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Analysis of Reverse Logistics System using COPRAS MCDM Method

*[1]Krishna Kumar TP, [2]M. Ramachandran, [2]Kurinjimalar Ramu, [2]Ashwini Murugan
[1]Nehru School of Management @ NCERC, Pamapady, Thiruvilwamala, Thrissur, Keral, India.
[2]REST Labs, Kaveripattinam, Krishnagiri, Tamil Nadu, India.
*Corresponding author Email: tpk683@gmail.com

Abstract. Reverse logistics, which is product recovery, Due to product returns or inventory management or revenue stream; creates a closed loop supply chain. Close-loop supply chain success means manufacturers and depends on the actions of the customers. Now, due to environmental protection laws, Easy to disassemble, reuse and recycle Products must be manufactured by manufacturers. On the other hand, many customers, By delivering goods to collection points Support environmental protection. According to the findings, the total cost for reverse logistics is huge. Total reverse logistics cost and collection points To reduce the high usage rate, Ideal for collection points in reverse logistics Choosing locations is very important. To design a decision-making model for that, Cost/time, legislative factors, environmental impact, Based on criteria such as quality, market etc Quantitative and qualitative assessment is required. Appropriate based on these criteria Performance must be considered to determine reversal. Manufacturing option is in this domain Depends on expert opinion. In this paper, based on COPRAS set theory A multi-criteria decision-making (MCDM) model is proposed. Remanufacturing, Reselling, Repairing, Cannibalization, Refurbishing is alternatives and Market factor (C1), Quality factor (C2), Legislative impact (C3), Environmental impact(C4), Cost/time factor (C4) is taken for evaluations parameters. As a result the Remanufacturing is in 1st rank and Refurbishing are last rank
Key words: Reverse logistics (RL), manufacturing organizations, Manufacturing businesses, MCDM

1. Introduction

Reverse logistics (RL) is intended to capture value from the final destination or materials properly defined as a disposal process it is the process of returning to normal. Goods from their point of origin Movement to their final destination is at the heart of logistics systems. An RL system (RLS) integrates the supply chain, It reproduces the flow of materials or parts, Redesigned to manage repair or removal and efficient use of resources. Today the product turnover is approx has become common across all product categories, in some industries the prices are as much as 20% higher. Hence, for product return handling beyond the functional level developing a comprehensive and cost-effective decision-making system a tough challenge. Hence, well-developed reverse logistics and the management plan will be a key strategic asset. Presence of multiple criteria(Management and Technology) and involvement of multiple decision makers The results can be extended from single to multi-dimensional, This adds to the complexity. By grinding through a mathematical model or algorithm it is clear that the selection problem cannot be solved. This kind of complexity and to support unstructured test problems, of choice and priority Multi-criteria decision-making problems we need new approaches that can be manipulated. The results of this selection of recycling alternatives will prioritize companies; correspondingly the inversion will help to improve the production facilities. Inverse manufacturing alternative selection decision framework is based on a flexible and scalable options decision framework this paper attempts to unify by Formulation of Fuzzy Decision Making and Reverse Logistics (RL). Based on the results of this systematic decision analysis, Analysis allows decision makers to rank alternatives. As the rate of return increases, Reverse logistics planning and infrastructure design becomes more essential. Financial management and EPA are recycled and risky Future material flow of goods and necessary In the number of facilities they have Very caring. Points, storage sites, extraction/recycling plants In a reverse logistics system and includes the final transshipment/stored goods market. Total cost by selling reclaimed materials It also aims to reduce revenue. Flow safety controls in the model, Facility capacity constraints, and new facilities Includes numerical limits and non-negativity constraints. COPRAS (Complex Proportion Estimation) is the most used One of the multiple criteria decision making (MCDM) methods, This is possible by Determining the ratio of the best solution and the best ratio Provides the best alternative in a set of alternatives. The technique is used to solve decision-making problems used by various researchers.

