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Flexible Decision Modelling for the Reverse Logistics System: A Value-Added MOORA Method Approach to Alternative

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ABSTRACT

Any strategy for recovering products should strategically take into consideration the fact that inverse manufacturing is always a better alternative to collection centers. Typically, these findings are characterized as multidimensional, trans disciplinary, complicated, and unstructured. Correctly installing reverse logistics systems, naturally, operational costs are decreased and customer loyalty is increased as a result of the reuse or reproduction of specific parts. With a follow-up interview to provide survey data, the main objective of this research is to analyze reverse logistics practices in this industry. The objective of this study is to identify the best inventory regulations for a reverse logistics system using a particular system. Over a particular planning horizon, it is thought that the rate of return on commodities consumed is a known continuous function. The foundation of the MOORA approach is theory in this article A multi-criteria decision-making (MCDM) model is what we suggest. The suggested method aids in creating adaptable revenue plans that are successful and efficient dependent on a number of variables. Businesses also conduct this analysis. Building new reprocessing facilities or making better use of the existing facility are tools for strategic decision-making. Given that some parts can be reused or remanufactured, it is not unexpected that well managed reverse logistics systems can boost customer loyalty and reduce operating expenses. For companies with quick product life cycles, like those in the mobile phone industry, this is crucial. The main goal of this study is to present the findings of a pilot survey and follow-up interviews that were done to look into the reverse logistics practices in this industry. Design, technique, and approach – A questionnaire survey was given to the industrial participants, and follow-up interviews were conducted with the respondents. Results - The industry needs reverse logistics systems, but their relative lack of relevance in comparison to other problems continues to be a significant roadblock to their implementation.

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Introduction

Recently, reverse logistics has received increased attention from both academics and business. There are numerous things that make people notice it. The total cost of logistics was $862 billion in 1997, according to the census conducted by Rogers and Tibben-Lembke in 1998. Reverse logistics accounted for a sizable chunk of that sum, or about $35 billion, or 4% of the entire cost of logistics. Concerns over energy conservation, environmental laws, and the adoption of electronic records are on the rise. The creators of eBay also supported product recycling. Due to their high consumption and return rates, paper, aluminum cans, and plastic bottles are commonly returned by online customers. Despite the fact that most companies are aware that the whole cost of processing returned goods exceeds the total cost of manufacturing, effective collections of returned goods can promote repeat purchases and reduce the likelihood of changes in material demand and pricing. For instance, The Body Shop uses an animal cruelty test and a green marketing strategy. Customers can get reimbursed at any retail location after returning their used cosmetic containers. This will unintentionally convince them to come back. Due to the ever-increasing demands of reverse logistics, the finest route planning for returns, as well as inventory and warehouse design for returned items, are more competitive than others. As a result, having such a strategy in place is essential for firms. Discarded items are often gathered and aggregated at approved regional distribution hubs, retail collecting locations, before being sent to a centralized return center. Reverse logistics also encompasses collection, sorting, disassembly, repair, and disposal in order to recover products. The main difficulties with those jobs are with distribution and inventory control. Distribution management optimization techniques can be used to handle issues including distribution network design and facility site allocation. Inventory management must consider ways to maintain the value of returned items and be mindful of the difficulties in estimating the irregular volumes of recovery products. As a result, academics start to place more emphasis on responsive scheduling than on forecasting. Reverse logistics is not the symmetrical opposite of forward logistics. Quantity, category, cycle time, stock keeping unit, and distribution channels are just a few of the different ways in which forward and reverse logistics are distinguished from one another. Most returned items are of various types and modest quantities. The cycle time for collecting returned products is unknown, which has motivated research on stochastic lead times (Lieckens & Vandaele, 2007). In addition, whereas it may be a weight unit in reverse logistics, the stock holding unit employed in forward logistics could be a box or a pallet. For instance, while used aluminum cans supplied to the collection facility might be measured in kilograms rather than boxes, the inventory for beverages might be kept in boxes. Compared to forward logistics, reverse logistics involves more complex delivery pathway scheduling and routing. Reverse logistics are forwarded from the approved regional distribution center to an authorized centralized return center, where they are processed prior to being delivered to manufacturers for remanufacturing or, alternatively, directly to manufacturers. Since return volumes are unknown, the physical flow pathway is trickier than in forward logistics. Because product return rates vary by location, the placement of collection points can significantly affect how well recycling is done. This article proposes utilizing artificial intelligence algorithms to select the optimum places for collection points in order to optimize their Coverage. According to Fleischmann et al. (1997), the principal recovery alternative can be broken down into four different types of networks: networks that are directly reusable, networks for remanufacturing, networks for repair services, and networks for recycling. Regarding remanufacturing, Using Lagrangian heuristics, Lu and Bostel (2007) created a 0-1 mixed integer programming model that simultaneously considered forward and reverse flows. Lee and Dong (2008) developed a two-stage heuristic technique to transform the integrated design of a logistic network for end-of-lease goods recovery into a site allocation problem. For the purpose of solving the issue, the demands for network flow conservation and capacity restrictions were taken into consideration. The locations were chosen at random, and the initial solution for returned items and the best forward logistics solution were chosen using a simplex algorithm

