**International Journal of Academic Research**
**ISSN: 2348-7666; Vol.3, Issue-2(5), February, 2016**
**Impact Factor: 3.075; Email: drtvramana@yahoo.co.in**

# Study of Reverse Logistics in Electronics Industry

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***Abstract***

***Reverse logistics:*** *process of moving goods from final destination for the purpose of capturing value.*

*In today's competitive world of manufacturing companies are searching new ways of improving the industry process, how to satisfy the customer and by following this how they can stay ahead with their competitors in the world of competition. The strategy that can bring these things to life for past decade and so is Reverse Logistics.*

*The role of reverse logistics is pretty much critical in this field as from the waste management to managing the flow, production to controlling the flow of the raw materials, stocks, finished goods from suppliers to suitable collecting, reuse, recycling or remanufacturing centres. Reverse logistics can be used as a management strategy as this helps the logistics manager to take decision on day today basis for the improvement in the logistics sector. The scope of this paper is to understand the reverse logistics process in electronics industry where this industry creates huge market volume, product life cycles that are short and repair process that leads to large potential supply of reverse logistics.*

***Keywords:*** *Reverse Logistics, Customer, Reuse, Recycling*

## Introduction

There are varieties of definitions for reverse logistics as this term is regarded as new field of research which have received much attention due to the direct impact on profit margins. The first thought of returning products came with Beckley and Logan in 1948 but they didn't termed it as reverse logistics. The same idea again strike to Terry in 1869, Giultinian and Nwokoye in 1975 but these people didn't refer to term reverse logistics. The first authors of term reverse logistics were b Murphy and Poist in 1989 which stated reverser logistics as "direction of product from the end customer to producer in a distribution channel."

In early 90's the council of logistics management introduced the first definition of the term reverse logistics which was stated as "The term often used to refer to the role of logistics in waste disposal, recycling, and management of hazardous materials; a broader perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal." This definition was introduced in 1992 in which it tells you about all the logistics activities which recognize three problems of reverse product flowing. The problems are stated as follows:

(i) Most of the logistics system isn't equipped properly to handle the movement of products going reverse.

(ii) Cost of reverse distribution that can be nine times more than the normal forward flow.

(iii) Return goods can't be transported or

Managed in the same way as the forward flow.

Council of logistic management issued two studies related to reverse logistics.

First study was by Stock in 1998 which stated that "the role of logistics in product returns, recycling, material substitution, reuse of materials, waste disposal, and refurbishing, repair and remanufacturing was referred by the reverse logistics." In this Stock wanted to explore the working procedure of reverse logistics and the importance of reverse logistics.

Second study was stated by Rogers & Tibben-Lembke in 1999 in which they conclude from the extensive collection of industry statistics data related to reverse logistics for an optimal recovery and disposal options for returns. They stated reverse logistics as "The process of planning, implementing and controlling the efficient cost and effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing the value or for proper disposal."

Then the new authors De Brito and Dekker gave a new definition in 2002 which says "a process in which a manufacturer systematically accepts previously chipped products from the point of consumption for possible remanufacturing or disposal."

According to EL Saadany and Jaber in 2011 they define reverse logistics mainly focuses on reuse, reclaiming, remanufacturing, take back and disposal.

The benefits of implementing reverse logistics strategy with the given points:-

1. Positive environmental impact- In this manufacturer should improve the collection policy which should benefit the products till the end of life cycle without any pollution as per the producer responsibility act.

2. Competitive advancement- Handling of used products in a proper manner leads to decrease in cost, satisfied customers and increased profits. By applying this company can lead to an competitive advantage in the market.

3. Regaining value- Reverse logistics can achieve values from the recovered discarded products. Earlier the companies weren't paying attention, now they have begun.

### Types of reverse logistics

Implementing the recovery option for each product is different as each type of product has its own characteristics which needed a new way of reusability.

| Material | Reverse Logistics Activities |
|---|---|
| Product | Return to supplier<br>Resell<br>Sell via outlet<br>Salvage<br>Recondition<br>Refurbish<br>Remanufacture<br>Reclaim materials<br>Recycle<br>Landfill |
| Packing | Reuse<br>Refurbish<br>Recycle<br>Reclaim materials<br>Salvage |

Table 1: Classification of product

The classification is in more detailed and in exhaustive manner.

