Future Directions of Reverse Logistics in Gaining Competitive Advantages: A Review of Literature

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***Abstract*— Logistics management is known for its complexity, dynamics and uncertainty. The advent of rapid technology development, intense business competition and changing customer needs and requirements, has forced companies to reshape their business model and strategies. Numerous new terms such as Global Supply Chain, Third Party Logistics, Green Logistics, E-Logistics and Reverse Logistics are becoming issues that have to be deal with by all companies, local, multinational and global. Lately Reverse Logistics start to get attention by most of the firms. The purpose of this assignment is to review and identifies clear definition of Reverse Logistics, comparison Reverse Logistics with Forward Logistics in order to have a better understanding and finally future direction of Reverse Logistics in gaining competitive advantages.**

***Keywords*—** *Reverse Logistics, Forward Logistics and Green Logistics*

1. Introduction

There is a growing concern in the area of supply chain management [11], [28], [32]. One of the important elements of supply chain which plays an important role in cost efficiency management is logistics component. Reverse Logistics is an issue that has received growing attention in the last decades. In the same time there are numerous concerns about environmental issues and sustainable logistics. The concept of Reverse Logistics and Green Logistics has not been sharply defined and there is an overlapping in some definitions. Reverse Logistics is a systematic process that manages the flow of products, parts and information from the point of consumption to the point of origin, by extending a product's traditional life cycle. Reverse Logistics is a growing and important area of strategic advantage for many companies. Many companies are just beginning to understand the importance of reverse logistics and start to grapple with how best to manage their Reverse Logistics. The purpose of this assignment is to review and identifies clear definition of Reverse Logistics, comparison Reverse Logistics with Forward Logistics in order to have a better understanding and finally future direction of Reverse Logistics in gaining competitive advantages.

2. Literature Review on Reserve Logistics

In order to have better view and clearer idea of Reverse Logistics, let us look at some of the definition the author found in literature: [13], defines "Reverse Logistics as the collection, transportation, storage and processing of discarded products". In [17] says that "Reverse Logistics is a process which encompasses the logistics activities all the way from used products no longer required by the user to products again usable in a market". Ref. [5], explains "Reverse Logistics as a process in which a manufacturer systematically accepts previously shipped products or parts from the point for consumption for possible recycling, remanufacturing or disposal". Ref. [9] says that "Reverse Logistics is the task of recovering discarded products (cores); it may include packaging and shipping materials and back hauling them to a central collection point for either recycling or remanufacturing".

According to [14] "Reverse Logistics are the logistics management skills and an activity involved in reducing, managing and disposing of hazardous or non-hazardous waste from packaging and products. It includes reverse distribution, which causes goods and information to flow in the opposite direction from normal logistic activities". In [30] coined the term Product Recovery Management (PRM) to describe "Reverse Logistics as all those activities that encompass the management of all used and discarded products, components, and materials that fall under the responsibility of a manufacturing company. The objective of PRM is to recover as much of the economic and ecological value as reasonably possible, thereby reducing the ultimate quantities of waste".

Finally, [21] define "Reverse Logistics as the process of planning, implementing, and controlling the efficient, cost

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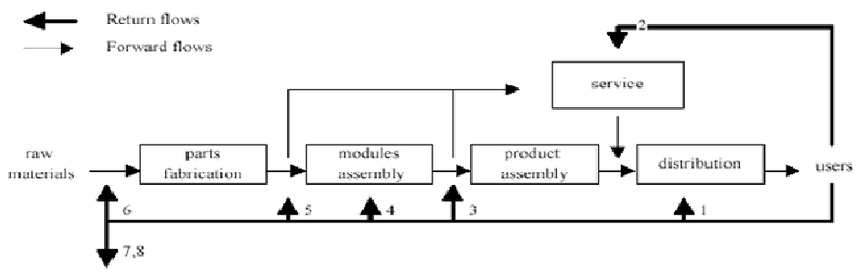
effective flow of raw materials, in process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal". Table 1 represent a summary of the Reverse Logistics elements which is grouped into what is, inputs, activities, output, from and to.