2. Reverse Logistics System

Reverse logistics is from the market to manufacture the returned goods, also a term for remanufacturing reusable materials. Freshly made (manufactured) and One should be satisfied with the remanufactured products. There is no difference between manufactured and recycled materials. So too for manufactured goods Remanufactured products are no different. If used materials are economical, this is a good opportunity to avoid burdening the environment with waste or conserve minerals. A product reverse logistics systems that have been determined in the past year were investigated in detail with optimal control theory. Optimal control at the right time Classifies the optimal path. Application of modern control theory to optimal

path and just in time Provides qualitative information about decision rules. Minner and Kleber and Topos are linear costing studied A linear inverse logistics problem with setup and removal. The results of these tests, implies that the optimal production-reproductive strategy is extrinsic. An optimal path always means that there are constraints on inventory levels or control variables. A reverse logistics network system consists of five main components. These are WEEE, Municipal collection points, Storage sites, recycling facilities and secondary Sources of material market/end disposal facilities. In the first phase, municipalities want housing and retailers Collect WEEE from various sources. Then, the liability of producers begins. They are responsible for both collection and recycling. Therefore, reverse logistics network design, from municipal collection points to secondary material market/final disposal facilities it is necessary to focus on the area of responsibility of producers. Reverse logistics is about logistics management skills and de-risking from packaging and products or reducing hazardous waste, Refers to activities involved in managing and eliminating. It involves inverse distribution, this is from normal logistic operations It involves the flow of materials and information in the opposite direction. Concepts in the area of reverse logistics, a comprehensive study of organizations and operations published by the Logistics Management Council. In this article, reverse logistics We consider the practical application: Reuse of secondary packaging material. For returnable containers, Used to create a return logistics system we offer several methods.

3. COPRAS

COPRAS was originally developed by Zavatskas and Kaklauskas (1996) introduced. COPRAS method with better resolution rate determines a solution. Adequately describe the values and weights of alternative methods and criteria Significance of versions examined in the criterion setting this method assumes direct and proportional dependence and utility. In conventional cobras, weights of scales and estimates of Soft's alternatives as numerical data are taken into account. However, under many conditions, real-world decision-making problems Smooth data is not enough to handle. On the other hand, accurate knowledge not easily obtained. These also make the results accurate. Alternative methods and criteria values and calculate the weights adequately Significance of versions examined in descriptive criteria setting this method is direct and proportional bias and considers usability. Determining the importance, order of priority and extent of use of alternatives is carried out in five steps: 1. Weighted normal decision matrix D. 2. Weighted normalized describing the alternative Calculating sums of symbols. 3. Advantages S+j and disadvantages S -j of substitutes Describe and determine the Qj values of the compared alternatives. Degree of application of alternative aj 5. Determining the priority order of alternatives. For pre-qualification of bidder's five window replacement versions Results of multi-criteria assessment, based on utilization degree equal to 100% the first alternative shows that it is better, and The third version is basically the second best Usage rate equals 100%. The next step is the final selection of the contractor. Satisfied pre-qualification requirements considering bids of candidates. After completing the technical assessment, for the final exam of the final short-listed contractors to award the contract Price proposals will be linked to the technical score. Show table 1 give in evaluation parameters.

TABLE.1 Evaluation parameters Criteria for segmental attractiveness

C1	Market factor
C2	Quality factor
C3	Legislative impact
C4	Environmental impact
C5	Cost/time factor

TABLE.2 given a data set

	C1	C2	C3	C4	C5
Remanufacturing	56.23	75.48	76.43	29.15	21.12
Reselling	75.43	86.43	49.73	33.69	27.30
Repairing	45.36	79.42	69.43	36.42	23.10
Cannibalization	56.14	65.43	85.00	24.60	45.13
Refurbishing	69.13	66.43	57.13	35.00	20.43

Table 2 is given The Data Set. Remanufacturing values is high values for the data set. Cannibalization is low values for the data set. Table 1 shows the data set for the Reverse logistics using COPRAS method for the Remanufacturing, Reselling, Repairing, Cannibalization, Refurbishing of the Market factor, Quality factor, Legislative impact, Environmental impact, Cost/time factor.

