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Reverse Supply Chain for Sustainable Growth – Remanufacturing Perspective

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Abstract: ***Reverse logistics refers to set of all procedures affiliated with reuse of various commodities and its ingredients. This article is predominantly concerned with various principles of reverse logistics, various activities comprehended with remanufacturing process, necessity of reverse logistics in India and various types of flows that reverse logistics deals with. Limited forecasting & planning, inadequate information & technical systems, shortage of pertinent attainment administration entity are the major barriers to reverse logistics system. However due to economic benefits there is a necessity for companies to adequately manage their strategies.***

Keyword(s): Reverse Logistics, Remanufacturing, Extended Producer Responsibility

I. INTRODUCTION

Reverse logistics (RL) is the mechanism of devising, materializing, and governing the flux of raw materials, in process stockpile, and finished goods, from a production, dissemination or use point to a point of desired ejection. The definition of reverse logistics varies according to the perspective in which it is perceived. Some of the other definitions are; •RL is the mechanism of propelling materials from the exemplary ultimate terminal for the aspiration of trapping value, or desired ejection. Reverse logistics is the flow of the finished products from customers towards a manufacturer in a medium of transportation (Murphy, 1986). •A reverse logistics specifies a cater chain that is televised to sufficiently manage the movement of commodities intended for prefabricating, recycling, or ejection and to adequately use the available resources (Dowlatshahi, 2000). RL stands for all procedures related to the reuse of products and material. It is "the mechanism of devising, materializing, and governing the proficient, cost adequate movement of raw materials, in-process inventory, finished product and linked data from the point of consumers to the point of inception for the scope of recapturing value or effective ejection (Fleischmann et al., 1997). •To be explicit reverse logistics is the mechanism of flow of goods from their exemplary ultimate destination for the scope of capturing value, or effective ejection. (Hawks et al., 2006). This paper views “Reverse logistics as a reservoir chain that is reconsidered to effectively govern the movement of goods or parts destined for remanufacturing and to efficiently consume resources”.

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II. DRIVERS OF REVERSE LOGISTICS

Reverse logistics begins with goods flowing back in the reservoir chain for recovery or value reclaim. The drivers behind reverse logistics can be classified as;

- Economics
- Legislation
- Extended Producer Responsibility (EPR)

Economics: It describes to all reclaim measures where the firm has direct or indirect financial merits. Industries may get tangled with resumption as a critical method to get scope for future regulation.

Legislation: It may be a arbitration indicating that a industry should reclaim its gods or obtain them back.

Extended Producer Responsibility: Reverse logistics activities are practiced based on Extended Producer Responsibility (EPR) strategy. In Europe, the responsibility for collecting products, such as consumer electronics has shifted to the manufacturers thanks to EPR strategy. EPR is an ambiance conserving measure that makes the manufacturer liable for the integrated life cycle of the product, especially for take back, recycle and ultimate ejection of the goods. Thus the manufacture’s authority is further extended. EPR deals with driving producer of goods to formulate out problems as much as possible at source level. The EPR policy is based on the “polluter - pay principle” and is represented by the deviating the burden from the municipalities to take care of the costs of treatment and ejection in to the market price of the device, indicating the impacts of the product. In collaboration with or under pressure from national governments, national accumulation and Processing of end of life (EOL) systems have been set up in Europe. Due to high uncertainties in returns reverse logistics operations can be quite complex to manage. In addition, demand can be difficult to predict, making product and information flows quite challenging to manage. Businesses responding towards reverse logistics are likely to contribute appreciable price hikes while business reactions in a organized fashion can expect to relish not only a comparative benefit, but also a significant discount in costs. This has been viewed as the impact of the Waste Electrical and Electronic Equipment Directive (WEEE Directive) carried out at the end of 2005. Many industries that did not spend sufficient time or power to manage and understand that reverse logistics is gaining much attention. They are comparing the return process with the best-in-class manufacturers. Some firms are even emerging as an ISO recognized on their return mechanisms. The third parties mentioning in returns have seen a greater raise in the requirement for their services.

Usually in industries where the worth of the commodity is the highest, or where the return rate is largest, much more concentration has been spent in increasing return processes. The Information Technology and telecommunication industry is a good example.

III. FORWARD AND REVERSE LOGISTICS

Reverse flow usually vary from forward flows as shown in Table 1. The maximum variation between them is that all the mechanisms of reverse logistics are quite inverse.

