

## Reverse Logistics and Remanufacturing in Industry

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**Abstract** - This Paper gives the introduction to Reverse Logistics and Remanufacturing also gives its impact on the industry and most impact on automotive industry and discuss some environmental issues related to the Reverse Logistics. The term Green Logistics and Green Remanufacturing is to develop the safe of user friendly network to the industries. It describes the supply chain management and the third party involvement in the Reverse Logistics process. It shows the comment of literatures on the Reverse Logistics and Remanufacturing on the aspects of supply chain management. Implement of the successful network of reverse logistics for the automotive industry and the effect of environment on Reverse Logistics. It explains the Remanufacturing process in 4R's concept. At the end concluded some key points related to the paper.

**Key Words:** Green Reverse Logistics, Two way Logistics, Aspects to reduce the cost of reverse logistics, Green Remanufacturing, Effect of environment

### 1. INTRODUCTION

Environmental awareness and recycling regulations have been putting pressure on many manufacturers and consumers to dispose used products in an environmentally responsible manner. Reverse logistics is a part of a broader supply chain management process called returns management<sup>[3]</sup>. Reverse logistics, dealing with the physical flows of products, components and materials flowing from user to re-users, is a growing field both in practice and in the academic world. In order to get insight in how reverse logistics are getting in practice this paper is useful<sup>[10]</sup>.

Recovering used parts and being environmentally and social responsible by one side, and gaining profits in others, with internal culture development, adoption of new structural arrangement and processes, creation of reverse distribution channels in industries to refuge recovery products<sup>[1]</sup>.

In recent years, more and more attention to environmental protection, as well as concerns optimal allocation of resources, the concept that "Reverse Logistics" has produced with "Return Management" that the international efforts to promote<sup>[2]</sup>. This paper shows that how to develop Reverse Logistics in industries.

Reverse logistics are not always as mature as forward logistics and this impose significant environmental repercussions as well as loss of profitability and customer satisfaction<sup>[11]</sup>. This paper contributes by offering them insights how to design effective reverse logistics and integrate them with forward logistics.

Remanufacturing is an environmentally and economically sound way to achieve many of the goals of sustainable development. Remanufacturing closes the materials use cycle and forms an essentially closed-loop manufacturing system. Remanufacturing focuses on value-added recovery, rather than just materials recovery, i.e., recycling<sup>[4]</sup>. One of the ways that develop the Reverse Logistics is to develop the recycling of waste products Remanufacturing supply chain. To solve this problem, many countries have developed regulations that require manufacturers to be responsible for the recycling of waste products<sup>[2]</sup>.

Closed-loop supply chain is a supply chain system that coexist remanufacturing and manufacturing, in this system, remanufacturing reverse logistics has been called the most complex aspect of manufacturing technology and only use about 50% to 70% of the human and material resources that made used or discarded products back to like new products, or in the functional characteristics and durability for at least the same level with the original products<sup>[2]</sup>. Due to the interdisciplinary and cross functional nature of reverse logistics, it provides a fertile and attractive research area in the field of operations management<sup>[3]</sup>.

A complete supply chain should include both forward logistics and reverse logistics. Forward logistics operations subsequently increase the reverse logistics activities and thus it plays an important role in the organization success<sup>[3]</sup>.

### 2. LITERATURE REVIEW

André Luiz, Marcelo, Andréa Brasco, perform the case study on the automotive industry they introduces an activity developed by an auto part segment company, leadership in manufacturing of sideshafts parts to automotive market and demonstrates the actual stage of Reverse Logistics operations to collect, evaluate, stock and transportation of the parts that are remanufactured at the industrial unit, finally they comment the actual stage and establish the questions to further requirement of study and orientation to Reverse Logistics operations and remanufacturing also they

state the concept of fulfillment of the Reverse Logistics and Remanufacturing of the used parts of the automotive industries and the parts are wear and have the age more than 5 years or old fashioned products <sup>[1]</sup>.