## Barriers of reverse logistics

Many companies follow various barriers during the implementation of reverse logistics. Following table will show various barriers:

| Barrier | Percentage |
|---|---|
| Importance of reverse logistics relative to other issue | 39.2% |
| Company policies | 35.0% |
| Lack of systems | 34.3% |
| Competitive issues | 33.7% |
| Management inattention | 26.8% |
| Financial resources | 19.0% |
| Personnel resources | 19.0% |
| Legal issues | 14.1% |

Table 2: Barriers

- Lack of awareness regarding reverse logistics which require a certain change in mindset to achieve efficient reverse logistics processes.

-Due to restrictive company policies and aggressive behavior which may relate it to the unimportance of reverse logistics.

- Lack of system is a serious issue for implementation of reverse logistics. The technological information should be known so that reverses the logistics operation should be done as they keep an track of products.

- Competitive issue hampers the implementing of reverse logistics. Reverse logistics can give a competitive advantage to an company by giving economic benefit.

### Drivers of reverse logistics

The drivers of reverse logistics differ from company to company that's why there are two kinds of drivers one is external and second one is internal.

External drivers of reverse logistics are forces outside the companies and customer which impact the decision making in implementing the reverse logistics.

- Economic drivers: It is the possibility to recover economic value from the product. The direct economic drivers are recovering their returns by increasing the revenues and profits and decreasing the operating cost. The indirect economic drivers mainly stress on the environment as the companies should me more environment-friendly.

-Extended manufacturer responsibility: It includes various preventive measures were taken for the disposition of end of life products.

Internal drivers of reverse logistics represented with reuse, remanufacturing and recycling which happen inside the company. There are certain internal drivers which are as follows:

- Manufacturing level: In this level the recovery of the products is done at the production stage.

- Distribution level: in this level the recovery of the product is done after manufacturing stage but before the distribution of the product to the end user. This situation occurs because the fault is caught in between the supply chain.

- After sale level: In this level the operation is done after sale of the product to the final destination. The customer can return the product if the product is not working properly or for the maintainenace.

### Reverse logistics process

Following are the key processes of reverse logistics:

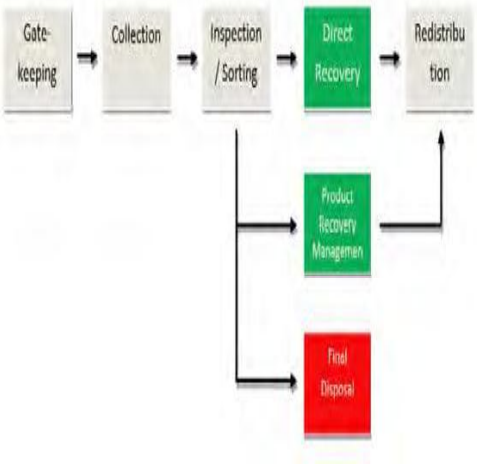


Fig 1: Process of reverse logistics

### Gatekeeping

It represents the main entrance flow of the reverse logistics. It is a procedure of screening of the products through which the retailers can decide how, which and what kind of products can go through this flow of proper disposal or recovery. Not every product can enter this flow of reverse logistics because the cost of transporting is higher than the value of product itself.

### Collection

This process will explain you about the gathering of discarded product from the customer to the recovery point. The transportation and the inventory cost of returned product from the type of the reverse logistics is used. Two approaches are there one is centralized approach which explains that integration of discarded products from various retailers

location and bringing them to the central library for the testing. Another approach is decentralized approach which helps in reducing the time delay so they can be inspected by the retailer's location and then sends it for the product recovery.

### Inspection

The condition of the discarded product has to be evaluated and some sort of treatment has to be defined. The inspection process starts with the disassembly, testing, sorting and rating of the returned product which helps in determining of the characteristics of the product and the quality level of the product.

### Disposition

It is very important for the company to ensure that the total cost of the recovered product doesn't exceed from the new one. Disposition is divided into three groups:

- Direct recovery: the process is applied only when the product is as good as new so that the company can resell the product as a new one if its condition is really good and it will not affect the company reputation.

- Product recovery management: the process in which returned product doesn't function properly are proceeded towards the reconditioning process to be usable again and can gain profit again.