Table 1. Differences between forward and reverse logistics

Forward Logistics	Reverse Logistics
Forecasting relatively straightforward	Forecasting more difficult
One to many distribution points	Many to one distribution points
Product quality uniform	Product quality not uniform
Destination/routing clear	Destination/routing unclear
Disposition options clear	Disposition options unclear
Distribution costs easily visible	Reverse costs less directly visible
Inventory management consistent	Inventory management not consistent
Product lifecycle manageable	Product lifecycle issues more complex
Visibility of processes more transparent	Processes are less transparent
Straightforward negotiation between parties	Negotiations complicated
Uniform Product packaging	Product packaging often damaged

Source: "Reverse Logistics Challenges" Rogersetal (2004).

IV. REVERSE LOGISTICS ACTIVITIES

Once a product has been returned to a company, the firm has many disposal options from which to choose. Some of these activities are summarized in Table 2.

Table 2 Common Reverse Logistics Activities

Material	Reverse Logistics Activities
Products	Return to Supplier
	Resell
	Sell via Outlet
	Salvage
	Recondition
	Refurbish
	Remanufacture
	Reclaim Materials
	Recycle
	Landfill

Source: Going Backwards: Reverse Logistics Trends and Practices, Rogers et al (1998)

The commodity may be advertised as a refurbished or remanufactured device after performing these set of activities but not as a new one. Therefore the reverse logistics incorporates a wide variety of processes and they can be further categorized as follows: if the products in reverse flow came from the end user or from another member dissemination medium such as a vendor or transportation centre; and if the product in the reverse flow is a device or a packaging product.

V. TYPES OF FLOWS

The Reverse Logistics process deals with three kinds of flows. Not only products travel backwards, but also information and money. According to Dekker et al (2004) the main flows are:

Material Flow: Material flow includes the tangible products being returned. In the case of consumer goods, products have a backward flow, going from
the customer to the retailer or seller, then to the collection point and finally to the place of origin or disposal. Factors like the quantity and characteristics of the products are taken into account.

Information Flow: Information flow is the intangible flow that accompanies the material flow. It is crucial in the process as it provides data about the products, their locations, time in the market, condition and reusability.

Financial Flow: Financial flow is the flow of money involved in the process. It includes all costs involved in the backward flow, such as transaction, handling, storage, transportation, disposal costs and the return money policies that apply in some companies.

VI. TYPES OF RETURNS

Four primary sources of product returns in this mechanism are:

1) Supply chain return – goods that are returned by the various actors in the supply chain excluding the ultimate user. An exemplary sample is unsold goods returned by the vendor.

2) Warranty returns – goods which are returned by ultimate user within the finite time period as mentioned by the producer, as failed goods or due to the reason consumers being unsatisfied with the product.

3) End-of-lease equipment returns - goods returned at the end of the lease period. End-of-lease returns are the subsequent of the flow towards sales service (leasing) instead of selling goods.

4) End-of-life products - goods discarded by the consumers after the end of their fruitful life span as perceived by the consumer. In some cases, the goods may still be working. There is a perception that about two-thirds of scraped electronics are still functional.

End-of-life is the stage at which goods will no longer executes the intended operations. 'End-of- life' treatment focuses on restoring value from goods, including the actions related with strategic planning and implementation of the collection and processing of used products along with the related impacts to the environment.

"This paper deals with the returns (EOL products) coming from the end user (household) consumers".

VII. NECESSITY OF REVERSE LOGISTICS/ RSC IN INDIA

The emblematic reverse logistics processes include the set of functions a firm, which utilizes the returned merchandise due to goods recalls, surplus stock storage, salvage, unwanted products, etc. In addition, it also incorporates the recycling programs, precarious product programs, and scrapping of obsolete goods and asset recovery. The reverse flow of the product starts from many points and is a collection of just a few (or one) terminals. The set of processes carried out throughout the reverse logistics functions include gate keeping, disposition cycle times, re fabricated, asset recovery, negotiation, outsourcing, and finance administration and consumer care. The necessity of reverse logistics is essentially derived from the general problems of environmental economics (Wagner, 1997).

There had been a keen population growth in India in the recent years.

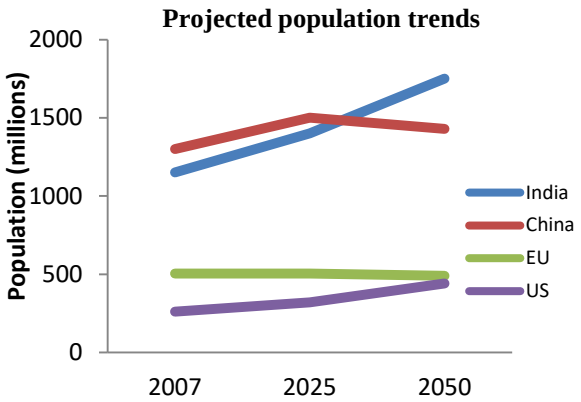

Figure 1. Projected Population Trends

From Figure 1 it is evident that India will overtake china in a few years from now. Increased population will lead to increased demand for natural resources. The after use effects of this high consumption rate may also result in a large amount of waste which had to be land filled.