XIA Wen-hui, JIA Dian-yan, HE Yu-ying, they argues in the paper that the face to the limited resources and waste treatment capacity, the article analyzed the current remanufacturing reverse logistics and made some recommendations for their development, but not enough, then the reverse logistics of remanufacturing remains to be further study <sup>[2]</sup>.

S. Senthil, R. Sridharan, they presents a review of literature in reverse logistics. Several extensions are possible in reverse logistics. We could also study the case with competition between manufacturing and remanufacturing processes, User friendly and smart decision support system may also be developed. Probabilistic demand pattern may also be considered in future studies <sup>[3]</sup>.

V. Daniel R. Guide Jr. they identified and described seven complicating characteristics of production planning and control activities for remanufacturing firms. The characteristics give focus to efforts in developing new systems for remanufacturing production planning and control <sup>[4]</sup>.

Sergio Rubio, Beatriz Jiménez-Parra, they concluded that the Reverse Logistics has several implications for SCM, but probably the most challenging is related to the design of the RL network. For this reason, a description of the basic activities related to the design process has been examined: collection, inspection, and recovery process. In spite of the relevance of the literature on the design of RL networks, new lines of research are still open <sup>[5]</sup>.

Reza A. Maleki and Jonathan Reimche, they comment on the Reverse Logistics done in the container reusing company they developed the effective, smart and easy way to track the container and improve the process of reverse logistics in container reuse and remanufacturing company <sup>[7,8]</sup>.

Marisa P. de Brito, Rommert Dekker and Simme Douwe P. Flapper, they gave a substantial overview of the diversity of real life reverse logistics situations and provided a reference guide to researchers searching for case support. The analysis was based on the framework for Reverse Logistics. They also present the focus on Network Structures, Relationships, Inventory Management, and Planning and Control in Reverse Logistics and Remanufacturing industry <sup>[10]</sup>.

### 3. REVERSE LOGISTICS

Reverse Logistics is the set of activities that is conducted after the sale of the product, such as servicing, refurbishment, and recycling for the purpose of recapturing value or recovery or proper disposal.

Reverse Logistics is sometimes called aftermarket supply chain, aftermarket logistics or retrologistics.

Reverse logistics refers to all procedures associated to product returns, repairs, maintenance, recycling and dismantling for products and materials. Overall it incorporates running products in reverse through the supply chain to gain maximum value <sup>[1]</sup>.



Fig -1: Reverse Logistics <sup>[16]</sup>.

### 3.1 Green Reverse Logistics

Environmental aspects of reverse logistics are critically important, traditional logistics may described in transport, warehousing, packaging and inventory management from producer to user, but due to protect environment so that consideration for recycling and waste disposal Green Reverse Logistics is aim to reduce the environmental externalities, through deal with logistics related aspects such as transportation, warehousing and inventories to reduce environmental issues, which including greenhouse gas emissions in logistics operations, noise and accidents. Green design for products indicate that before manufacture a product will considering the impact on environmental, for instance, the used materials, and it could be recycling or not when the products end its service life.

### 3.2 Two Way Logistics

This process is same as the Reverse Logistics but in this process we have a feedback system as a closed loop supply chain management. It is a collaboration of the both Reverse Logistics and Forward Logistics. We can say that the process is done after the sales of the product is called as Reverse Logistics but before that it is a forward Logistics process.

### 3.3 Aspects to reduce the cost of Reverse Logistics

- Improved Gatekeeping technology
- Partial returns credit
- Earlier disposition decisions
- Faster processing / shorter cycle times
- Better data management

#### 4. REMANUFACTURING

Remanufacturing is the rebuilding of the product to specifications of the original manufactured product using combination of reused, repaired and new parts. It requires the repair or replacement of worn out or damage components and modules.

If a product is or is not remanufactured, it is essential to consider the process utilized. Remanufacturing is a process of recapturing the value added to the material when a product was first manufactured.

Used components and spare parts can be considered remanufactured if they are brought to at least Original Equipment Manufacturer performance specification from the customer’s perspective and given a warranty equal to that of an equivalent new product. A product may be remanufactured with or without brand or product identity.