Reverse Logistics System

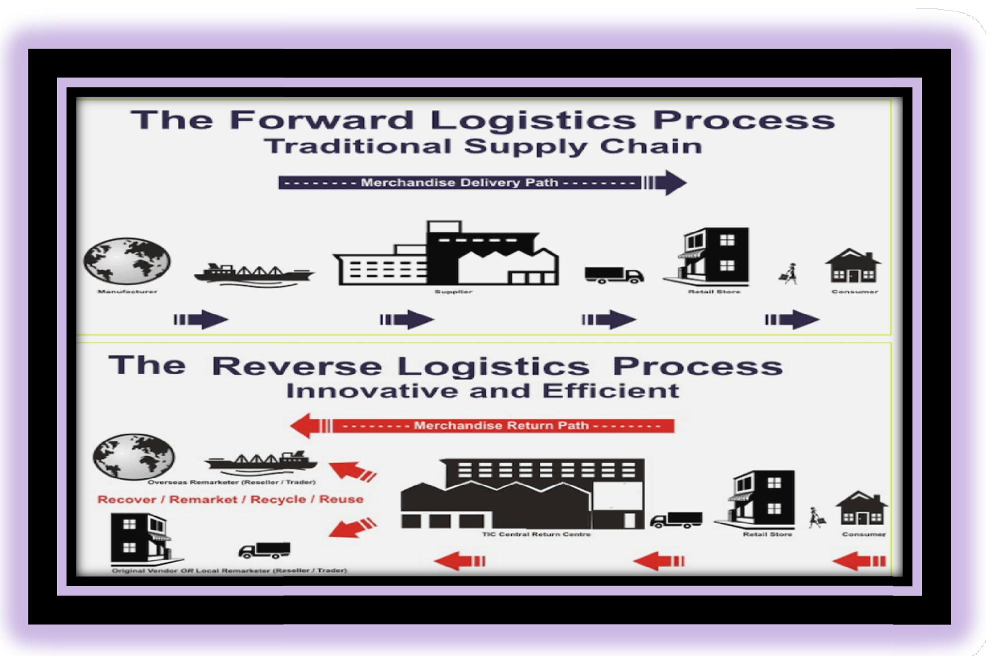

Figure 1. Reverse Logistics System

Reverse logistics refers to supply chain management that returns commodities from sellers or producers to purchasers. After a customer receives a product, reverse logistics are required for processes like returns and recycling. Reverse logistics (RL) is the process of transferring goods away from their typical final destination in order to add value to them or appropriately dispose of them [1]. The goal of logistics systems has always been the delivery of products from their point of origin to their final destination. A resource-efficient supply chain is incorporated into an RL system (RLS) to control the flow of goods or components intended for recycling, repairing, or disposal [2]. Product returns are now commonplace across almost all product categories, with some industries reporting rates as high as 20%. As a result, developing a comprehensive and cost-effective decision system for producer turn handling is a difficult issue that extends far beyond alluvial operation. A well-crafted reverse logistics and management plan can therefore be a very beneficial strategic asset [3,4]. The average return percentage was 8.46%, according to a prior survey by the Reverse Logistics Executive Council (RLEC), which also listed each customer's expected return. When considering the entire industrial value chain in 2005–2006, return rates were as high as 20–30% or more, and it is anticipated that they will continue to climb.

“Reverse logistics is a process in which a manufacturer systematically accepts previously shipped products or parts from the point for consumption for possible recycling, remanufacturing or disposal A reverse-logistics system incorporates a supply chain that has been redesigned to manage the flow of products or parts destined for remanufacturing , recycling, or disposal and to use resources effectively. Reverse logistics has received a great deal of attention from operations managers and company executives. The issues surrounding functions, channels, differences between forward and reverse operations, cost, and other general information about reverse logistics have been described by Kopicki et al. [1993], Pohlen and Farris [1992], Sarkis [1995], Stock [1992], and Thierry et al. [1995]”.