The summarized benefits which can be realized by practicing reverse logistics are;

- A large amount of raw materials are saved and are partially substituted from the materials from closed loop supply chain.
- Less landfill capacity is needed because of waste getting treated. Also because of the fact that landfill costs are increasing enormously, reverse logistics has become a viable option.
- As the environmental regulations had tightened their stand on waste treatment, reverse logistics has become a viable option for manufacturers.
- RL has two dimensions, viz., the "green" dimension and the "value reclamation" dimension (Santhanam, 2006). Green dimensions have been to answer environmental concerns and value reclamation for ensuring economical and energy benefits.

VIII. HURDLES FOR REVERSE LOGISTICS

• Inadequate perception related to reverse logistics: The paltriness of consciousness for benefits is a key obstacle for its enactment. The large variety of products in the market has been favourable to the consumers. This has made an impact by a substantial increase in returns rate, unsold products, and packing materials and also wastes. This has lead to a surge in the quantity of goods returns. It may steer to financial benefits by the recuperation of returned goods and appending the value of the product by practicing reengineering options like reuse, remanufacturing, recycling or a combination of all these choices.

• **Management Inattention:** The established perception is in the recent years, many industries have adapted reverse logistics largely due to the legislative pressures from government and environmental agencies, and not for economic profits. So no emphasis is given for this non profit venture and importance is shown towards the forward flow of products.

• **Financial Constraints:** Issues regarding the expenses have been the important challenge for commercial recycling. Also, heavy investments are required for carrying out reverse logistics. The establishment of management information systems and technology is important because the product tracking, tracing and product recovery cannot be realized without such an information platform. But its implementation is more expensive. However financial provision is required carrying out all these ideas

• **Problems with product quality:** Customers anticipate a product of same quality from the manufacturer irrespective of the returned product. But the returned product may be damaged, faulty or partially faulty and their quality may vary up to a large extent. This may result in the disparity in the cost of secondary market goods.

• **Inadequate productivity governing system:** Assessment and administration of various mechanisms of the reverse logistics system is a difficult task. A partial assessment and evaluation of certain operational and internal process are available but an entire evaluation is not in practice. Only if necessary steps are taken to establish a proper performance assessment system, the industries can survive in this competitive world.

• **Industrial policies:** Corporate schemes are related to reverse logistics on issues regarding the management. Their first quality or "A" channel, they often make principles that make it tedious to manage returns effectively.

• **Legal Issues:** Our national legislation imposes a rule that tax paid products vended by the producer must not be fetched without former documentation and defiance may result in legal actions taken against the manufacturer. Many companies identified this as an obstacle for the successful implementation.

• **Administrative and financial burden of tax:** Preparation and administration of taxes is a basic economic regard. Convoluted flow of products and the wide services bought-in services indoctrinate in the reverse chain makes an elevated intensity and result in unforeseen tariff disclosures and charges.

• **Shortage in forecasting and planning:** This is an unswerving barricade for operational planning. Many industries encounter adversities in foretelling and managing the reverse chain because of huge variations.

• **Behaviour of industrial partners:** The lack of assistance shown towards the reverse logistics by the dealers, distributors and retailers has been identified as the largest obstacle.

IX. CONCLUSION

The scope of reverse logistics research from remanufacturing perspective is shown in the Figure 2.

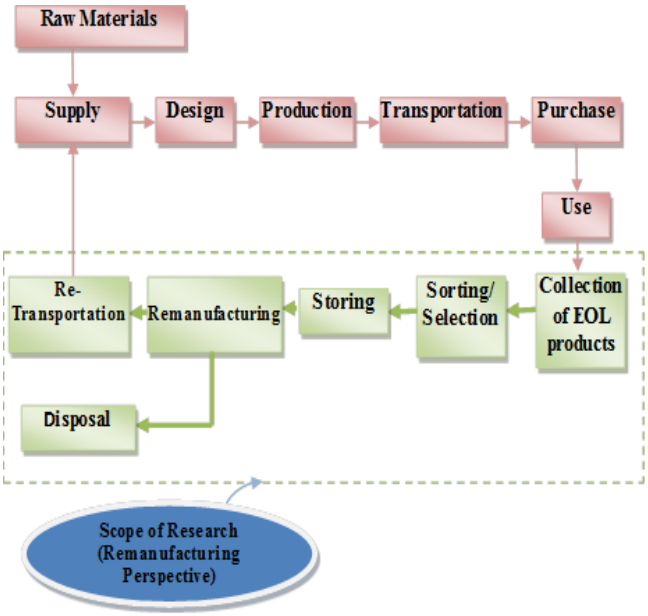

Figure 2 Research scope depicted in a closed loop supply chain

The difficulties related with handling processes are multi-dimensional due to certain deviations related to the aspect, capacity and the returning period. But still there are many profits making improvement opportunities that cannot be ignored. The principles and financial benefits of reverse supply chain have forced the firms to take a closer look at their processes. Therefore, it is important for industries to effectively manage their reverse supply chain system.