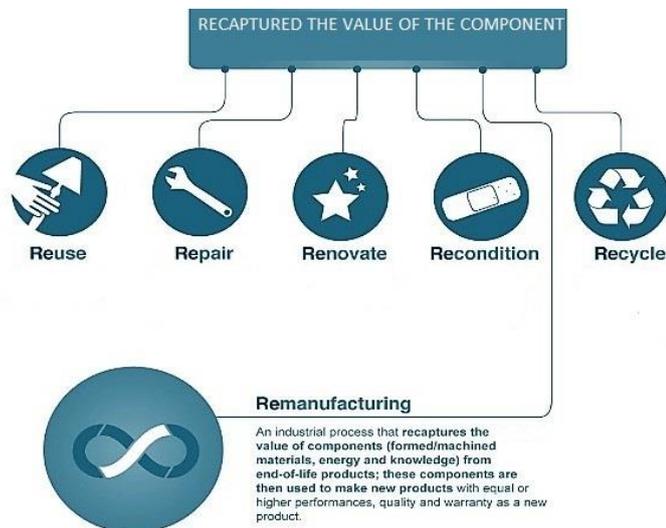


Fig -2: Recaptured the value of the component [17].

#### 4.1 Green Remanufacturing

Green Remanufacturing is defined as “manufacturing practices that do not harm the environment during any of its journey phases”. It involves green redesign of products, use of environmental friendly raw materials, eco-friendly packing, distribution, and reuse after end of life of product. It slows the depletion of natural resources and lowers the trash. Its emphasis is on reducing parts, rationalizing materials, reusing components. It covers a number of manufacturing issues; including 4R’s i.e. reduce, reuse, recycle, and recover [12]. Green Remanufacturing is term totally related to Reverse Logistics and combining of both we can say as ‘Green Reverse Logistics’.

Green Remanufacturing is a method for manufacturing that minimizes waste and pollution. It slows the depletion of natural resources as well as lowering the extensive amounts of trash that enter landfills. Its emphasis is on reducing parts,

rationalizing materials, and reusing components, to help make products more efficient to reuse [13].

#### 4.2 4 R’s Concept in Remanufacturing

- Reuse - This term is generally applied to a product that has been used previously. The product will retain the problems it acquired during its previous life as it will not have been repaired [9].
- Repair - makes a broken product operational again. An analysis of the root cause of the problem is generally not performed in the repair process which means the product may not perform like a new product. Typically, a warranty on a repair will only apply to the specific repair and not the whole item [9].
- Recycled - The term 'recycled' is used by some legitimate remanufacturers to describe a product that may meet the minimum remanufacturing requirements [9].
- Reconditioning – it restores a product functionally to as-new or almost as-new condition but may not come with a warranty that matches a new product. Reconditioning may return a product to like-new quality but the process may not disassemble and clean all of a product’s components [9].

#### 5. SUPPLY CHAIN MANAGEMENT

Supply Chain Management is the term related to the Reverse logistics processes the best industries around the world are discovering a powerful new source of competitive advantage for Reverse Logistics. It’s called supply chain management and it encompasses all of those integrated activities that bring product to market and create and maintained a satisfied customers.it is also the third party involvement in the entire process which gives better solution to the remanufacturer.



Fig -3: Supply Chain Management

#### 5.1 Closed Loop Supply Chain Management

The conception of Reverse Logistics dates from long time ago, but the denomination of this term is difficult to trace with precision. During the 1980s, the definition was inspired by the movement of flows against traditional flows in the supply chain (reverse distribution, reverse channel) at the end of the 1990s, Reverse Logistics was characterized by

recovery of the value of products and the processes involved; now, a holistic view of the supply chain is proposed by considering forward and reverse flow from a business perspective, the so-called CLSC<sup>[5]</sup>.

There exist a lot of argument about the concept of remanufacturing in closed-loop supply chain, to sum up the main means is a process that waste products through a recycling process to restore the state that may re-use and re-sell. In this process, waste products are recycled, dismantling, testing or replace parts, make some re-use value be re-applications or create “new” products, the “new” products has the performance of original product or higher performance. Remanufacturing is currently mainly used for automobiles, computers, printers, copiers, mobile phones, televisions, refrigerators, air conditioners, washing machines, tires and bulky products such as printed circuit boards<sup>[2]</sup>. In this only different is the presence of feedback than the traditional supply chain management.