Many businesses use reverse logistics, including those that make steel, commercial airplanes, computers, mobile phones, chemicals, appliances, and medical supplies. “Companies that have practised reverse logistics include BMW, Del phi, DuPont, General Motors, Hewlett Packard, Storage Tek, and TRW. Thierry et al. [1995] report that reverses logistics is widely used in the automobile industry. It provides automobile firms with far reaching cost and strategic advantages in a highly competitive industry.” BMW's long-term objective is to create a car that is "totally reclaimable" by the twenty-first century. All parts are to be recovered, restored, and then used again [Giuntini and Andel 1995a]. When faced with fierce competition and limited profit margins, a company might compete in its business by using reverse logistics effectively.

Moora Method

Programming with multiple objectives, multiple criteria, or multiple attributes It also goes by the name "optimization" and comprises more contradictory traits (notes), subject to specific limitations. It involves simultaneous upgrades. Design of goods and processes, finance, the design of aircraft, the oil and gas business, manufacturing, the design of automobiles, and other fields or trade exchanges where there are two or more competing objectives Many objective optimization issues must be solved in order to make the best choices. Profit maximization, product price reduction, improved vehicle efficiency and fuel economy, and increased engineering component strength are all goals. Losing weight is a goal of multi-objective optimization. Typical instances include Instantaneous production Different interests and values in context decision-making by various decision-makers They make things exceedingly challenging. For each decision alternative in a decision issue, objectives (characteristics) that may be measured allow for the measurement of the consequences. It is simpler to select the best (pleasing) alternative when there is a basis for comparison between possibilities provided by objective outcomes. Due to the numerous multi-objective optimization strategies' reliance on frequently at odds with each other features among the possibilities provided It seems to be a suitable tool to rank one or more alternatives or to make a decision. Brauers was the first to introduce the MOORA technique. It has a number of uses. This is in a production environment, according to the optimization technique. Numerous difficulties Problems making decisions Use the phrase successfully solve. An indicator of how effective an option is, where m is the number of alternatives and n is the count of parameters. The resulting team is then normalized, making all of its components equivalent and dimensionless. In relation to that criterion, this normalization technique uses a ratio system. When compared to a class, representation of all possibilities shows substitution efficiency. Here are the details: It is acceptable to normalize things simply. xij is a jth scale dimensionless number in the [0, 1] range. The performance is normalized of the ith substitution. (Beneficial or unbeneficial) Type of criterion a decision matrix's constituent parts Despite the fact that are homogenized It is important to note here. Result Matrix Great value while having For that criterion normalized value it is too much than one Can occasionally be noticed, despite the following normalization process being given. The largest size value drops below one. The MOORA approach uses a normalized version of this. Performance is advantageous. All that is of substitute with regard to the parameters yi is an estimated value, in addition to the criteria and unnecessary criteria, the Maximum criteria, to be lowered Number of criteria, and the criteria. Best alternative assessment while descending sorting high worth. To pick the final group of viable candidate options It is advised to rank yi values hierarchically. Breyers and Zavatskas showed that connections between goals and goals and alternatives are particularly strong this time for stakeholders (decision makers). Since this method is non-subjective and based on the most recent data, it is far superior to other MCDM methods now in use.

Analysis And Discussion

Table 1. Alternatives

A1	Remanufacturing
A2	Reselling
A3	Repairing
A4	Cannibalization
A5	Refurbishing

Table 1 shows the Reverse Logistics System Alternatives In alternatives A1 as Remanufacturing, A2 as Reselling, A3 as Repairing,A4 as Cannibalization,A5 as Refurbishing.

Table 2. Reverse Logistics System Data Set

	Market factor	Quality factor	Legislative impact	Cost/time factor	Environmental impact
A1	56.23	75.48	76.43	29.15	21.12
A2	75.43	86.43	49.73	33.69	27.30
A3	45.36	79.42	69.43	36.42	23.10
A4	56.14	65.43	85.00	24.60	45.13
A5	69.13	66.43	57.13	35.00	20.43

Table 2 shows the different factors like, market factor, quality factor, legislative impact, cost/time factor and environmental impact evaluation data.

