions and checkboxes. This was supplemented with face to face interviews using semi structured questions with managers of manufacturing firms, and companies providing logistics, consulting on logistics and developing logistic systems to identify reasons for the current use of the different ATs. The third step involved generating hypotheses to test the usage of ATs using a comparison of means, graphical analysis, frequency analysis and cross-tabulation. To analyse interview data content analysis and discourse analysis were used after preparing and coding data using "NVIVO" software.

3. Results

3.1. Familiarity and usability of ATs

The hypothesis for usage of ATs being conditional to familiarity with the specific ATs was tested. As shown in Figure 1 the response to AT usage had a lower distribution when compared to the distribution of familiarity with ATs.

Thus, as shown in Figure 1, it is observed that while usage is lower than familiarity, there is no relationship between the two. It is seen that while familiarity with ATs is a pre-condition for use, it does not always occur. It seems that sound familiarity results in

use only half the time but that too intermittently, while partial familiarity also leads mostly to intermittent use.

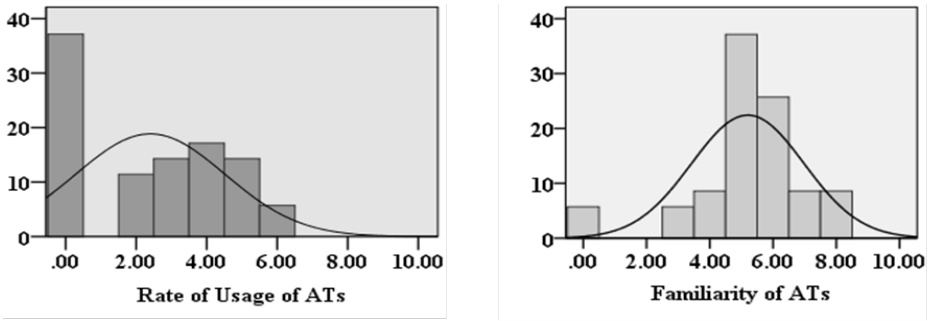

Figure 1: Distribution of Responses for Familiarity and Use of ATs

Figure 2 shows that even though only 29% indicated regular AT use and 37% indicated no use at all, the ATs when used are mostly employed for marketing: in the manner of demand forecasting tools, or in either inventory and production planning/procurement activities or logistics decisions. These activities are also followed by ERP solutions. ATs for planning operational activities such as Vehicle Routing Problem (VRP) or Location Selection have a much lower incidence of use. On the other hand, selecting the best mode of transport appears to be handled mostly by experience. Inventory management is performed but VRP (vehicle routing problem) techniques are not used more compared with the availability of techniques for VRP.

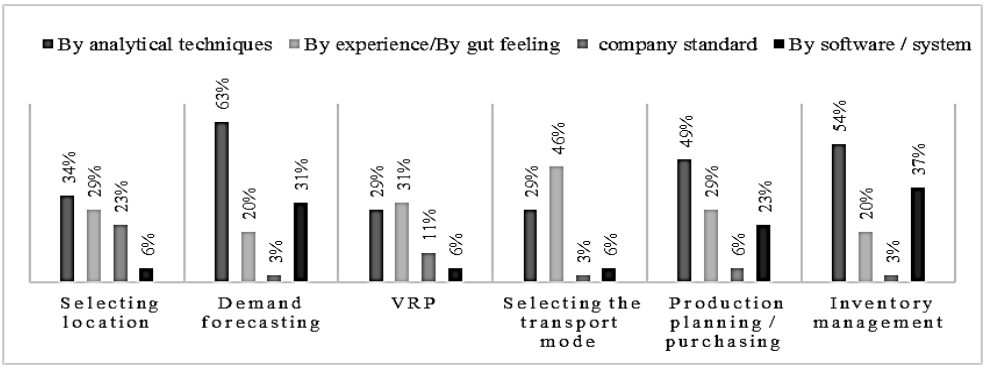

Figure 2: Decision Making Method by Logistic Activity

Hierarchy analysis was done from interview data to investigate what kind of techniques are used in the industry and it was found that the most frequent responses were forecasting techniques such as moving averages, trend analysis and regression, in built techniques and gravity model.

Moreover, testing the use of ATs by the following hypothesis yielded the result that Multinational companies (MNCs) did not perform significantly better when compared with local companies in their use of ATs; with 37% of both MNCs and local companies

reporting they did not use any ATs. However, the analysis shows that 25% of the apparel manufacturing industry indicates frequent use of ATs, compared with16% in the FMCG (fast moving consumer goods) industry. Also, in FMCG, 47% of the industry indicated that they used ATs but did so less often. The portion of the apparel industry who responded in this manner accounted for 25% of the whole.

The main reasons for the reluctance to use ATs as stated in the interviews are found using hierarchy analysis. The data availability and costs are stated as the main problem to use quantitative techniques. On the other hand, data capturing technologies are not used effectively, as R&D (research and development) for logistics decision making has received less attention in manufacturing companies than R&D for product development.

3.2. Industry criteria for increasing the use of ATs.

The tabulation of criteria that will increase the use of ATs in the logistics decision making processes in the manufacturing industry in Sri Lanka are given in Table 1. Accordingly, flexibility to integrate with inputs and outputs of other software and enterprise resource planning (ERP) systems was given as the most important criteria, while being easy to use, ability to provide direct solutions, the time taken, and accuracy were the other criteria most highlighted when comparing the mean response with deviations.

Table 1: Manufacturing Industry Criteria for Increasing use of ATs in Logistics

Feature/Criterion	Mean	Std. Deviation
Flexibility (capability of integrating side constraints encountered in real world applications)	4.5143	.61220
Easy to use	4.2571	.78000
Provides direct solution	4.2571	.85209
Time required to get solutions using the AT	4.1714	.82197
Accuracy of result	4.1429	.91210
Availability of data for ATs	3.9714	.98476
Software availability	3.6000	.94558
Simplicity to use	3.4286	.94824
Availability of expertise to use	3.2000	1.23193
Cost (training / technologies etc)	3.0000	.93934

4. Conclusion/Recommendation

The use of ATs for logistics decision making within the manufacturing industry in Sri Lanka is low. This is associated with less familiarity with such techniques, even though familiarity itself has not increased the use. It has been found that the level of such applications vary considerably across sub-sectors within logistics processes which are mostly used for marketing oriented processes as opposed to operational or planning processes. This also is seen to vary across the different types of organisations, with the

FMCG industry showing the lead. Multinational companies do not demonstrate a higher use of AT use compared with Sri Lankan companies.

There are a number of stated reasons for the non-use of ATs led by considerations of cost and availability of data. However, the interview results varied slightly to indicate that AT use could be enhanced by making them more user-friendly, integrating to existing ERP solutions, making them easier to use and equipping them to give answers that can be directly applied.

Techniques like data mining including sensor-based data can be used to make more data available and also to reduce cost. Integrating ATs into ERP applications and use of multi objective algorithms can also be considered as potential steps to improve AT use in Sri Lanka so that managers need not be familiar with several different ERPs, and software applications using both qualitative and quantitative factors can be used so that theoretical criteria could be mixed with more subjective assessments. In this regard, multi criteria decision making techniques can be used.

Therefore, improving the use of ATs in the manufacturing industry in Sri Lanka requires greater focus on practical problems surrounding their familiarity and problems of applying ATs to the industry conditions. Thus, developing ATs for the logistics industry requires more attention to be paid to the flexibility of techniques and user-friendly software for a rapidly growing business industry. Increasing R&D in areas of logistic operations will also enable improvements to the design of ATs with a view to solving current problems in the industry.

References

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