Table 1. Reverse Logistics Elements

What is?	Inputs	Activities	Output	From	To
▪ Process ▪ Task ▪ Skills ▪ Activities	▪ Discarded products ▪ Used products ▪ Products/parts previously shipped ▪ Packages and products from hazardous and non - hazardous. ▪ Information ▪ Raw material ▪ In process inventory	▪ Management ▪ Collection ▪ Transportation ▪ Storage ▪ Processing ▪ Acceptance ▪ Recovering ▪ Packaging ▪ Shipping ▪ Reducing ▪ Disposing	▪ Products again reusable ▪ Recycling ▪ Remanufacturing ▪ Disposal ▪ Reducing ▪ Managing ▪ Recapturing value	▪ Point of consumption	▪ Point of origin ▪ Central collection point ▪ Manufacturer

Considering the elements of these definitions the author believe that the definition given by [21] is the most complete, and incorporates the principal characteristics of what we think about Reverse Logistics is. Reverse Logistics also includes processing returned merchandise due to damage, seasonal inventory, restock, salvage, recalls, and excess inventory. Additionally, it includes recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery. Based on the integrated supply chain view, there are various components of activities that can be classified under Reverse Logistics. According to [30] the three major components in the Reverse Logistics process are; direct reuse, product recovery and waste management, refer to Figure 1. Flow and Activities of Reverse Logistics.



WASTE MANAGEMENT	PRODUCT RECOVERY MANAGEMENT		DIRECT REUSE
7. INCINERATION 8. LANDFILL	5. CANNIBALIZATION 6. RECYCLE	2. REPAIR 3. REFURBISH 4. REMANUFACTURE	1. DIRECT REUSE / RESALE

Figure 1. Flow and Activities of Reverse Logistics (Thierry, 1995)

3. Methodology

This study complies with the appropriate research methodology in order to fulfill the hallmark of scientific research [27], [29]. There is extensive of study and literature on Reverse Logistics and Green Logistics in the past. In order to identify and review the competitive advantages in managing the Reverse Logistics, the author search in online databases such as Emerald and Pro Quest. The journals cover the period of 1995-2009 and set relevant search keywords such as Reverse Logistics, Return Management and Green Logistics. Eventually 28 articles were selected and grouped according to the relevance to the research review.

This review is built as follows. In the next section the discussion is on Reverse Logistics concepts and its scope. The definitions are extracted from a review of past and recent literature. In the second part, an overview of the ways in which forward and reverse logistics differ is presented. Next, the author concentrates or narrows down on the Green Logistics concept in comparison with Reverse Logistics.

Finally, the author looks into the future directions of Reverse Logistics in gaining competitive advantage.

4. Comparison between Reverse Logistics and Forward Logistics

There have been very few published article to discuss on the variation between these two logistics concepts. The next part of this assignment will presents an overview of the ways in which Forward Logistics and Reverse Logistics differ. Table 2 summarize the major differences between Reverse Logistics and Forward Logistics in terms of planning and forecasting, product and packaging, distribution, order fulfillment speed, transportation and total cost.

The author found that Reverse Logistics flow if different compare to Forward Logistics in various ways. Figure 2 shows the process of Forward Logistics on product and information flow for a retail industry. Generally in retail industry they depend on sales forecasts to generate the future requirements. Distribution Center (DC) plays an important role in completing the loop in retail industry. DC receives and stores for temporary before channel it out the retail stores. When the specific product is needed in stores especially Fast Moving Consumer Goods (FCMG), the products transport direct from the DC to the specific retail stores. Inventory visibility and forecast is important at each level to ensure the right product, deliver at right time at each stores.

In contrast a Reverse Logistics flow is much more reactive process; it is mainly due to the less inventory visibility. Planning and decision making is much more difficult in Reverse Logistics.

