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Analysis of Factors Affecting Efficient and Effective Reverse Logistics in the Soft Drink Industry of Sri Lanka

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1. Introduction

Reverse logistics play a prominent role in entire supply chain of any industry. Increasing efficiency in reverse logistics processes through the recovery of returned products or disposal of end-of-life products is one way by which firms attempt to maintain and increase competitiveness and market share [3]. Reverse logistics for the soft drink industry is an order qualifier for glass-bottled soft drink manufacture. Due to lack of access to a reverse logistic framework and high attention to forward distribution, soft drink manufacturers bear high rates of inefficiency and ineffectiveness within the backward chain [1]. Reducing the cost of reverse logistics through an efficient and effective channel of reverse logistics can have a greater impact on total logistics cost and supply chain cost.

The main objectives of this research are to identify current reverse logistic practices adopted by soft drink companies in Sri Lanka and to identify the most critical factors affecting efficient and effective reverse logistics pertaining to empty soft drink glass bottles. This paper will provide an insight to the current reverse logistics model adopted by soft drink companies in Sri Lanka while identifying the most critical factors that influence the efficiency and effectiveness of the reverse logistics system. Although companies focus mainly on transportation, there are other critical factors like accidents, packaging and storage within the cleaning and sorting processes of soft drink industry. Maintaining an effective and efficient reverse logistics process has moved to the forefront as a key capability for logistics and manufacturing firms [2]. An efficient and effective reverse logistic channel can improve the visibility of the reverse supply chain while increasing productivity and responsiveness across the entire supply chain.

2. Methodology

The population of this study was defined as manufacturers of soft drink in glass bottles within Sri Lanka. Three soft drink manufacturers use glass bottles, and thus the population under consideration is three. Data collection was done covering all three players, as a three-stage process: namely, illustration of the problem diagnosis using issued and received bottle volume data, Pareto analysis for prominent factor identification, and weight calculation for critical factors using Analytical Hierarchy Process. Primary data collection was carried out through questionnaire surveys and telephone interviews.

3. Results

Problem diagnosis was done using the volume of bottle cases issued and received using five distributors' data. Fluctuations in the numbers of bottles issued in Figure 3.1 occur based on seasonal demand fluctuations and based on the sales plan. Technically, the returning empty bottles need to be lower or equal to the volume issued in previous month.

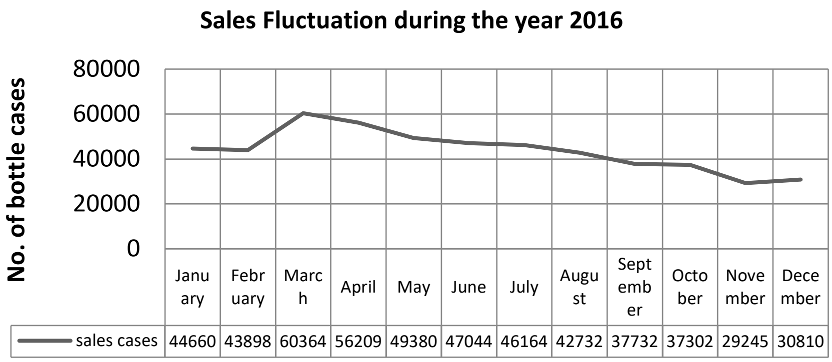

Figure 0.1: Monthly dispersion of issued soft drink glass bottles

Figure 3.2 depicts that return volumes may either be less than the issued volume of bottles in the previous month or more. Thus, there is no direct relationship between the bottles issued and received and the two are independent. This occurs due to various factors in reverse logistics.

Out of the total population of leading soft drink manufacturers in Sri Lanka, 75% handle the reverse logistics of empty soft drink bottles (Figure 3.3 Shows the current process). Returned glass bottles are used by the manufacturers for remanufacturing. Among all manufacturers the country-wide distribution channel including the reverse logistics channel is handled by 256 outsourced distributing agents.

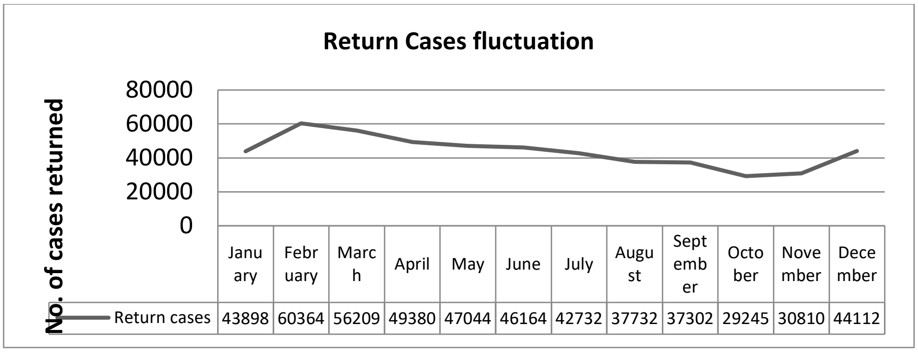

Figure 0.2: Monthly dispersion of returned empty soft drink glass bottles

The monthly procurement cost for new glass bottles would be less than or equal to 20% of monthly production cost. 56% of the respondents have suggested that one undamaged glass bottle can be used between one and five times for refilling, and 44% suggest its use more than five to 10 times. The average glass bottle requirement per month due to insufficient returns depends on the number of damaged bottles and the sales plan.

