To Find the Effectiveness of Barriers in Reverse Logistics by Using ISM

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1 Introduction

In an organization, the major challenge is managing return product to the customer, can be done with the help of Reverse Logistics (RL). RL is the path used for mange all process connected to the return and use again the return items. This is a latest approach to increase the productivity and effectiveness using the sustainability concept and activity which involved reducing the cost, managing the goods, arranging of hazardous waste from packaging and production; From a commercial perspective, Reverse Logistics is a process where products move from final destination to manufacturer, to capture value otherwise unavailable, and for proper dumping of the goods [1]. Technology and human resources are gifts for India. Despite this, just because of the successful implementation of RL companies face lots of problems, which is the barriers of RL, due to it the idea of RL is not generally accepted. Some of these RLBs are lack of strategic planning, lack of personnel training, financial constraints, company policies, the problem with product quality, etc. For the top management, it is hazardous to handle the involvement of economic and other operational feature that recognize the long term company activities [2]. Mentioned RLBs are affecting the implementation of RL and also they are influences to each other, so it is necessary to know the reciprocal relationships between them. Recognize that barrier which provokes some other barriers and that independence barrier which are influenced by driving barrier and support in the implementation of the RL program by top management. Taking correct action for dealing with barriers in RL can guide to come out form that implementation problem. For structuring the barriers of RL, the ISM approach has been used here.

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2 Literature Review

2.1 Reverse Logistics

In the beginning, RL was introduced for both business and society and the Logistics management commission start publishing those studies [3]. After that other studies are stretching the opportunities on reuse and recycling the goods. RL encourage another use of resources, which can be cost-effective by extending the product life cycle. RL motivates the producer to make blueprint that can be dismantle and renewal, in the structure of sustainable development [4].

2.2 Studies Related to RL

From the last few years, companies have been planed the RL programs and reuse the damage products and try to increase the product life-cycle have been concentrated and complete structure to set up. A wide range of RL company put into practice have presented by Chandra Prakash and Pandya [5]. Multiple attribute decision-making (MADM) approach is most widely used in industry to take better decision [6].

In his study (G. Thiyagarajan and Saifil Ali), they identify the most affecting RLBs that prevent implementation in different–different online retail industries and for this, they used methods to recognize the most influencing obstructions for Reverse logistics execution [7].

Analysis of RL strategies for An Indian perspective has been discussed by S. K. Sharma et al. in his paper focus points are: hierarchy of action and obstruct the execution of RL, Relationships, inventory management, planning and control [8]. Most of the articles are dedicated to the analysis of practice that has been appeared in RL.

Marta Starostka- Patyak, Marcin Zawada, and Aleksander Pabian explain how to implement RL in enterprises [9].

However, a computer-assisted learning process called Interpretive Structural Modeling (ISM) methodology, which is used to recognize the interrelationship between the variables (or elements) and build a structure on the basis of RLBs level. Analyses of interactions among the reverse logistic barriers have studied by V. Ravi and Ravi Shankar using ISM methodology [10].

Here in this paper use, fifteen barriers are mentioned, some of them are from different-different research papers and others from the self-study. A Literature Review for this paper is shown in a chart, which is given in Table 1.

Table 1 Literature review

S.No.	Barriers	Researcher
1	Lack of strategic planning	Chehab Ali (2017), Chandra Prakash (2015), Marta Starostka-Patyk (2013), V. Ravi (2004)
2	Lack of advanced information system	Chehab Ali (2017), Dr. Saifil Ali (2016)
3	Shortage of devoted employees/staffs for handle returned product	Chehab Ali (2017)
4	Financial constraints	Chehab Ali (2017), Chandra Prakash (2015), S.K. Sharma (2011), V. Ravi (2004)
5	Lack of personnel training	
6	Lack of economic support from the government	Muhammad Waqas (2018)
7	Lack of inspection	
8	Lack of higher authority commitment	Muhammad Waqas (2018), Dr. Saifil Ali (2016), Marina Bouzon (2015), Marta Starostka-Patyk (2013), Sharma (2011), Ravi (2004)
9	Quality issue	Muhammad Waqas (2018), S.K.Sharma (2011), V. Ravi (2004)
10	Company policies	Muhammad Waqas (2018), Marina Bouzon (2015), Marta Starostka-Patyk (2013), Chandra Prakash (2015), V.Ravi (2004)
11	Opportunist behavior	Chehab Ali (2017)
12	Lack of knowledge about reverse logistics	Muhammad Waqas (2018), Marina Bouzon (2015), Marta Starostka-Patyk (2013), S.K. Sharma (2011).
13	Restrictive return policy	Muhammad Waqas (2018), Marina Bouzon (2015), Chehab Ali (2017)
14	long processing cycle time of returned product	Chehab Ali (2017)
15	Unknown total cost of return process	Muhammad Waqas (2018), Chehab Ali (2017)

3 ISM-Based Framework Development

To analyzing the complex systems researcher Warfield in [11] first proposed a methodology called Interpretive Structural Modeling (ISM), it is an interactive learning process. Here in this study to determine the relationship between RLBs uses ISM methodology.