For example in retail industry, product return, defect and non moving stock at stores will be return to DC which will generate the Reverse Logistics flow. Figure 3 shows a Reverse Logistics of information and product flow for the retail industry. When a consumer returns their product to a retail store, the store collects the product to be sent to a DC. At the time of the product return, the information about the product and its condition may be entered into the retailer's information system and forwarded to the returns processing center. According to [22] "found that many retail companies use Centralized Return Centers (CRCs) to process returned product". Basically most of the DC could be utilize to process both Forward and Reverse Logistics.

Most of the manufacturer take back of their product at the end of life or when is not required. There is also a trend lately on recall product due to some defect such as what Toyota did by recall some of their cars with defect parts. In the other hand customer normally returns the product shortly after purchase due to poor performance in the product quality, incorrect specification and etc. Later, this product will be collected from the respective retailer and sent to the manufacturer, vendor or to the point of origin where it's been produce. Even there is some manufacturer in the USA implement "Zero Return Policy". "The system work by retailers is credited for customer returns, but the return product is never physically returned to the manufacturer instead, the retailer dispositions the product at its facilities according to the instructions of the manufacturer" [31]. The benefits of this policy are that the manufacturer avoids the product return cost especially the transportation cost. Again form the retailer perspective it is additional work and their storage capability to cater the defect product.

There is also some manufacturers concern about the brand equity which requires all the defect product return to them and they will determine what next cause of action. They might rework the product; sell the product on secondary market, recycle the product or dispose of it in a landfill.

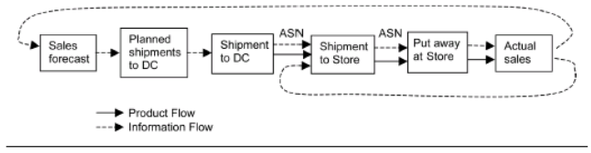


Figure 2. Forward Logistics of Information and Product Flow

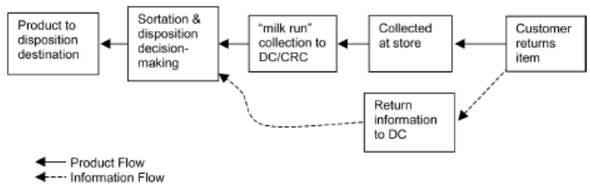


Figure 3. Reverse Logistics of Information and Product Flow (Ronald, 2002)

Table 2. Major Differences between Reverse Logistics and Forward Logistic

	Reverse Logistics	**Forward Logistics**
Planning and forecasting	More difficult	Relatively straightforward
Product and packaging	Not uniform, poor quality and often damaged	Quality and uniform
Distribution	Many to one	One to many
Order fulfillment speed	Speed often not considered as priority	Importance of speed recognized
Transportation	Cost per unit higher	Cost per unit relatively lower
Total cost	Less directly visible	Closely monitored by accounting systems

In [17] pointed out the "Reverse Logistics is not necessarily a symmetric picture of forward distribution".

Table 2 shows a comparison of how various features of logistics systems differ for Reverse Logistics and Forward Logistics.

4.1 Planning and Forecasting

"Planning for Reverse Logistics is more difficult than planning for Forward Logistics due to greater uncertainty involved in Reverse Logistics" [9], [6]. In Reverse Logistics future planning and forecasting is regarded as a great challenge and this forecast figure is needed precisely not only to determine customer demand but mainly for the availability of product to be remanufactured. In the retail context, future planning and forecasting for Reverse Logistics are made difficult because individual customers ultimately hold the decision to initiate Reverse Logistics activities in terms of timing and quantity. According to [31], "unlike Forward Logistics, incoming Reverse Logistics product is not tracked extensively because of the lack of the information system (IS) resources necessary to do this". Due to the Reverse Logistics product given low priority most of the firm does not put intention or effort to manage it. In [23] found the "lack of the IS resources and general lack of recognition of the importance of Reverse Logistics were two of the largest barriers Reverse Logistics executives face".

