RESEARCH PROJECT

ON

REVERSE SUPPLY CHAIN AND REVERSE LOGISTICS

An Important dimension of Supply Chain Management

FOR THE PARTIAL FULFILMENT OF THE REQUIREMENT
FOR THE AWARD OF

BACHELOR OF BUSINESS ADMINISTRATION

UNDER THE GUIDANCE OF:
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GALGOTIAS UNIVERSITY
(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

SCHOOL OF BUSINESS, GALGOTIAS UNIVERSITY

Certificate from Faculty Guide

This is to certify that the project report ***"REVERSE SUPPLY CHAIN AND REVERSE LOGISTICS"*** has been prepared by **Mr. Abdulla Qazi** under my supervision and guidance.The project report is submitted towards the partial fulfillment of 3 year, full time Bachelor of Business Administration**.**

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DECLARATION

I, **Abdulla Qazi** student of BBA-VI Semester from Galgotia University, Greater Noida, hereby declare that the project is entitled ***"REVERSE SUPPLY CHAIN AND REVERSE LOGISTICS"*** The information, facts and finding in this report are based on my indigenous work and are original in nature. This information is used for academic purpose only. Any resemblance for existing work is purely coincidental.

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ACKNOWLEDGEMENT

I take this opportunity to thank my faculty guide **PROF. ASHOK KUMAR SHARMA** for his unending help and support and guidance without which the project could not have been completed. I am also grateful to Mr.Harish Jain for his valuable advice while carrying out this project.

I would also like to thank Dr. Gurinder Singh and the entire Research cell staff of the Institute for their unrelenting help during the course of the project.

Last but not the least I would thank all friends who have been instrumental in the execution of the project.

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EXECUTIVE SUMMARY

In today's highly competitive business environment, the success of any business depends to a large extent on the efficiency of the supply chain. Competition has moved beyond firm-to-firm rivalry to rivalry between supply chains. Managers in many industries now realize that actions taken by one member of the supply chain can influence the profitability of all others in the supply chain.

Reverse supply chain is defined as "the process of planning, implementing and controlling the efficient, cost 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." The **reverse supply chain** aims to recover used products from consumers for *repair, refurbishing, remanufacturing, recycling and disposal*.

Reverse logistics is a new and emerging area, and as such, only a limited amount of information has been published to date. Moreover most of the information available is from American sources and therefore this report also quotes some US examples that are also very relevant in the present Indian context.

The purpose of this Report is twofold: to present an overview and introduction to reverse logistics, and to provide insights on how to manage reverse logistics well. We also try to find out the future trends,, which will dominate reverse Supply Chain Management in times to come. We have picked up a few industries where Reverse logistics management is of utmost importance and analyzed how it can be managed efficiently.

CONTENTS

REVIEW OF LITERATURE

CRITICAL REVIEW OF LITERATURE

Monczka and Trent (1995), studied that a purchasing and materials managers' second highest rated future concern was the impact of environmental regulation on business activities.They concluded that Reverse logistics programs can also result in significant savings.

Jahre (1995), tried to introduce the concept of Reverse Logistics in his study, however his study was limited to the reverse distribution of consumer waste, rather than the more holistic concept of reverse logistics.

Drumwright (1994), concentrates upon the internal, intraorganizational factors rather than the interorganizational factors that influence reverse logistics activities. The literature shows that a firm's reverse logistics activities are affected by intraorganizational factors, including a sincere commitment to environmental issues and successfully implemented ethical standards, and the existence of policy entrepreneurs who make a strong commitment and take personal responsibility for organizational adoption of an environmentally friendly philosophy.The literature also indicates that a firm's reverse logistics activities are directly affected by one or more of four environmental forces: customers, suppliers, competitors, and government agencies.