In 2013 an overview is presented by Rajesh Attri. According to them, ISM is an established methodology where develops a hierarchy of system variables who

represent the structure of that system. In this method structure those elements in a comprehensive systematic model that are different–different and directly affect the system. Using this model, try to find driving barriers and independent barriers which are based on the driving and dependence power [12].

ISM can be used as an individual or group process. The ISM methodology involved various steps, they are given below:

1. To identify those variables which are related to the problem;
2. To create a contextual connection between elements,contextual relation between any two variable can be drawn;
3. Develop a structural self-interaction matrix (SSIM) of variables which depicts pair-wise relation between variables;
4. Develop a Reachability matrix (RM) from the SSIM, and scrutinize it for transitivity;
5. Partitioning of the Reachability matrix into several levels;
6. Depends on relationship given in the Reachability matrix, drawn a directed graph;
7. Convert the resultant diagraph into an ISM-based model by placing the statements instead of variables nodes; and
8. Re-examining the model to test for conceptual in consistency and performing the modification if required.

3.1 Development of Self-interaction Matrix

ISM methodology recommends taking the specialist suggestion depend on different-different management techniques, to build up the appropriate relationship among the variables. For the contextual relationship ^{i}leads to^{j} type method is chosen. An appropriate relation is selected for analyzing the RL barriers. Maintaining the appropriate relationship for every RL barriers in intelligence, the existence of a relationship among any two barriers (i and j) and associated direction of the relationship is questioned. Development of SSIM led to describe the appropriate relationship between different pair of variables [12]. For representing the direction of a relationship between RLBs (i and j), following four symbols have been used (Table 2):

1. V is used for the relation from RLB_i to RLB_j (i.e. if i support to j).
2. A is used for the relation from RLB_j to RLB_i (i.e. if j support to i).
3. X is used for the relation in both directions (i.e. if i and j support to each other).
4. O is used for no relation between two RLBs (i.e. if i and j are unrelated).

Table 2 Structural Self-Interaction Matrix (SSIM)

RLB's	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	V	V	V	X	V	V	V	A	V	V	V	V	V	V	X
2	A	A	V	A	V	V	V	A	X	O	A	A	V	X	
3	O	A	O	A	A	O	A	A	A	A	A	A	X		
4	V	A	V	A	V	V	V	A	V	V	A	X			
5	O	V	V	A	V	V	V	A	V	V	X				
6	O	O	O	O	X	A	A	A	A	X					
7	A	A	A	A	V	V	V	A	X						
8	V	V	V	V	V	V	V	X							
9	A	A	O	O	V	V	X								
10	A	A	X	A	V	X									
11	A	A	A	A	X										
12	V	V	V	X											
13	A	A	X												
14	O	X													
15	X														

Table 3 SSIM Entry Rules

Entry in SSIM at the (i,j) cell	Entry in initial RM	
	(i,j)	(j,i)
V	1	0
A	0	1
X	1	1
O	0	0

3.2 Establishment of Initial Reachability Matrix

In this step, SSIM is converted into the initial Reachability matrix by transforming the information of each cell of SSIM into binary digits (i.e. ones or zeros). Table 3 shows the transformation has been done by the following rules:

3.3 Final Reachability Matrix

The final RM is generated by eliminating the transitivity in initial RM. Concept of transitivity is, if element X is related to Y and Y is related to Z, and then X is related to Z.

So, following incorporating the transitivity relationships by 1* final Reachability matrix is established:

3.4 Developing Level Partition

With the help of the final Reachability matrix, reachability and antecedent set for all barriers are found out. The Reachability set included the variable itself and the other variable help to achieve it [13]. Then, the intersection of these sets is derived for all the RLB's and the element having reachability & intersection sets are equal in leveling at the apex level (level I) in structure. After reaching the apex-level variable, it is divided from other variables. To find the criterion in the next level the similar manner iteration procedure is repeated and continued till the every level is found (level II, III, IV, V and so on…).

Table 4 shows the final partition level of RLB's for reverse logistics after all iterations.