4.2 Product and Packaging

Complete and appropriate packaging of a new product protects it from damage. Most of the return products in Reverse Logistics chain do not properly packed. Some of the return products damaged in transit due to in proper packaging or using wrong packaging materials. Due to the unclear or systematic process of Reverse Logistics the safety of a return product is not an assurance. By contrast, most products in the Reverse Logistics may not have complete packaging and labeling. If the product is an unsold product coming back from a retailer, some of the packaging may have become damaged during handling or while on the shelf and other packages may have been opened by customers curious to examine the product. Return products and an unsold product coming back from retailer have a very high percentage of pilferage. Due to lack of awareness and value of return products, the initiator seldom put minimum effort in managing Reverse Logistics.

4.3 Distribution

According to [17], one of the biggest differences between Forward Logistics and Reverse Logistics is the number of origin and destination points. Whereas Forward Logistics is generally the movement of product from one origin to many destinations, the reverse movement of a product is the opposite, from many origins to one destination". Distribution in Reverse Logistics is generally small, commonly from initiator (origin) to final destination (distribution center or central unit returns). Reverse movement is generally from many origins to final one destination.

4.4 Order Fulfillment Speed

In Reverse Logistics speed and urgency is not considered as priority. Many firms often consolidate the return or reverse products before deliver or transport to final destinations. In the forward channel, it is important to fulfill a customer's orders quickly, to keep the customers satisfied. If the customer is not promptly served, there may be some cost incurred, but it may not be directly observable. "In Forward Logistics, the penalty to be paid for not satisfying a customer may not be felt until much later, when the customer reduces future orders or does not order at all" [24]. By contrast, in Reverse Logistics the ultimate destination for the product is back to the Distribution Centre or Central Unit Returns for further action or process.

4.5 Transportation

In Forward Logistics transportation could be planned so that economic of scale and distance could be achieved. But in Reverse Logistics it's much difficult, besides that the major cost associated with collecting a returned product from a location is the transportation cost. Transportation costs for Reverse Logistics per item will generally be higher than for Forward Logistics. This is due in part to the fact that the reverse shipments tend to be much smaller. For example, a store may receive full truckloads of new products inbound each week, but return only one or two pallets of reverse material in that same amount of time. Most of the firms consolidate their return products before transport to the final destination. Furthermore location or origin of the return product is wide and scattered which doesn't contribute to the economic of scale and economic of distance.

4.6 Total Cost

The total cost associated with Reverse Logistics is not similar to Forward Logistics. In Forward Logistics cost is well defined and known in advance [31]. Forward Logistics generally have a systematic accounting system is designed to handle the comprehensive cost development for a product as it moves through the forward channel. Nevertheless for Reversed Logistics it's much difficult due to the unclear product visibility. Table 3 compares Reversed Logistics costs to Forward Logistics. Transportation, collection, sorting, quality diagnosis and handling are much higher compare to Forward Logistics. However inventory holding costs and shrinkage (theft) much lower compare to Forward Logistics. Refurbishment or repackaging and change from book value are significant for Reversed Logistics.

5. Reverse Logistics from Environmental Perspective

According to [15] Reverse Logistics from a holistic environment perspective focuses primarily on the return of recyclable or reusable products and materials into the forward supply chain. For the particular reason Reverse

Logistics is important for a completion of the industrial eco cycle. Figure 4 shown how Reserve Logistics from the environmental perspective specifically from the operational lifecycle of a product. Reserve Logistics supports in term of material reuse, remanufacturing, recycling and disposal. The figure shown how all the materials been keep within the operational lifecycle and thus minimize any flow into external environment. The availability of each of these services will be dependent on the product life cycle, industry and design of the Reverse Logistics network.