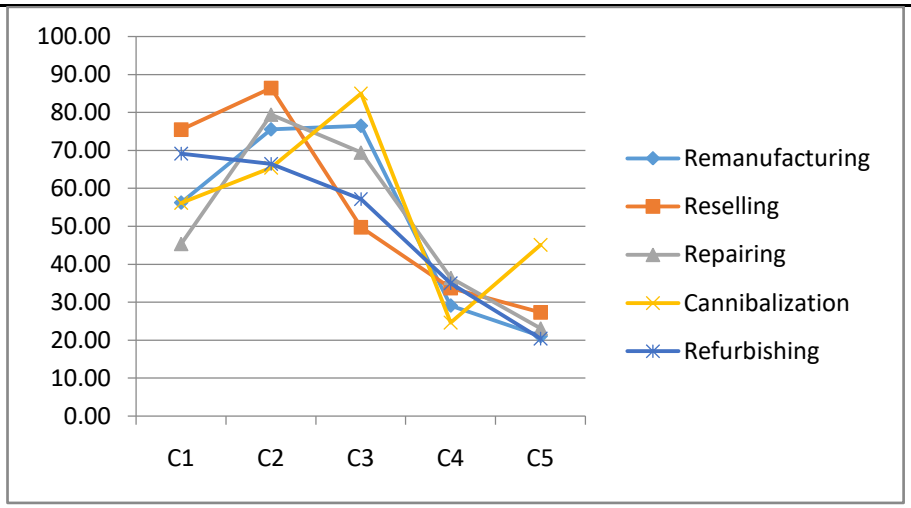

FIGURE 1. Give a data set graph

Figure 1 shows the data set for the Remanufacturing, Reselling, Repairing, Cannibalization, Refurbishing of the Market factor, Quality factor, Legislative impact, Environmental impact, Cost/time factor.

TABLE.4 Normalized data

	C1	C2	C3	C4	C5
Remanufacturing	0.186	0.20226	0.2263	0.183495	0.15
Reselling	0.25	0.2316	0.1473	0.212074	0.2
Repairing	0.15	0.21281	0.2056	0.229258	0.17
Cannibalization	0.186	0.17533	0.2517	0.154853	0.33
Refurbishing	0.229	0.17801	0.1692	0.22032	0.15

Table 4 shows the normalized data which is calculated from the data set each value is calculated by the same value on the data set divided by the sum of the column of the above tabulation.

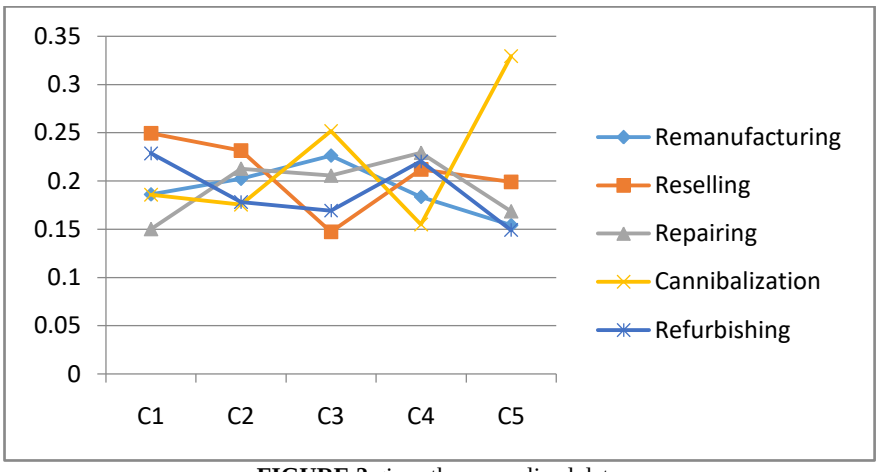

FIGURE 2 gives the normalized data

TABLE. 5 gives weight matrix

C1	C2	C3	C4	C5
0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25

Table 5 shows the weight of the data set the weight is equal for all the value in the set of data in the table 1. The weight is multiplied with the previous table to get the next value.

TABLE.6 Weighted normalized result matrix

	C1	C2	C3	C4	C5
Remanufacturing	0.05	0.05	0.06	0.05	0.04
Reselling	0.06	0.06	0.04	0.05	0.05
Repairing	0.04	0.05	0.05	0.06	0.04
Cannibalization	0.05	0.04	0.06	0.04	0.08
Refurbishing	0.06	0.04	0.04	0.06	0.04

Table 6 shows the weighted normalization decision matrix it is calculated by multiplying the weight and performance value in table 4 and table 5.