Stock (1992), proposed a reverse logistics hierarchy. He proposed that resource reduction should be the ultimate goal in the reverse logistics process. Resource reduction refers to the minimization of materials used in a product and the minimization of waste and energy achieved through the design of more environmentally efficient products. Through resource reduction, both the forward and reverse flows of materials will be minimized. In addition, recycling can be performed more efficiently, as components can be more easily disaggregated into similar recyclable materials. Once the resource reduction option has been exhausted, the firm should attempt to maximize reuse, followed by recycling. Disposal should be the last option. Within this option, the firm can either dispose of a product through incineration, whereby some form of energy recovery

may be possible, or through disposal at a landfill; incineration should be the preferred method.

Kopicki and others (1993), provide support for the hierarchy by noting that a reused item can reduce purchasing, transportation, and disposal costs, while a recycled item will often reduce only disposal costs. Like all other logistics decisions, this hierarchy should be considered within the context of a life-cycle analysis, in which all relevant and measurable costs are considered.

Achrol and others (1983), introduced a model that examines the way in which the four forces affect dyadic relationships between channel members. The model is exhaustive in that it shows all the distinct types of tangible, external organizations that affect a firm's reverse logistics activities. The organizations they identified include suppliers, competitors, government agencies, and nonprofit organizations, such as activist groups.

Krumwiede D.W. and Sheu C. (2002) developed a model for Reverse logistics entry by third party providers. The model focusses mainly on recycling of used products.

Fleischmann M and others (1997), developed a quantitative model for reverse logistics whereby quantitative techniques were used to address the various issues in reverse supply cahin and predict the materials flow.

Vineet Pathania and Hrishikesh Mhatre (2003), tried to bind the diverse needs of different reverse supply chains through a common information model, combining inputs from research and insights from experience of different sectors. It addresses the adaptability of this model to specific industry sectors and goes on describe the potential benefits

INTRODUCTION

1.1 INTRODUCTION TO REVERSE SUPPLY CHAIN

Once the consumer has used the product, the manufacturer still has a couple of things to do. *For example, what happens to that bottle of Coke? What happens to those empty drums of fuel and chemicals at the factory?*

Reversing the flow of material (back into the supply chain) post-consumption is the idea behind reverse logistics. This need not happen at the consumer interface alone, but needs to take place during the manufacturing and procurement cycles as well.

The environmental lobbies are gaining in strength, and consequently, the consumer does not hesitate to let you know, that he wants to ensure that any waste is disposed of properly. To meet such demands, managers are using reverse logistics to make their manufacturing cycle more efficient, friendly and profitable

Companies spend more time and money in fine-tuning their forward supply chains while ignoring their backward supply chains. However, in today's competitive business environment when there is both external and internal pressure, companies can no longer ignore reverse supply chains. Efficient reverse supply chains bring many benefits to the companies. However, reverse supply chains are different from forward supply chains and most of the existing forward supply chains are not designed to handle reverse supply chains.