REFERENCES

1. Ramachandra TV,2006. Management of Municipal Solid Waste' book ISBN:9788179931875.
2. Cointreau SJ, 1982. Environmental Management of Urban Solid Wastes in Developing Countries: A Project Guide. World Bank, Washington DC., ISBN-10: 0821300636, pp: 97-98.
3. Ball JM, 2004. Aspects of Landfill Site Selection. Proceedings of the Institute of the Waste Management, South Africa Waste on Sun City, Northern Province SA.
4. Ramattamassayoada, 2014.Domestic waste disposal practice and perceptions of private sector waste management in urban Accra' BMC Public Health. 14: 697.
5. David Jones D, Wayne E, Woldt , Michael E, Hagemeister 1998.Characterization of an Unregulated Landfill Using Surface-Based Geophysics and Geostatistics. Ground water journal 36(6):966-974.
6. EPA, MES, MLGRD, Ghana Landfill Guidelines2002. Best Practice Environmental Guidelines. Accra: Ghana: EPA, MES, MLGRD, Ghana Landfill Guidelines.
7. Ozeair Abessi, Mohsen Saeed 2010.Hazardous Waste Landfill Siting using GIS Technique and Analytical Hierarchy Process. Journal of Operations Research 15:259-276.
8. JanicM,Reggiani,2002.Application of Multiple Criteria Decision Method Analysis to The Selection of New Hub Airport.EJTIR, 2(2):113-141.
9. Saaty TL (1980). The Analytic Hierarchy Process, Mcgraw Hill, Reprinted By Rws Publications, Pittsburgh.
10. Mahmoodzade, ShahrabiM,Pariazar, M,ZaeriS,2007.Project Selection byUsing Fuzzy AHP and TOPSIS Technique. International Journal of Human and Social Sci.2:7-12.
11. Mohawesh Y, Taimeh A, Ziadat F, 2015. Effects of land use changes and conservation measures on land degradation under a Mediterraneanclimate', Solid Earth Discuss, 7:115–145, doi: 10.5194/sed-7-115-2015.
12. Rafiqul Islam, M 2014. Analysis of land use and land cover changes in the coastal area of Bangladesh using landsat imagery. Land Degradation &Development,27: 899–909. doi: 10.1002/ldr.2339.
13. Go¨zde Pınar Yal,HalukAkgu¨n 2014. Landfill site selection utilizing TOPSIS methodology and clay liner geotechnical characterization: a case study for Ankara, Turkey. Bulletin of EnggGeology Env 73:369–388.
14. AyoBabalola,IbrahimBusu,2011.Selection of Landfill Sites for Solid Waste Treatment in DamaturuTown-Using GIS Techniques. Journal of Environmental Protection 2(1):1-10.
15. MohdArmi Abu Samah, LatifahAbdManaf,NurllyanaMohdZukki, 2010.Application of AHP Model for Evaluation of Solid Waste Treatment Technology .International journal of Engineering Technical science . 1:35-40.

AUTHORS' PROFILE

Dr. K. Balasubramanian obtained M.E Production Engineering from Thiagarajar College of Engineering, Madurai and Ph.D. in Mechanical Engineering from Anna University, Tamilnadu, INDIA and worked in the area of Scheduling using metaheuristics. He is an able administrator for more than 15 years and he held positions like Professor cum Principal and Dean during his career. He has been a pioneer in conducting International conferences in India and abroad in Mechanical Engineering. He has published nearly 40 papers in International Journals and more than 50 papers in various Conferences held at IIT Delhi, IISC Bangalore, IIM Ahmadabad, Malaysia and Indonesia. He is currentlyworking on Reverse Engineering and Composite Materials. His areas of interest are Parameters Optimization in Composite Materials&Machining and Operations Management. He has been a panel reviewer for the peer reviewed international journals such as IJAMT, IJSTER, JEIF, JMER, ITRJ and JSS and member of Various Society like ISTE, IET and IAENG. Sudhakara has completed undergraduates during 1996 in Mechanical Engineering, S V University, Tirupati and his postgraduate during 1999 in Industrial Engineering, Anna University, Chennai Now he is doing research in bharath Institute of Higher Education and Research Chennai. He has 19 years of teaching and industry experience.