It is represented in many activities:

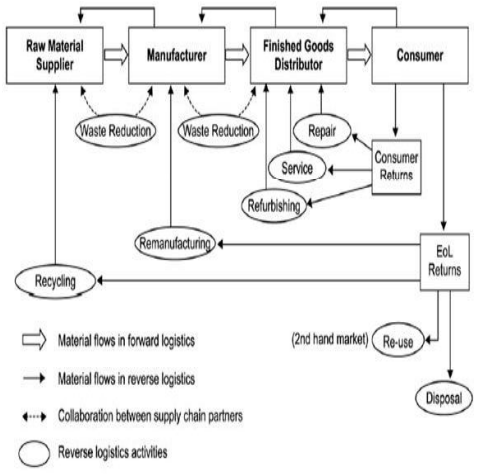


Fig 2 Reverse logistic activities Repairing

It is the kind of process in which it is implemented to the returned products into the working condition again. The quality of the repaired product is not that good than the new ones but some products can work by repairing it without disturbing the main function of that product. This process doesn't need that much disassembly as it can be performed fast or at the customer location.

### Refurbishing

This process is applied only when the repairing of product is not sufficient. The refurbishing process aims at the product's performance by extending the service and bringing it to the acceptable quality level. It's better to refurbish the product rather than buying a new one.

### Remanufacturing

The aim of the remanufactured product is to make the product quality standard, life expectancy and performance like that of new products. In order to apply this process the company need to deep interventions, after that all the products need to disassembled and tested fully.

The outdated and the damaged material is replaced by the new ones and exchanged parts are fixed. The customer can buy the high quality product in low price with full warranty.

### Retrieval of parts

In the previous recovery option the returned product is either outdated or damaged is scalable for recovering. In this process there are few parts from used components which could be recovered and considered as potentially valuable. The remaining parts are not recoverable that's why it will be recycled or dispose off. The parts can be reused in the process of repair, refurbishing and manufacturing of other products. The performance level of these parts depends on the process in which they will be reused.

### Recycling

Recycling process is not same as the recovering process as to recover the products. Recycling aims to retain the functionality of composing materials. The returned products are disassembled into parts and then it is grouped into different categories of various materials.

### Final Disposal

When the returned products can't be recovered anymore then it should be disposed off. The process is implemented only when the physical value of the recovery can't be achieved or the economical and technological cost is too high.

### Redistribution

It is a process in which the reconditioned or recovered products are distributed again in the market where the customers could be attracted to that product. It returns back the process from the reverse flow to the forward flow of supply chain.

### Practical Implication

We will be taking case study of a company to see how the reverse logistics work in that company.

The company focuses on the four fundamentals that are

#### a) Why do companies involve in the reverse logistics activities?

The company gets involved in such activities because they want to

- Gain profit and

- They feel socially activated

These categorize three driving force as

#### 1. Economics

In this the reverse logistics brings both direct and indirect gain.

Direct gain include:-

- Raw materials for making of products

- returned products can be recycled to manufacture a new product so that it can reduce the manufacturing cost.

Indirect gains include:-

- Market protection

- Green image

- improved customers

#### 2. Legislation

#### 3. Corporate citizenship

#### b) Why are things returned?

Customer can return the product due to several reasons. These reasons may be

- Physical damage

- Customers are unhappy with the functionality of the product.

- Customer found a better product with a different functionality that's why return the product

- Sometimes customer misuse the return policy and return it without any reason.

### c) How reverse logistics process works in practice?

It deals with how the value can be recovered from the products which are returned back to the manufacturer.

This is the process that works in a company

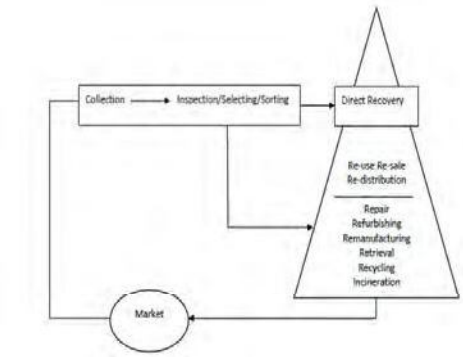


**Fig 3 : Process**

First there is collection, next there is the combined inspection/ selection/ sorting process, thirdly there is recovery, and finally there is redistribution. Collection refers to bringing the products from the customer to the point of recovery. The products are inspected, and their quality is assessed and a decision is made on the type of recovery that is being done at this point.

### d) What is being returned?

There are some product characteristics that are relevant in this regard which are as follows:-

#### Composition

Design engineers should keep the material composition of the products in their mind for the design of recovery. Not all the products can be recycled so the designers should kept this thing in mind that they should not use the unrecyclable products.

#### Deterioration

This term will eventually tell you about non functioning of the product but it will also determine if there is any functionality left to make further use of the product either as a whole or as a part.