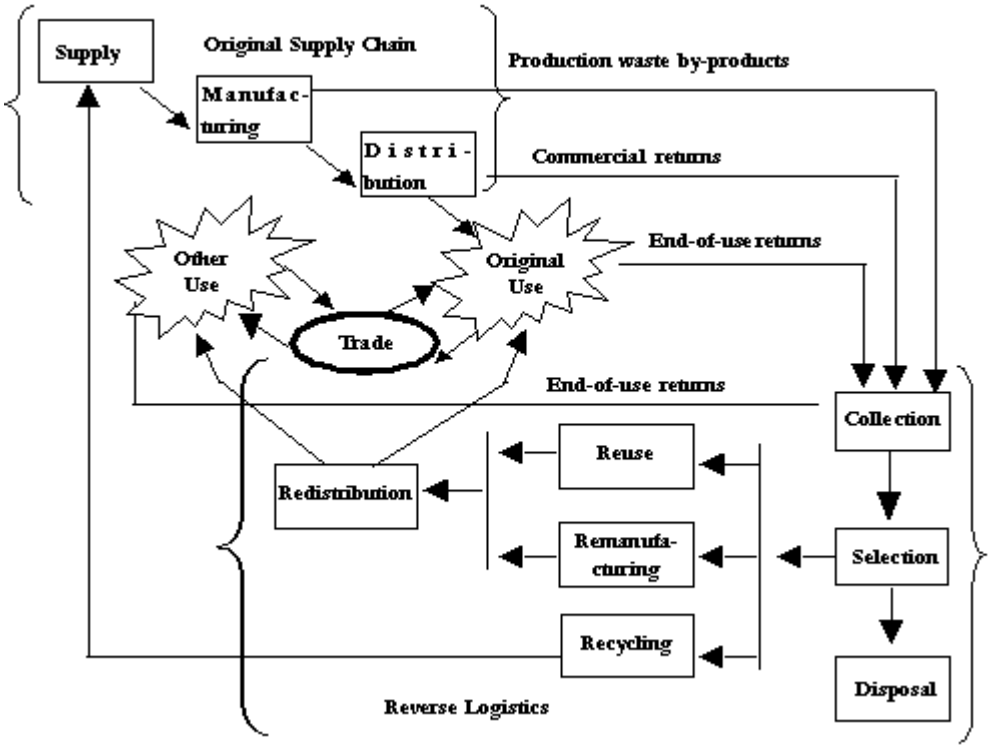
In today's highly competitive business environment, the success of any business depends to a large extent on the efficiency of the supply chain. Competition has moved beyond firm-to-firm rivalry to rivalry between supply chains. Managers in many industries now realize that actions taken by one member of the supply chain can influence the profitability of all others in the supply chain. Companies like Wal-mart are trying to squeeze more costs out of their supply chain to offer everyday cheaper price to the customers. On the other hand, more and more companies are focusing on their core competencies while outsourcing the rest. But without efficient and effective supply chain, companies cannot benefit from outsourcing.

Supply chain is defined by The Council of Logistics Management as "the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements." However, a company's supply chain is not limited to delivering products to the end-consumers. What about the defective products that are returned by the consumers back to the company?

Though reuse of products and materials is a common phenomenon, companies have long ignored this part of the supply chain, known as reverse supply chain or backward supply chain. A common example of reverse supply chain is the soft drinks bottles pickup and delivery system, where soft drink bottles are returned and reused repeatedly. Companies were so long under the impression that returns compared to sales generate little or no money. However, with the growth of direct-to-consumer channels like catalogs and Internet, sales returns of merchandize by the consumers has increased. C Glenn Mauney, Senior VP, Manufacturing Services Genco Distribution System, says, "there is growing recognition of the value that can be recaptured from the unproductive assets resulting from return merchandize." Goods worth over $100 bn are returned to US retailers annually. According to Devangshu Dutta, Director of a supply chain solutions company, "nearly 20% of everything that is sold in America is returned."

The Council of Logistics Management defined reverse supply chain as "the process of planning, implementing and controlling the efficient, cost 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." (Refer Figure 1)

Figure 1 : Reverse Supply Chain



Reverse logistics also includes remanufacturing and refurbishing activities, processing returned merchandize due to damage, seasonal inventory, restock, salvage, recalls, excess inventory and recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery.

Necessity of Reverse Supply Chain

The foremost reason behind companies giving importance to reverse supply chain is that it reduces operating costs by reusing products or components. For example, previously, Estee Lauder Companies Inc., used to dump nearly $60 mn worth of its products into landfills every year. However, after setting up reverse supply chain it has been able to reduce the volume of destroyed products by half.

Companies have started realizing the importance of reusing products or components; as a result, reverse supply chains are becoming essential part of business. "Retailers/e-tailers are facing challenges as returns policies are becoming more lenient," opines Mike Nardella, Senior VP, Logistics, return buy. C Glenn Mauney supports his views,

according to him, "the increased emphasis on new products and product "freshness" has caused a need to clear the distribution channel more often, requiring an efficient means to bring back obsolete, outdated or clearance items." For example, Xerox replaces or upgrades hundreds of office printing machines every month.

In some cases companies are forced to set up reverse supply chains because of environmental regulations. C Glenn Mauney, opines, "many countries/states have instituted regulatory requirements regarding recycling and product disposition that requires increased record keeping and tracking. For example, from 2003, European Union is bringing a legislation that will require tire manufacturers operating in Europe to arrange for the recycling of one used tire for every new tire they sell. Some companies are using reverse supply chains as an integral part of new businesses.