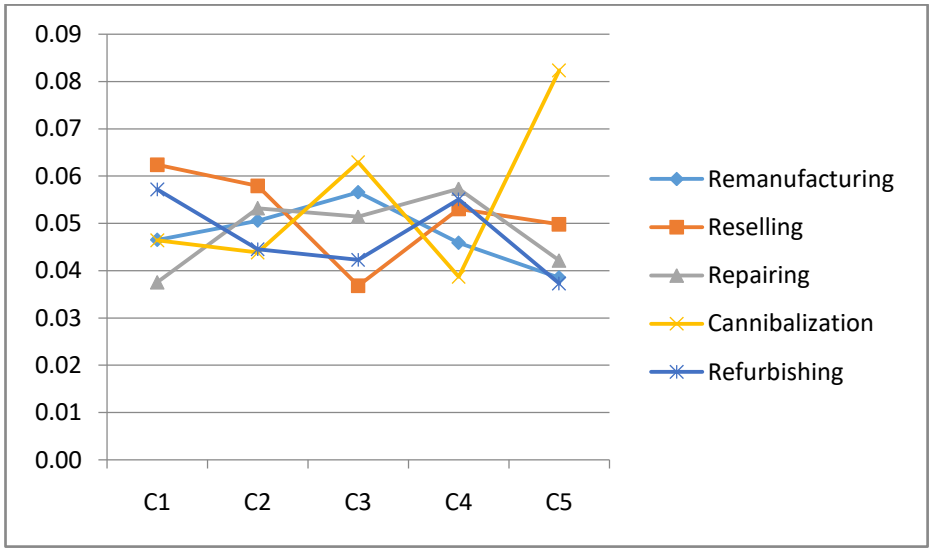

FIGURE 3 Weighted normalized result matrix

TABLE 7. Value of Bi, Ci

Bi	Ci	Min(Ci)/Ci
0.1536	0.084	1
0.1571	0.103	0.820873
0.1421	0.099	0.848638
0.1532	0.121	0.697338
0.1440	0.092	0.913928

TABLE.8 Ranking

Qi	Ui	Rank
0.2704	100	1
0.253	93.53924	2
0.2412	89.19884	4
0.2346	86.75739	5
0.2507	92.70305	3

Table 7 and Table 8 show the value of Bi, Ci, Qi, Ui. The Bi is calculated from the sum of the Specific strength, Specific Modulus, Corrosion resistance. The Ci is calculated from the sum of cost category. Qi is calculated from the Bi and Ci and the Ui is calculated from Qi. Table 8 shows that the Remanufacturing is on 1st rank, Reselling is on 2nd rank, Refurbishing is on 3rd rank, Repairing is on 4th rank, Refurbishing is on 5th rank,.

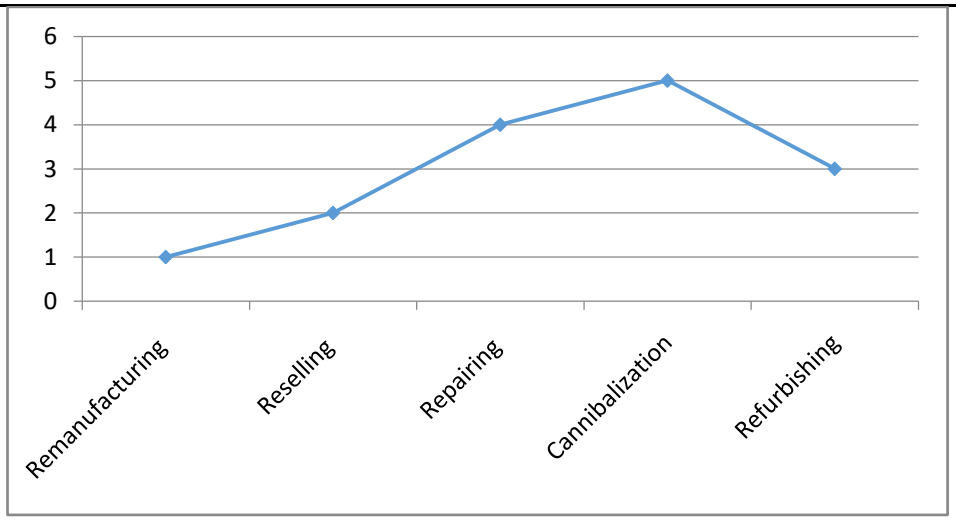

FIGURE 4 shown in ranking.

Table 8 shows that the Remanufacturing is in 1st rank and Refurbishing are last rank. Figure 4 shown in ranking.

4. Conclusion

Reverse logistics has become very important in the recovery system to handle backflows. Due to the importance of the subject, in most countries of the world Environmental laws have made it mandatory to create recycling systems. All of these conditions provide a selected environmental impact, that's mainly as a result of substances worried in one of kind situations. COPRAS are one of the most broadly used of a couple of criterion selection method. One, it gives the pleasant opportunity for a set of viable options via locating the pleasant reaction rate and the exceptional-worst response fee. This approach became decided on by means of critical researchers to remedy the troubles used. We analyzed that the Remanufacturing is on 1st rank, Reselling is on 2nd rank, Refurbishing is on 3rd rank, Repairing is on 4th rank, Refurbishing is on 5th rank,.

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