### e) Who is executing reverse logistic activities?

Three main participants:-

- Forward supply chain actors which includes supplier, manufacturer, wholesaler and retailer

- Reverse chain players which includes recycling specialists

- Opportunity players such as charity organizations

### Case Study: Intex Technologies (India) ltd.

Intex Technologies (India) ltd., incepted in the year 1996 is a major player in India in mobile handset, consumer durables and IT accessories. A pioneer in technology, the company's flagship brand is 'INTEX'.

The main objective of this company is the customer satisfaction or we can say the quality of customer service. The company has proposed certain policies and strategies to the reverse flow of product for return, exchange, maintenance and repairing for improving the customer

satisfaction and the efficiency and effectiveness of the company.

A group of products can be returned back to Intex for the replacement of a product within a product range. Products with poor performance and failing with the customer satisfaction are ensured to be returned or exchanged within a certain period of time after the product has been purchased.

In this company the process of reverse logistics varies from case to case which is divided into two parts one is product returns for refunding and exchanges (PRE), and second one is products for repair or maintenances (PRM).

**Product returns for refunding and exchanges**

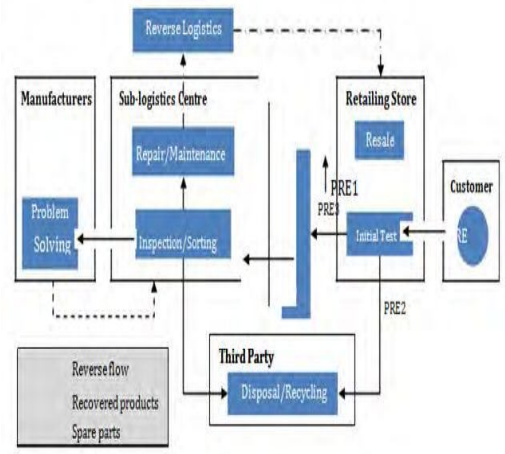


**Fig 4 Process of refund and exchange**

In this case, products are brought back to the retailers by the customers after being purchased where quality testing and evaluation will be checked by the specialists. The evaluation will aim to filter out new products and the non valuable products from the returned products.

After being sorted the new products will be send to the resellers and the non valuable products will be sent to the subcontractors or the third party for recycling or scrap. When the new product is available in stock then customer will receive it immediately but if the product is out of stock the customer has to wait for the delivery in 3-5 days.

Returned products with poor quality yet it contains some value and profit can be recovered are sent to sub-logistics centre which act as distribution centre for retailing. In sub-logistics centre professional employees work on the inspection and evaluation of products so that they can found reasons of poor quality and determine the alternative for the product recovery.

Apart from the reverse flow, spare parts of all kinds of products and sometimes the products are delivered by the manufacturers to the sub-logistic centre. Spare parts and new products for refilling the inventory at sub-logistic centre are delivered periodically by which the company intends to reduce the transportation cost through which it ensure the customer service level.

During the product acquisition and product test in stores the company puts emphasis mainly on the processing speed of the demand of product exchange and also aiming to provide a high customer service level. During this process of reverse supply the processing cost are taken into consideration. After the initial product test a certain amount of return has to be inspected that would be consolidated in the retail store and then it will be moved to sub-logistics centre. Once the product has been refunded or exchanged in the retail store then the customer is satisfied. In this whole

process the main aim is to minimize the cost in all the processes.

### Product return for repair and maintenances

The figure will show the process of reverse flow where the products are returned for the repairing and the maintenance purpose in Intex which contain product in poor quality. The customer need to sign certain documents for the completion of acquisition process which regulate the duty and responsibilities and state clearly the delivery issues regarding recovered products and need to pay cost regarding it.

Following diagram will explain you about the process in the repair and maintenance of the products which has been returned by the customers as they were having issues in the functionality of the product.

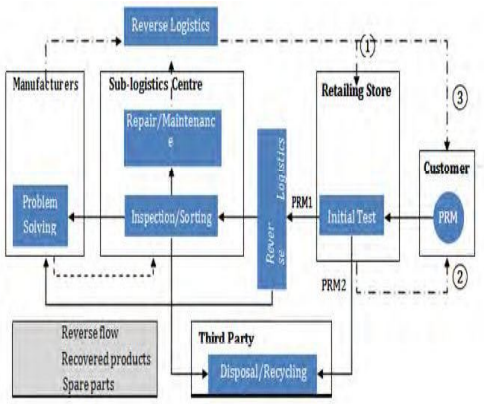


**Fig 5: Process for repair and maintenance**

According to this process the returned products will go through the initial test which sorts all the required products into the repairable products and the non valuable products. The non valuable products will produce profit for the company and which can be recycled or scrapped. Meanwhile the returned products are pushed into the reverse logistic flow which will be transported to the recovery spot, according to the damages and the problems of the product they can be grouped into sub categories in that case. The problems and the damages of the returned products which can be fixed and solved by the company by sending it to the sub logistics centre for inspection and recovery. If the damages of the products are too severe for the company to repair or if the poor qualities have not been encountered by the company before, they will be sent back to the manufacturer for thorough reconditioning and inspection.