Table 3. Reverse Logistics Costs (Ronald, 2002)

Cost	Comparison with Forward Logistics
Transportation	Greater
Inventory Holding Costs	Lower
Shrinkage (Theft)	Much Lower
Obsolescence	May be higher
Collection	Much higher and less standardized
Sorting, quality diagnosis	Much greater
Handling	Much higher
Refurbishment or repackaging	Significant for Reverse Logistics, Non-existent for Forward Logistics
Change from book value	Significant for Reverse Logistics, Non-existent for Forward Logistics

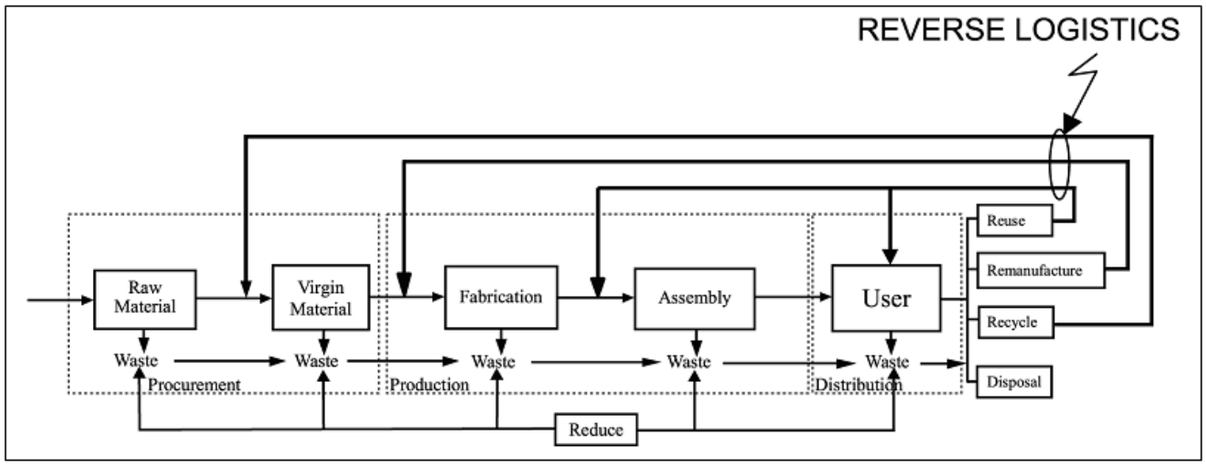


Figure 4. Operational lifecycle of a product and Reserve Logistics location (Laura, 2002)

Table 4. The summary of literature with focus on Reverse Logistics

Reference	Authors	Product				Reason for return	Reverse/Green Logistics Elements
		Type	Inputs	Process	Outputs		
"Outsourcing reverse logistics and remanufacturing functions: a conceptual strategic model"	[19]	Capital goods and Consumer durable goods	Parts	Remanufacturing	Used parts	Recycle, value added and extend product life cycle	Recycling, remanufacturing and secondary market
"Green perspective and practices: a comparative logistics study"	[18]	Mail	Mail	Redistribution	Mail	Return mail	Product return
"Returnable containers: an example of reverse logistics"	[14]	Containers and packaging material	Used container and packaging material	Recycling	Recycle containers	Recycling	Recycling, reuse packaging and reduction
"Reverse Logistics Operations In Paper Industry: A case study	[20]	Papers	Wood pulp and waste papers	Recycling and remanufacturing	Papers	Recycling and reprocess	Recycling, remanufacturing and reduce environment impact
"Reverse Logistics in the Automobile Aftermarket Industry"	[4]	Automobile	Car parts	Recycling and remanufacturing	Used car parts	Product returns, recondition and refurbish	Secondary market
"The challenge of reverse logistics in catalog retailing"	[1]	Catalog Retailing	Electronic goods	Rework or repair	Electronic goods	Product returns	Rework or repair and secondary market
"Closing the supply chain loop: Reengineering the returns channel process"	[3]	Xerox products	Xerox products	Refurbishing and recycling	Reprocess Xerox products	End of use and no longer required	Remanufacturing and marketing return
"Commodity indexed surplus asset disposal in the reverse logistics process"	[2]	Commodity surplus	Scrap metal, paper based products and food by products	Remanufacturing and recycling	Useable metal, papers and livestock foods	Remanufacturing and recycling	Remanufacturing, recycling and secondary market
"Using activity-based costing to reengineer the reverse logistics channel"	[8]	Beverage distributors	Empty container	Recycling	Useable container	Recycling	Recycling and reduce environment impact
"Managing product returns for reverse logistics"	[26]	Cellular handsets, personal computers, televisions, refrigerators	Cellular handsets, personal computers, televisions, refrigerators	End of life user and recycling	Useable parts	Recycling	Recycling and secondary market

