



REVERSE LOGISTICS PRACTICES IN PLASTIC RECYCLING UNITS WITH SPECIAL REFERENCE TO KERALA

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Abstract

Logistics in business focuses on the movement of goods. These specially refer to the forward movement of goods from Manufacturers to the ultimate consumers. An unexplored area in this concept is Reverse Logistics. It refers to the backward movement of products from the customers to the manufacturers or third parties. This concept has gained its importance because it helps in the recycling of products. In this study the researchers have identified 81 plastic recycling units in Kerala registered under Suchitwa Mission through random sampling method. The motives, barriers and the benefits of these units were analysed. It was concluded that the recycling units in the Urban area mainly entered into these practices for economic motive while it was social motive for the units in rural area. Human Resource was a major barrier for units in Urban area in contrast to which technological barrier was persistent in Rural area. The social, economic and environmental benefits for the units were higher than their expectation

Keywords: *Reverse Logistics, Recycling units, Motives, Barriers, Benefits*

I) Introduction

The logistics system must meet certain standards for economic and environmental performance in order to maintain sustainable expansion. Due to the complexity and increasing importance of the logistics process, reverse logistics has been one of the most crucial areas of the eco-efficiency growth. With uses in a wide range of industries and output growth predictions of 4% each year until 2030, plastics are extremely adaptable industrial products. The use of plastic waste due to this material's low degradability, which takes anywhere from 100 to 1000 years to degrade depending on the form of plastic, has negative environmental effects, as well as the effects of climate change and rising consumer demands for environmentally friendly product design, are just a few of the issues the plastic industry is currently dealing with. Plastic recycling facilities in the state of Kerala were thus the subject of the current investigation. For the collection of data the list of companies registered under the Suchitwa mission under Kerala Government was taken. The recycling units are spread across Kerala in both rural and urban areas.

II) Review of Literature

K K Dhanda and A Peters (2005) did a study on "Reverse Logistics in Computer Industry". In order to establish a proper reverse logistics, the article used a reverse logistics hierarchy to the computer sector and discovered the necessary stages. The reverse logistics method has been shown to have some significant obstacles. The young age of the sector is one of the main obstacles in reverse logistics. Another significant finding of the study is that customers are less likely to buy used replacement parts than they are new parts. Additionally, organization's have to deal with some political barriers while implementing reverse logistics. These are all in the pilot stages even though the regulators have begun their research. Accordingly, more research in the field of reverse logistics is required, according to the findings.(Dhanda et al., 2005).

Joel R. Kinobe, Girma Gebresenbet and Björn Vinnerås (2012), studied on “Reverse Logistics Related to Waste Management with Emphasis on Developing Countries—A Review Paper”. The report attempted to summarise the state of waste management at the moment and the uptake of reverse logistics. The focus of the study is primarily on developing nations. The study examines the development of logistics and its continued shift toward reverse logistics. It also reveals that industrialised countries are more focused on reverse logistics than emerging ones. It has been demonstrated that industrialised nations are better at disposing of waste. In the case of emerging nations, a proper coordinated effort involving the public, community, and commercial sectors is required to properly put everything into place. The leftovers are frequently used as raw materials in other industries.(Kinobe et al., 2012)

Sumalee Pumpinyo and Vilas Nitivattananon (2014) carried out a study on “Investigation of Barriers and Factors Affecting the Reverse Logistics of Waste Management Practice: A Case Study in Thailand”. In Bangkok and the surrounding areas, research using both qualitative and quantitative methods was conducted. The data gathering phase included a thorough interview with the important stakeholders and a questionnaire from the management. The study's conclusions indicate that there are three categories of RL practises: upstream, downstream, and middle stream. When compared to other garbage buyers and sellers, the Separation centres in Reverse Logistics have more negotiating leverage. Financial, commercial, legal, management, technological, and other issues are the main limitations in RL.(Pumpinyo & Nitivattananon, 2014)