After being remanufactured and reconditioned by the company sub logistics centre or by the manufacturer, the product will be again placed in the logistics flow so that they can be transferred back to the customers. There are three situations for the delivery of the product that are:-

1. Returned products are transported from the remanufacturing to the store.

2. Products can either be post to the customer who are ready to pay the transport cost.

3. Some special products are demanded quickly which are put on track directly to the specific end customer for which the transportation cost is on the customer which could be higher than the first situation.

The processing time for product claim or return should be less than 15 days.

The main aim of the company is to put their customer ahead and provide them best service as possible. Customer coming to them for the repairing of the products always hopes that they can get the

recovered product as soon as possible. You can't let your customer wait for a month or so long, otherwise they wont come.

### Analysis

In electronic retailing industry the reverse flow are triggered by commercial returns which are taken back to the system by the customers. The company carries out an initial test before putting the product in track so that they can filter out new product and non valuable product from the returned products. The initial test are performed when the customer return the products. The returns that are repairable is taken into the logistics system and send it for the remanufacturing and the inspection. After this we analyzed what is the perception of the people regarding reverse logistics and the strategies which has been used in the process.

### Perception of reverse logistics

Now we are aware of product life cycle which doesn't come to an end after the delivery of the product to the customer but continues with the reverse flow system. To achieve competitive advantage the reverse flow has to be involved with the supply chain management which plays an important role for managing all the activities of the supply chain.

The establishment and the controlling of the reverse logistics demands a large amount of investment, but some companies claim reverse logistics process as a additional cost.

Deriving from electronic chain retailers in India, company have been focusing on the establishment and management of their reverse supply chain, associated with the 'after-sales service', 'claim management', and 'warranty service'. They refer to the backwards flow to those products which are returned from the customers for refunding, exchanges, and repairs and maintenances.

The company has suggested a strategy for the acquisition of end of life and end of use products which stimulate the customer to return the products that are coming to an end of usage for the replacement of new products.

### Reverse Logistics Strategies

There are certain strategies which have been used by the company but here we will see what kind of strategies have been used.

### Criteria for strategy selection

Regarding the reverse logistic management, primary purpose of companies that they should select proper strategies to achieve appropriate competitive advantage and long term profitability. When selecting the apt strategies, it should be kept in mind that practical supply chain strategy is grounded on the business goals of the company.

The company has to implement advanced information system in recent years to realize the real time data sharing among the participants within the network. The company provides mass customized products at lower price and at the same time enables the responsiveness towards reverse flow for the product return so that they can level up to the customer satisfaction and can maintain the customer loyalty.

The company regards the service as its unique product and persists in business operation innovations and customer service expansion. It has separated the forward supply chain network from the

reverse supply chain network, which is referred as 'after-sales service network'. A large amount of after-sale service centers have been set up, by which company aims to localize the after-sales service and complete the repairing and maintenance locally at after-sales service points in most cases so as to provide the customers quick response to the product returns.

Another unfavorable criterion for the strategy selection was the nature of the return. It is mandatory to match the reverse flow strategies with the characteristics of the particular product and the market demand. The product returned have been analyzed in this paper were commercial returns, including the wrongful deliveries, damaged and non-functioning products, and also the returns owing to the customers' demands. As customers return the purchased products randomly, the customer demands are hard to be forecasted. Moreover regarding the product characteristics, consider the product life cycle, marginal time value and replenishment lead time. All the products being focused in this paper have a short life cycle and rather high marginal time value, and also the replenishment lead times of the products are short.

## Implementation of Lean, Agile and Leagile Approaches

Likewise forward supply chain, reverse supply chain also follows lean approach was applied to eliminate all the wastes in the process and to achieve the economies of scale in processing and transportation. Agile approach need to be adopted to ensure the agility and responsiveness of the reverse system. And leagile approach benefits the company from both the cost reduction and increased responsiveness.