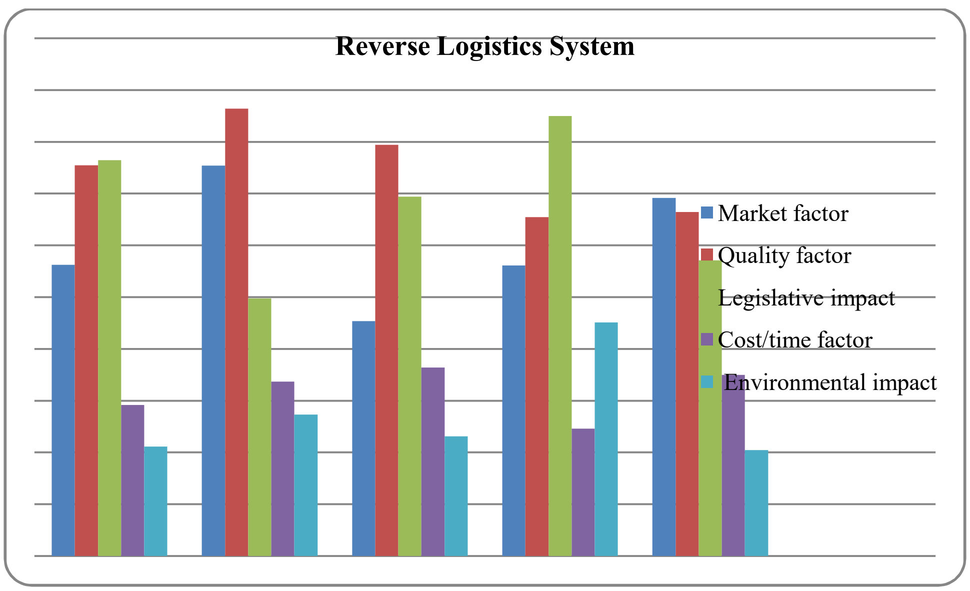

Figure 1. Data Set Graph

Table 3. Reverse Logistics System Square Root of Value

	Market factor	Quality factor	Legislative impact	Cost/time factor	Environmental impact
A1	3161.8129	5697.2304	5841.5449	849.7225	446.0544
A2	5689.6849	7470.1449	2473.0729	1135.0161	745.2900
A3	2057.5296	6307.5364	4820.5249	1326.4164	533.6100
A4	3151.6996	4281.0849	7225.0000	605.1600	2036.7169
A5	4778.9569	4412.9449	3263.8369	1225.0000	417.3849
	18839.6839	**28168.9415**	**23623.9796**	**5141.3150**	**4179.0562**

Table 3 shows the different factors Reverse Logistics System Square Root of Value.

Table 4. Normalised data

	Market factor	Quality factor	Legislative impact	Cost/time factor	Environmental impact
A1	0.4097	0.4497	0.4973	0.4065	0.3267
A2	0.5496	0.5150	0.3236	0.4699	0.4223
A3	0.3305	0.4732	0.4517	0.5079	0.3573
A4	0.4090	0.3898	0.5530	0.3431	0.6981
A5	0.5037	0.3958	0.3717	0.4881	0.3160

Normalised data Table 4 shows the data from which the normalized data is calculated from the data set value is divided by the sum of the square root of the column value. It is the normalisation of the set of data of market, quality factor, legislative impact, cost/time factor, environmental impact.

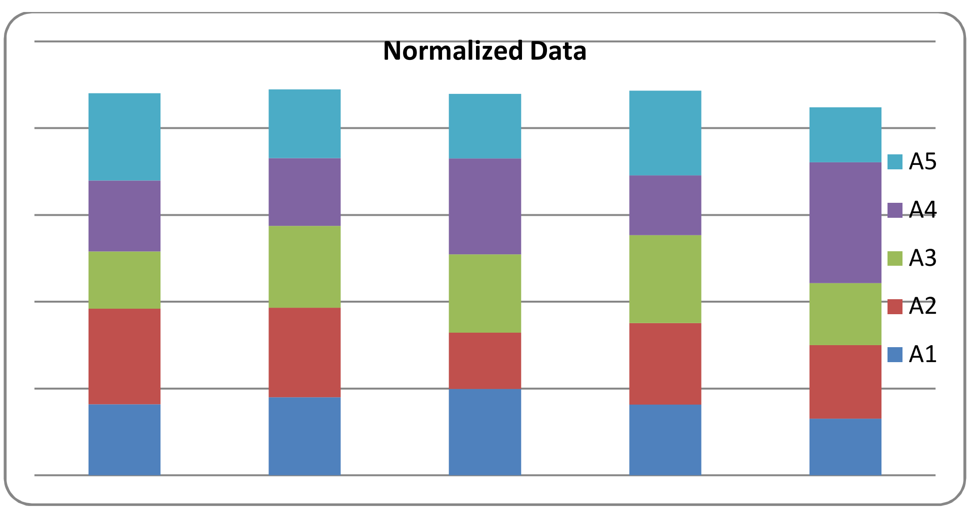

Figure 3. Normalised data

Table: 5 Weight

	Market factor	Quality factor	Legislative impact	Cost/time factor	Environmental impact
A1	0.25	0.25	0.25	0.25	0.25
A2	0.25	0.25	0.25	0.25	0.25
A3	0.25	0.25	0.25	0.25	0.25
A4	0.25	0.25	0.25	0.25	0.25
A5	0.25	0.25	0.25	0.25	0.25