Reference	Authors	Product				Reason for return	Reverse/Green Logistics Elements
		Type	Inputs	Process	Outputs		
"Fuzzy approach for the selection of third party reverse logistics provider"	[12]	Battery industry	Battery	End of life user	Materials	Recycling	Recycling and reduce environment impact
"Examining the impact of reverse logistics disposition strategies"	[25]	Auto parts	Car parts	Remanufacturing	Used car parts	Remanufacturing	Remanufacturing and secondary market
"Reverse logistics strategies for end of life products"	[10]	Electrical and electronic equipments	Waste electrical and electronic equipments	Recycling	Materials	End of life user and no longer required	Recycling and reduce environment impact
"The role of resource commitment and innovation in reverse logistics performance"	[7]	Automobile aftermarket industry	Car parts	Remanufacturing	Used car parts	Remanufacturing	Remanufacturing and secondary market
"The returns management process in supply chain strategy"	[16]	Household appliances, book publishing, auto spare parts, pharmaceutical and marine propulsion and transmissions	Household appliances, books, auto spare parts, pharmaceutical and marine spare parts	Recycling and remanufacturing	Materials and used auto and marine spare parts	Recycling, end of life user, no longer required and remanufacturing	Recycling, remanufacturing and secondary market

6. Future Direction of Reverse Logistics

Generally, there is confusion between Reverse Logistics and Green Logistics, because there is no clear demarcation between both concepts. Reverse Logistics is commonly misleading with the Green Logistics concept. Redesigning packaging to use less material, or reducing the energy and pollution from transportation are important activities, but they might be better placed in the realm of Green Logistics. If no goods or materials are being sent "backward," the activity probably is not a Reverse Logistics activity. There is a lot of confusion and overlapping activities between Reverse Logistics and the Green Logistics.

The term Green Logistics is coined to refer to those practices within the supply chain that aim at reducing sources of waste and resources of consumption. They are not specific to Reverse Logistics processes. For instance, disassembly is an operation needed within Reverse Logistics before deciding, in many cases, what to do afterwards (repair, remanufacture, recycle or safely dispose it). However, it will be only linked to Green Logistics if the design process allows disassembly operations to be carried out without going through destructive operations. Figure 5, gives a brief comparison of Reverse Logistics and Green Logistics in terms of activity based.

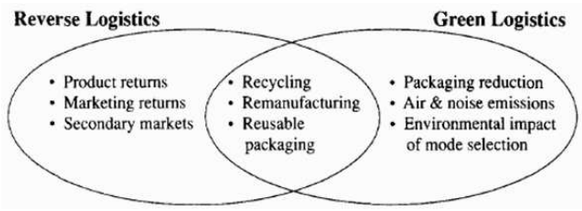


Figure 5. Comparison of Reverse Logistics and Green Logistics (Rogers, 2001)

7. Discussion

In final part of this literature review, the author summaries all 15 articles and break down base on product type, inputs, process, outputs, reason for return and elements of Reverse or Green Logistics refer to Table 4. This summary was use to discuss further on each of the Reverse Logistics issues and findings.