Table 4 Final Reachabiliuty Matrix

RLB's	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	D.P.
1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	14
2	0	1	1	0	0	1*	1	0	1	1	1	0	1	0	0	8
3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4	0	1	1	1	0	1	1	0	1	1	1	0	1	0	1	10
5	0	1	1	0	1	1	1	0	1	1	1	0	1	1	0	10
6	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	3
7	0	1	1	0	0	1	1	0	1	1	1	0	1*	0	0	8
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
9	0	1	1	0	0	1	1*	0	1	1	1	0	1*	0	0	8
10	0	0	1*	0	0	1	0	0	0	1	1	0	1	0	0	5
11	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	3
12	1	1	1	1	1	1	1	0	1*	1	1	1	1	1	1	14
13	0	0	1*	0	0	1*	0	0	0	1	1	0	1	0	0	5
14	0	1	1	0	0	1*	1	0	1	1	1	0	1	1	0	9
15	0	1	1*	0	0	1*	1	0	1	1	1	0	1	0	1	9
Dp.P.	3	10	15	4	4	14	10	1	10	12	14	3	12	5	5	

3.5 *Development of the ISM Model*

Eighth levels have been found for fifteen RLBs. From these results, the ISM model has been generated by changing variables node by relationship status exposed in the final reachability matrix after eliminating the indirect relations (Fig. 1).

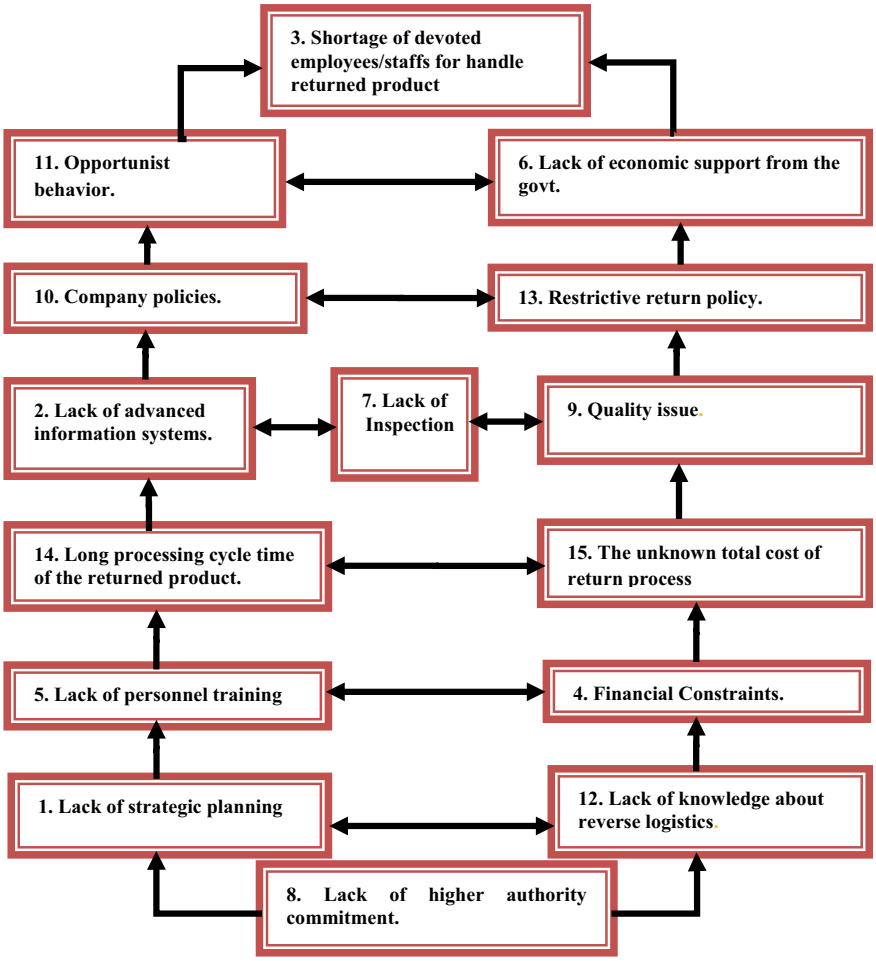

Fig. 1 ISM Based Model for Barriers of Reverse Logistics

4 MICMAC Analysis of Obtained Results

The MICMAC analysis is simply a 2D graph (Fig. 2), and the main purpose of this is to examine the driver power and dependence of variables.

The RLB's are organized into four various groups:

4.1 **Cluster-I Autonomous RLB**—Autonomous Barriers is those which driving and dependence powers are low. They do not have much influence on the system. In the present study, no autonomous barrier is found.