Table 5 indicates of the weight of the given data. In everything like A1, A2, A3, A4, A5 the same data is given, The given is weight is 0.25.ss

Table 6. Weighted normalised decision matrix

	Market factor	Quality factor	Legislative impact	Cost/time factor	Environmental impact
A1	0.1024	0.1124	0.1243	0.1016	0.0817
A2	0.1374	0.1287	0.0809	0.1175	0.1056
A3	0.0826	0.1183	0.1129	0.1270	0.0893
A4	0.1023	0.0975	0.1383	0.0858	0.1745
A5	0.1259	0.0990	0.0929	0.1220	0.0790

Table 7 show us the value of the given data weighted normalised decision matrix. They are marked with A1,A2,A3,A4,A5.

Table: 7 Assessment value

A1	0.1559
A2	0.1240
A3	0.0975
A4	0.0777
A5	0.1167

Table 7 indicates the assessment value of the Reverse Logistics System. These values are given in the rows as A1, A2, A3, A4, and A5.

Table: 8 Rank

Remanufacturing	1
Reselling	2
Repairing	4
Cannibalization	5
Refurbishing	3

Finally the rank of the reverse logistics system is given. The rank is not the same or in the order but Remanufacturing is 1 rank, Reselling is 2 ranks, Refurbishing is 3 ranks, Repairing is 4 ranks and Cannibalization is fifth ran

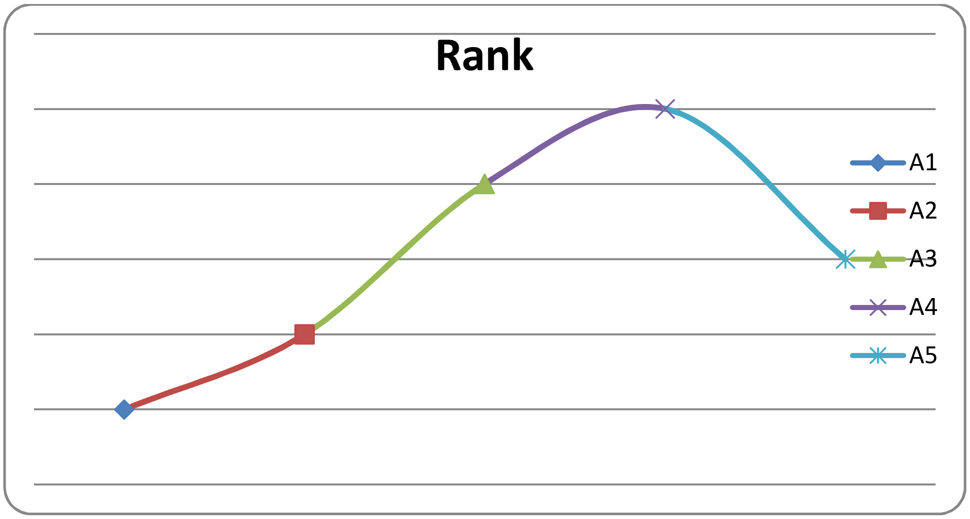

Figure 4. Ranking

Figure 3 Remanufacturing is 1 rank, Reselling is 2 ranks, Refurbishing is 3 ranks, Repairing is 4 ranks and Cannibalization is fifth rank.

Conclusion

Political, economic, technological, and diplomatic connections are all influencing variables when deciding on offset policy because the process is complex and the offset is dynamic. Many literatures consider the MCDM model in light of the evaluation criteria and suggest independent conditions for the end result or other formats. They assess its framework for making decisions using a range of potential possibilities. When dealing with multi-probability MCDM, it may be a turning point when the assumptions are parameter independence and a problem of linear hierarchy. The MOORA approach is simple to utilize, nevertheless. So, cooperate with MOORA to address concerns with reliance and feedback. The MCDM model was suggested by the author, and it aids decision-makers in reaching the best choice. On the other hand, creating IR introduces a number of challenging factors. An issue with causality MOORA is one of the scales used for measurement. Consequently, the methodical and objective assessment methodology is more precise. A worthwhile contribution to consider is MOORA. In contrast to the conventional way of solving the MCDM problem, the best research methodology is MOORA. Nonetheless, the method for installing offset forms and signing offset agreements the truth changes in each circumstance. Therefore, research focusing on case studies may be the way forward in the future in order to harmonize theory and practice.

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