### 6. EFFECTS OF ENVIRONMENT ON REVERSE LOGISTICS

Now that we have a basic idea of Reverse logistics, in this section of the paper we will see what role reverse logistics has in the remanufacturing world, how the reverse logistics activities affect various decisions in a company, and what impact these activities and decisions have on the environment. Many manufacturing industries often get involved in improving their reverse logistics either they are forced by law to keep track of their returned goods and dispose them safely or they are self-motivated to maintain a green image among their customers. Whatever may be their motivating factor, in future their logistics decisions will be greatly impacted by environmental effects. list out a few reasons why this is true:

- Increase in landfill costs over the years.
- Many products can no longer be landfilled because of environmental regulations.
- Economics and environmental considerations are forcing firms to use more reusable packaging, totes and other materials.
- Environmentally motivated restrictions are forcing firms to take back their packaging materials.
- Many producers are required by law to take back their products at the end of their useful lifetime.

Disposing of unwanted products is becoming a more closely monitored activity. To a great extent this is true for most nations in the world. It can be seen that often companies based in the US and European nations that have facilities or have outsourced manufacturing jobs to countries like India, China and Thailand where the labor is cheaper still monitor how these offshore sites deal the waste material that is generated at these sites. Also they propose a certain standard for the outsourcing firm which has to be met. The

exponential growth in the landfill costs in the US and Europe can be attributed to the regulations affecting landfills<sup>[6]</sup>.

### 7. REVERSE LOGISTICS IN AUTOMOTIVE INDUSTRY

Reverse Logistics implementation in automotive industries basically presented in four aspects: product return, recall the automotive, cost saving and environment protection during production processes and the recycling waste products in reverse logistics. Reverse logistics and reverse processes emphasized green logistics at the first time which indicated added environmentally into logistics strategies, including product return, recycling, waste disposal, refurbishing, and repair and remanufacturing<sup>[15]</sup>.

The present situation of reverse logistics in automotive industry indicates reverse logistics has an important role in the development of automotive industry. The empirical findings show all daily work related to reverse logistics<sup>[10]</sup>.

It indicate that because nowadays high technology content of the product, cause the difficulty, costly and long production of the manufacturing processes in automotive industry. It is a necessity for them to adopted reverse logistics. Implementation of automotive reverse logistics, based on the view of corporate, not only helps to improve enterprise logistics service levels, enhance operational efficiency, but also reduces production costs<sup>[15]</sup>.

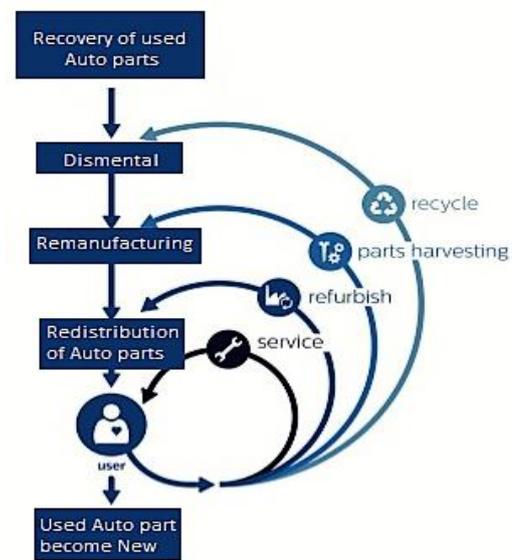


Fig -4: Reverse Logistics in Automotive Industry

### 8. CONCLUSIONS

- We conclude that our responsibility is not over after the sale of the product. We can use the used product as a raw material for make it new by reverse logistics and remanufacturing processes.

- Reverse Logistics contain supply chain management [SCM] and it can be handled or managed by third party also.
- We know the successful implementation of the Reverse Logistics in the industry by without harming the environment by using the green remanufacturing.

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