For many large manufacturing and technology companies, aftermarket services forms a significant portion of their revenue. Also, providing timely and efficient service has become a key competitive differentiator in many industries. Karen Peterson, VP and Research Director, Gartner, agrees. According to her, "better management of the reverse supply chain translates into higher customer service and consequently, higher customer satisfaction; and industries and the enterprises within them are realizing that management of the reverse supply chain is a revenue opportunity." For example, GE Aircraft engines makes more in servicing its aircraft engines than it did in initially selling them.

Some firms have also set up reverse supply chain capabilities for altruistic reasons. Nike encourages consumers to bring their used shoes back to the store from where they were purchased. These shoes are shipped back to Nike, where they are shredded, which are then donated to make basketball courts and running tracks. The company also donates funds to help build and maintain those courts. By doing this, companies enhance the value of their brand and also encourage people to purchase their products.

The Starting Point

Though companies have been successful in fine-tuning their traditional supply chains, they need to make change in their existing supply chain management systems to implement reverse supply chain management systems. Says Karen Peterson, "most enterprises do not have supply management systems which handle the reverse supply chain or, if they do, the existing applications are disconnected."

Opined Mike Nardella, "companies need to make a major paradigm change. No longer can companies accumulate returns in the back of the warehouse or stores and ignore the issue of returns." The first step in any successful reverse supply chain management system is to define the rules of reverse supply chain system. Karen Peterson views, "the first and most important activity is to actually understand where the reverse supply chain will contribute profits." Adds C Glenn Mauney, "the initial focus should be on the desired business outcome of the reverse supply chain process and then the policies and procedures that are in place to support that outcome." Many companies accept all types of returns while others do not. A lot also depends on the type of product. The return policy of the companies should clearly mention the type of return. Customers return products for repair or replacement. Channel partners return goods because of excess inventory or products exceeding their shelf-life. Original equipment manufacturers also initiate recalls. Ford recalled its Explorer model because of faulty tyres. Companies also need to educate the customers and establish new points of contact with them.

The different activities in reverse supply chain process are gatekeeping; collection; inspection and sorting; reconditioning; disposition; and redistribution. In gatekeeping, it is decided which products to be allowed in the reverse supply chain, otherwise companies might be flooded with products which cannot be recycled, remanufactured or disposed. Good gatekeeping is the first critical factor in making the entire reverse flow manageable and profitable. Next, is the process of collection of the chosen items. A major issue in collection is the high uncertainty regarding locations from where used produced products need to be collected, their quantity and timing. Once collected, the items need to be transported to locations for inspection and sorting. The inspection and sorting is necessary to decide what to do with each item. Companies might capture value from

returned products by reconditioning components for reuse or by completely remanufacturing the products for resale. Disposition is the activity which decides where the items will finally go. Disposition of items is based on quality or product configuration. In redistribution, the company plans to sell the recycled product. While doing so the company first needs to determine whether there is demand for the recycled product or whether a new market must be created.

Reverse Supply Chain vs. Forward Supply Chain

Reverse supply chains differ from forward supply chains in information flow, physical distribution flow and cash flow. To manage reverse supply chain, companies need sophisticated information systems. Some of the technology involved in reverse Supply chain is similar while in some areas the technology used differs from that of traditional supply chain. According to C Glenn Mauney, "depending on the volumes and complexity of the returned goods flow, there is some information capture specialization and processing efficiencies in returned goods processing that requires some unique systems." Technology used in reverse supply chain such as real time inventory tracking system (bar codes and sensors) are similar to that used in the forward supply chain. On the other hand, Devangshu Dutta said that activities such as warranty tracking or de-manufacturing of product is different. Agrees Karen Peterson. According to her, "repair optimization; slow moving inventory optimization; and reverse logistics," are the areas where reverse supply chain differs from forward supply chain.