4.2 **Cluster-II Dependent RLB**—Dependent Barriers those which have low driving power and high dependence power. They are at the top in the model, therefore, considering the important BARRIER. Barrier numbers 2, 3, 6, 7, 9, 10, 11, 13 are dependent barriers in this study.

4.3 **Cluster-III Linkages RLB**—Linkages RLB are those which have high driving as well as high dependence power. These Barriers are not stable in nature and effect on successful Reverse logistics implementation. There are no Linkage barriers.

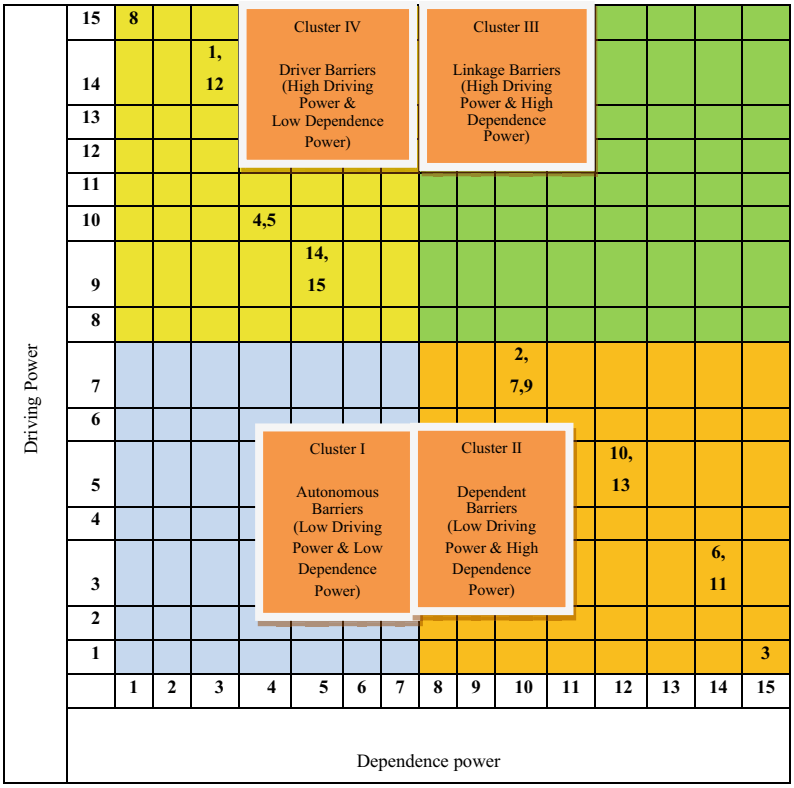

Fig. 2 Cluster formation by MICMAC analysis

4.4 **Cluster-IV Independent or Driver RLB**—Independent RLB is those which have high driving power and low dependence power. Therefore, the manager should try to remove it for effective implementation of RL. Barrier number 1, 4, 5, 8, 12, 14, 15 are independent barrier.

5 Conclusion

Lots of works have been done on factors which affect RL behavior. However, every time human behavior is complex and not easy to guess, more research work should be done. For this purpose, the present research tries to find the effectiveness of RL barriers. The company theatre a very important role in the development of any nation. This thesis summarized the mostly repetitively used RLBs which influence RL along new dimensions from industries viewpoint. It is very helpful for the researchers and managers involved in RL. Learning from old faults, times have come to modify and take RL toward the concept in the correct way and reap its advantages to the fullest.

In research, a try to identify and recognized the RLBs for smooth RL in the company. RL helps firms for their continued existence, profit, and growth. The RL increases the efficiency and production rate. Most of the companies face RL problems due to RLBs. Overcoming the identified RLBs provides a sustainable competitive benefit to the firms through smooth RL. Hence, the managers of the industries must consider these RLBs in order to utilize the benefits of RL. Result of study is that Lack of higher authority commitment, Lack of strategic planning, and Lack of knowledge about reverse logistics are significant RLBs. Therefore, for good management it is necessary to give attention to these Barriers during RL practices. This result assists the managers in judgment making and strategies to enable the identified RLBs according to their driving power.

ISM model results in an imaginary ranking that require a appropriate quantitative technique to calculate their effectiveness. From ISM and model, this thesis concludes that lack of higher authority commitment is the most effective barrier and lack of strategic planning and lack of knowledge about RL are the second most effective barriers in RL so managers should focus on these barriers while implementation of RL activity in the organizations.

Since the ISM model is depend on the experts view. So, it doesn't need further validation. But for the accuracy and sustainability of the result, structural equation modelling (SEM) used to test the model fitness for any organization.

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