A study was done by **Hao Yu and Wei Deng Solvang (2016)** on the topic, “A general reverse logistics network design model for product reuse and recycling with environmental considerations”. In order to gain a deeper understanding of the subject, the researchers conducted computational and sensitivity analyses. The carbon emissions, cost-effectiveness, resource use, etc., must be balanced in an ideal way. The reverse logistics system is greatly benefited by this. It assists with both the configuration and transportation of the reverse logistics system.(Yu & Solvang, 2016)

Hendy Suryana, Gatot Yudoko, Heru Purboyo, Hidayat Putro and Puspita Dirgahayani (2019), did a study on Model Reverse Logistics System of Plastic Waste Recycling at Indonesia”. A model for reverse supply chain management is developed in the study. Also a list of each entity's cost and capacity for producing plastic waste. The time for minimising the cost was employed in a linear mathematical model.(Suryana et al., n.d.)

III. Research Gap

Though Reverse Logistics is considered to be a novel area, there are a lot of studies that were conducted in relation to Reverse Logistics Area. But no studies have been conducted among the plastic recycling units in Kerala. Therefore, this study attempts to study the Reverse Logistics Practices among the Plastic Recycling units in Kerala registered under Suchitwa mission.

IV. Objectives of the Study

- i. To find out the major motives of the recycling units to enter into Reverse Logistics Practices
- ii. To analyze the Barriers encountered by the recycling units
- iii. To examine the benefits derived by the units after entering into Reverse Logistics

V. Research Methodology

- a) Research Design: Analytical and Descriptive
- b) Research Approach: Telephonic Survey
- c) Research Instrument: Interview Schedule
- d) Research Period: December 2020 to February 2021
- e) Sample Design:
 - i. Population : Plastic Recycling units in Kerala
 - ii. Sample Unit: Plastic Recycling units registered in Suchitwa Mission Portal in Kerala
 - iii. Sample Size: The Cochran formula was used and the size was determined to be 81
 - iv. Sampling Procedure: Simple Random Sampling Method
- f) Sources of data collection:
 - i. Secondary Source: Research journals, official website of Suchitwa Mission
 - ii. Primary source: Plastic Recycling units in Kerala registered in Suchitwa Mission

g) Tools used for analysis

SPSS version 25 was used. Tests such as Mann Whitney U test, Multiple Discriminant Analysis and Levene's Test for Equality of Variances was used.

VI. Analysis and Interpretation

According to the objectives, various tests were used. Analysis and Interpretation were done with the help of SPSS and major statistical tests were performed. Based on the objectives, the following analysis was done and the interpretations were made thereof

i) Objective 1: Motives of Recycling Units to enter into RL Practices

This objective aims at exploring the motives for which the recycling units in the rural and urban area enter into Reverse Logistics.

Test Used: Mann Whitney U Test

Table 1

Motives of Recycling Units to enter into RL Practices

Motive	Location		Test Statistic	
	Urban	Rural	Z	Sig
Economic	39.13	42.22	-.637	.524
Environment	42.31	40.14	-.451	.652
Social	41.83	40.46	-.282	.778

Source: Computed using SPSS

Inference: Table 1 shows the different motives that drives the recycling units to enter into RL Practices. The statistical test shows that, Economic motive acted as a major driver for the urban units to enter into RL Practices, while Environmental and Social Motives were the major drivers of entry into RL practices by the Rural Area. Although the motives vary, the significance level show that there is no significant difference between them.

ii) Objective 2: Barriers involved in Reverse Logistics Practices

This objective focuses on the barriers that were encountered by the Plastic Recycling units once they entered RL Practices

Test Used: Multiple Discriminant analysis

Table 2 Eigen Values

Eigen Values				
Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	.085 ^a	100	100	.280

a. First 1 canonical discriminant functions were used in the analysis

Table 3 Wilks' Lambda

Wilk's Lambda				
Test of Function	Wilk's Lambda	Chi Square	df	Significance
1	.922	6.061	9	.000

b. Wilk's lambda was used to test significance

The canonical correlation coefficient of .280 with 100 per cent variance is seen significant at 5 per cent level with a Wilk's Lambda value of .0922 and Chi Square value of 6.061. Hence the function between the recycling units situated in the Urban and the Rural area is statistically significant and therefore these can be further analysed.