Christopher introduced matrix for the supply chain strategy selection in alignment with the demand predictability and responsiveness to lead time. When the product demand is predictable lean approach should be adopted no matter the lead time is short or long. With the combination of unpredictable demands and short lead time, agile supply chain should be executed based on quick response. Where demand is unpredictable and lead time is long, the leagile strategy is integrated with the supply chain.

Based on Christopher's matrix for supply chain strategy selection and the characteristics of the analyzed products in this paper, it seems that agile approach ought to be selected as the most suitable strategy for the reverse supply chain in the electronic retailing chains. However, when we took a closer look at the reverse supply chain process of product returns in the analyzed retailers, it is obvious that no agile reverse supply chain has been implemented throughout the whole process.

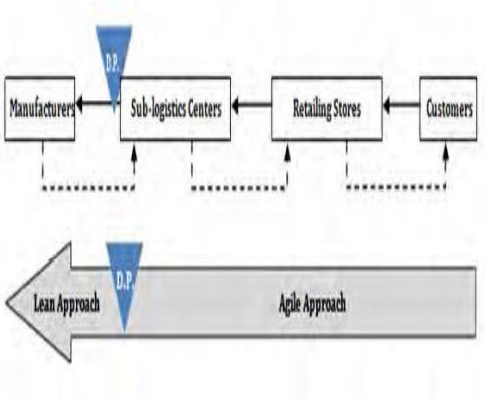


Fig 6 Leagile approach

The company consolidates the recovered products at the sub-logistics center to certain amount and delivers them back to the retailing stores. Besides, the spare parts for product repairing are delivered from the manufacturers to sub-logistics center on a monthly basis to avoid unnecessary repeat in transportation. In general, a leagile reverse supply chain has been applied in the company reverse system, as can be seen from figure, which introduces a de-coupling point at the sub-logistics centers.

Upstream flows from the de-coupling point were managed with lean approach, where the demands are not as fluctuated as at the customers' side, and were much more easily to be predicted. Hence, the flows of returns from retail stores to sub-logistics centers and the flows of spare parts from manufacturers to sub-logistics centers were consolidated before delivery, which were designed to achieve cost minimization through the economies of scale in transportation. Downstream flows from the de-coupling point are closed adhered to agile reverse supply chain, which enables the company to realize the customer-orientation goals. In this part of reverse supply chain, company seeks to respond to customers' demand as soon as possible and control the processing time within 15 days, regardless of incurred costs.

## Conclusions and Recommendations

### Conclusion

With this in mind, a frame of reference was constructed where definitions like reverse logistics were clarified and theories in existing literature were explained and compared in terms of different supply chain strategies. It has been pointed out that the selection of strategy is closely related to the characteristics of the products, e.g. demand predictability, product life cycle, etc. Moreover, centralized and decentralized reverse supply chains were contrasted, which paved the way for analyzing the business strategies in the context of a reverse supply chain.

In practice reverse logistics was closely associated with 'warranty service' or 'after-sales services', which was actually considered as part of the customer services rather than within the logistics area. Criteria for strategy selection were then discussed. And the implementation of the lean, agile and leagile concepts in the two electronic appliance retailers were later analyzed.

When selecting the proper strategies, the nature and characteristics of the returns ought to be considered, including the market demand predictability, product life cycle, and replenishment lead time. When the product demand was predictable lean approach should be adopted no matter the lead time was short or long. With the combination of unpredictable demands and short lead time, agile supply chain was to be executed based on quick response. Where demand was unpredictable and lead time is long, the leagile strategy is integrated into the supply chain.

### Recommendations

There are certain recommendations which have been recommended so as to make reverse logistics better. Certain recommendations are

1. Create awareness about customer centric approach which can add value. The main focus should be on the customer satisfaction. By adopting such an approach companies should assure that there right focus is on customer.

2. Handling reverse logistics is not an activity of one department. Every department should be equally responsible for the flow of operations so that it can optimize end to end chain through a proper channel in every department.

3. Intercepting avoidable returns is a main focus area in managing reverse logistics.

## Limitations

There are some limitations which has been thought after studying the information. The limitations are:-

a) The explicit focus is on only one industry, the consumer electronics industry, where it presents limitations to the generalisation of findings. Examining similar research questions across multiple industries should be considered.

b) We deal with producers, retailers, logistics service providers and service and repair companies but do not consider others, such as end-consumers and non-governmental organisations.

## Future Scope

The future scope of this topic can be

-The reverse logistic approach can be applied in other industry like manufacturing, pharmaceutical industry etc.

-We can also compare the electronics industry with the other industry so that we can see the differences between them.

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