7.1 Planning and forecasting

The author identifies generally planning and forecasting is much difficult in Reverse Logistics due to the uncertainty. However the author concludes it is vital to all firms to manage the Reverse Logistics and its give significant in returns. Besides that the firms should integrate the existing IS in managing Reverse Logistics or expands the existing IS to cover the Reverse Logistics activities [26]. All level of the firms should understand the important of the Reverse Logistics by educate, continuous training and most of all suite to the organization culture the important of managing Reverse or Green Logistics in environment sustainability [7].

7.2 Product and Packaging

Proper packaging and using the right packaging material is required in managing products in Reverse Logistics. Most of the return products have some economic value besides that it is important to properly manage due to the environment concern [14]. Some of the return products are dangerous goods which required specific packaging and disposal method [12]. Lately most of the countries in the world emphasize the important of following the environmental act and standard in handling and dispose the dangerous goods [19]. The author suggests the need for clear environment standard and metrics used in managing and evaluate the Reverse Logistics and Green Logistics.

7.3 Distribution

Reverse Logistics involve reverse product movement from origin to final destination. Due to the reverse movement is from many origins to final one destination it's involved many transportation movements and which does not contribute to economic of scale and economic of distance. Most of the organization consolidates the return products movements to reduce their transportation cost [18]. There is a new trends involve whereby the firms outsource to third party logistics (3PL) service provider in collecting and dispose of return products [10]. In some retailing outlets the origin equipment manufacturer (OEM) give compensation to the retail outlet to carry out the dispose at their points or store to avoid all unnecessary movement and cost [25]. Proper planning and coordination required in managing Reverse Logistics especially in transportation movement. It could be achieve by integrates the IS to the transport management [16]. The final receiving sites such as distribution centre (DC) or central unit returns (CUR) should have adequate storage to accommodate the return products from the channel [3]. For those remanufacturing products it is recommended to immediate start the process to avoid any more product depreciation value and product deterioration [1].

7.4 Order Fulfillment Speed

In most of the articles, the firms often put less priority and urgency in handling reverse or return products [2]. The author identify there is four reason why the firms puts less priority and urgency in handling the reverse or return products.

- Depends on the product characteristics such as components, parts, high value or perishable goods.
- After market value.
- Contributes to preserve environment sustainability.
- Compatibility with legislation.

7.5 Transportation

It is important to all firms plan their reverse transport movement, to achieve maximum in economic of scale and economic of distance [4]. Time, quantity and quality uncertainty in acquisition are known critical factors for Reverse Logistics transportation. The author find out the trade off between the environmental benefits of recycling versus the extra transportation cost has not been established yet. It is preferable to bring together both economic and environment aspects in planning for reverse transportation [8].

7.6 Total Cost

Basically the author find out it is much difficult to defined and know in advance Reverse Logistics total cost. Most of the cases show that the firms difficult to identify the total cost involve in Reverse Logistics due to the unclear product visibility and uncertainty in product returns [20]. It is important to every firm to acknowledge the significant cost involve in managing Reverse Logistics. These costs generally have to be trade off with recycling and the environmental benefits.

8. Conclusions

In the nut shell most of the organizations have considered the important of Reverse Logistics as competitive advantages. Besides that by managing Reverse Logistics there is few process and activities which act as guideline to the organizations to follow which add significant of cost and man power to the firm. Thus there are also trends whereby some organizations outsource Reverse Logistics functions and concentrate in their core business.

The above discussion reflects that Reverse Logistics is a complex and dynamic process and not merely a reversal of the direction of the supply chain. It involves tremendous planning and requires diligent commitment not only from endogenous parties that is the business unit along the initial supply chain, but also from the third party logistics provider and the government. Without the direct involvement of an entire organization, the whole process of Reverse Logistics and its strategy will become cumbersome and unresponsive.

Moreover with the emergence of e-commerce and the ever increasing willingness of consumers to return goods, comes the need to rethink the significance of Reverse Logistics management. This has also given rise to the development and incorporation of Reverse Logistics strategies in their business model with the expectation to gain cost effectiveness and competitive advantage.

Acknowledgements

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