Table 4 Functions at Group Centroids

Location	Function
Urban	-.356
Rural	.232

Under standardised canonical discriminant functions evaluated at group means

The table above shows that the recycling units in the urban area are placed on the left side of the recycling units in the rural area, with a group centroid value of -.356. The value of the same for units in the rural area is .232. The cutting point therefore is calculated to be -.062. So all the variables above this value will be applicable for the units located in the rural area and the rest of the values below will be applicable for the units in the urban area. The values of the canonical discriminant function coefficients are listed below

Table 5 Standardized Canonical Discriminant Function Coefficients

Regulatory Barriers	.474
Financial Constraints	.201
Technological Barriers	.493
Management Barriers	-.089
HR and Organisational Barriers	-.623
Strategic Barriers	.301
Benchmarking issues	-.080
Behavioural issues from personnel	-.257
Societal issues	.013

Source: Primary Data

From Table 6 it can be inferred that Management Barriers, HR and Organisational Barriers, Benchmarking Issues and issues form Personnel are associated with the recycling units in the Urban area. All other barriers are associated with the recycling units in the Rural Area.

To find out the variables that explain the Discrimination Function, a structure matrix containing total correlation between the discriminating variables and standardised canonical discrimination function was developed

Table 6 Structure Matrix

	Function
Technological Barriers	.580
HR and Organisational Barriers	-.577
Regulatory Barriers	.398
Strategic Barriers	.222
Management Barriers	-.214
Financial Constraints	.182
Behavioural Issues from Personnel	-.150
Benchmarking issues	-.068
Societal Issues	-.046

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions.

The variables are arranged according to the size of correlation within function. From the matrix it is evident that the recycling units in the rural area is the most affected by Technological Barrier and the recycling units in the urban area is most affected by the HR and Organisational Barrier.

iii) Objective 3: The Benefits attained by the Recycling units after entering into RL Practices

This objective tried to find out the major benefits that the Recycling units attained by entering into Reverse Logistics Practices

Test Used: Levene's Test for Equality of Variances

Table 7 Benefits of entering into Reverse Logistics Practices

Benefits	Mean		Significance
	Urban	Rural	
Relationship Stakeholders with	2.72	2.43	.358
Environmental Benefit	2.69	2.88	.489
Cost and Profit Benefit	3.19	2.65	.044
Social Benefit	2.78	2.69	.762

Source: Primary Data

Table 8 shows that, Manufacturing units in the Urban area enjoys the benefit of Relationship with Stakeholders, Cost and Profit Benefit and Social Benefit more than that of the units located in the rural area. Manufacturing units in the Rural area only enjoys the Environmental Benefit compared to the units located in the Urban Area.

VII) Conclusion

The study was extensively conducted among the plastic recycling units registered in Kerala under Suchitwa mission. Economic motive drives the units in the urban area and environmental and social motives drives the units in rural area for the entry into RL Practices. Units in the Rural area encountered technological problems while HR and organisational barriers were faced by the units in Urban Area. Environment Benefit was the only advantage that was higher for the units in Rural area compared to the units in Urban area. They benefitted from stakeholder relationship, social benefits and cost and profit benefits.

It was concluded that the units in both rural and urban areas had their own benefits and barriers. The barriers can be removed only with the help of higher authority and the benefits can be further improved if they have ample support from all the stakeholders.

VIII) Suggestions

The following suggestions are made

- The firms must be financially supported for the long-term existence
- Awareness classes must be given to the public about plastic recycling
- Proper management of human resources training must be given to the entrepreneurs along with proper installation of technological equipment must be provided to the units

IX References

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