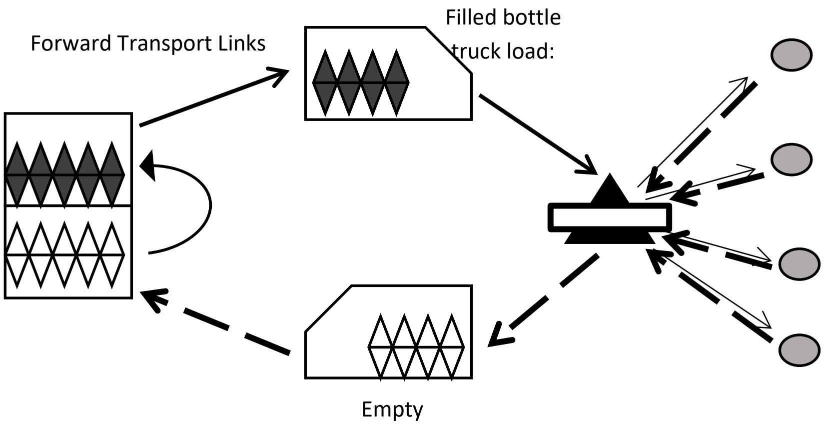

Figure 0.3: Illustration of the current reverse logistics model for one distributor operation

Figure 3.4 indicates that 80% of the impact is attributable to 10 out of the 13 factors identified in the literature survey. To reduce the complexity in the pair-wise comparison proceedings as well as to ensure the accuracy of pair-wise comparison, the six topmost factors were selected: these were Transportation, Method of Storage, Packaging, Accidents, Cleaning Process and Sorting Process. Based on the calculations, the most critical factors are Transportation, Accidents, Packaging, Method of Storage, Cleaning Process, and Sorting Process, the factors having weights of 0.43, 0.26, 0.14, 0.08, 0.05 and 0.04 respectively. The consistency ratio is 0.07 and since it is less than 0.1 the data received for calculation of weights is consistent.

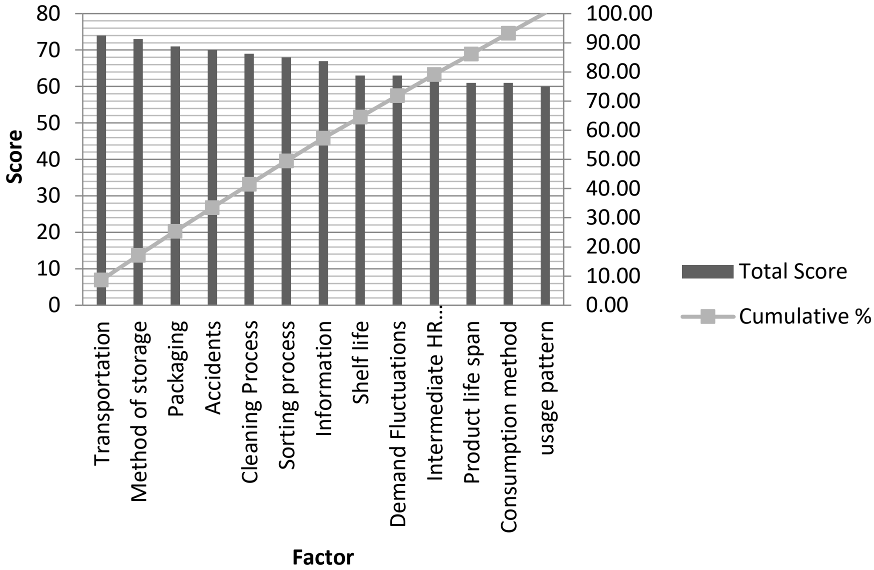

Figure 0.4: Pareto Analysis Chart

Table 4.1: Weights and influence level of each factor for efficiency and effectiveness

Criteria	Weights from AHP	Affecting probability for efficiency	Affecting Probability for effectiveness	Affecting probability for both
Transportation	**0.43**	0.4	0.2	0.4
Accidents	**0.26**	0	0	1
Packaging	**0.14**	0.2	0.2	0.6
Method of storage	**0.08**	0.4	0	0.6
Cleaning Process	**0.05**	0.2	0.8	0
Sorting Process	**0.04**	0.4	0.6	0

Higher-weighted factors are crucial and exert a higher influence on both the efficiency and effectiveness of the reverse logistics process. Accidents, Packaging and Method of storage have a higher probability of affecting both measures. Transportation is the most critical factor, standing for a bigger scope covering numerous sub-factors such as Driving Skill and Behaviour, Vehicle Condition, Road Condition, Geographic Features of the Road, Fuel Efficiency of the Vehicle, Road Congestions, and Peak/Off Peak Transportation. These sub factors can change the perception of the respondent as to which measure of transportation as a whole can be placed.

4. Conclusion and Recommendation

This paper identifies the most critical and prominent factors that can have severe impacts on the efficiency and effectiveness of reverse logistics of the soft drink industry. Its findings can give insights for industry professionals as to the most important factors to be focused on in order to implement an efficient and effective reverse logistics channel. It emphasises the importance of giving primary focus to the distribution channel even though it is outsourced. Transportation, Accidents, Packaging and Storage have higher impact on measures of both efficiency and effectiveness. These factors will help in identifying the correct root causes of inefficiencies in the current practices and providing an opportunity to successfully implement a sustainable green supply chain practices in the reverse logistics process.

5. References

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Keywords*: reverse logistics, soft drink industry, returned empty glass bottles, analytical hierarchy process*