In designing a successful reverse supply chain, it is important to know what type of product will be returned at which point in time at which place and in which condition. Hence, importance of data is immense. C Glenn Mauney opines, "tightly integrated automatic data capture, system directed disposition support, unique receipt handling, credit processing, comprehensive and flexible reporting are some of the important functional capabilities in reverse supply chain." However, the legacy systems or the standard enterprise resource planning systems used by companies are not effective to support these functional capabilities. What is required is a data warehouse with extranet and intranet technology.

Table 1: Barriers to Reverse Logistics	
Barrier	**Percentage**
Importance of reverse logistics relative to other issues	39.2%
Company policies	35.0%
Lack of systems	34.3%
Competitive issues	33.7%
Management's inattention	26.8%
Financial resources	19.0%
Personnel resources	19.0%
Legal issues	14.1%

Reverse supply chain also differs from forward supply chain in physical distribution flow. In the reverse supply chain, inbound logistics consists of defective units and other returns from customers. Inbound logistics follow sporadic or random routing. On the other hand, outbound logistics consists of repaired and remanufactured products; recycle items; or products meant for disposition. Outbound logistics follow both fixed and random routings. In forward supply chain, inbound logistics consists of flow of parts to a factory from the suppliers, which are consolidated, high-volume in nature and follows fixed routing. Outbound logistics in the forward supply chain consists of finished product from the factory to the customers, which is a single unit shipment and follows random routing.

Cash flows in reverse supply chain are in terms of credits and discounts. Customer expects to get a refund on a return, in the form of credit card reversal or a cash discount. Unit warranty tracking is done by product serialization. While in forward supply chain, cash flows are mainly in terms of cash. Customers purchase goods with cash or credit cards.

Barriers to Reverse Supply Chain

Successfully implementing reverse supply chain is still a problem for companies, as they face a number of obstacles. Mike Nardella views that reverse supply chain is still treated more like a necessary evil of the back end process of a logistics process. Another barrier according to him is that there is lack of commitment on the part of senior management. Senior management should show commitment in the form of dedicating a team of individuals, software and conveyor systems for reverse supply chain.

PROBLEM DEFINITION:

Experts feel that Companies are losing out by not focusing on Reverse supply Chain. With increasing input costs, and global recession there is huge pressure on corporates to lower prices and also maintain profitability. Thus effective Reverse Supply Chain management can play an important role in cutting costs and improving bottom lines

1.2 RESEARCH OBJECTIVES:

1. To analyze the different activities involved in Reverse Supply Chain process and understand their implications.

2. To study the various industries where reverse logistics plays an important role like Publication houses, Automotive Industries, Electronics/Computer Industries, Retail industries, etc.

3. To analyze the Reverse supply Chain Network in consideration of the strategic points that determine the design of such a network.

4. To study the importance of Reverse Logistics Information Systems.

5. To find out newer avenues where Reverse Supply Chain can play an important role in reducing costs and subsequent increase in revenues.

1.3 RESEARCH METHODOLOGY:

Hypothesis:

Null – Focus on Reverse Supply Chain Management can help companies reduce cost and subsequently increase their revenues.

Alternate – The reverse supply chain is not worthy of much attention by the companies as the benefits from it are minimal.

Research Design:

The study intends to analyze the importance of Reverse Supply Chain management in four industries namely

Publication houses

Retail/Consumer Goods Industries

Computer/Electronic Industries

Automobile Industries

The study will try to find out industries which do not focus on Reverse Supply chain, but a huge opportunity of increasing income via the reverse supply chain management exists. Design of the existing models of Reverse Logistics networks will be studied so that a new Reverse Logistics network can be developed for newer industries.

Sample Design

Sample size: Four Industries have been studied extensively and the importance of Reverse Supply Chain Management has been analyzed in detail.

Sampling: Judgemental sampling has been done

Source of Data

Most of the data has been sourced from secondary sources like International and National journals, Business Magazines, other published sources and also various websites.

THE REVERSE SUPPLY CHAIN CONCEPT

2.1 The "REVERSE" Concept

The traditional supply chain and its enabling technologies focus on sourcing, manufacturing, and distributing products to consumers, retailers, and distribution outlets. The **reverse supply chain** aims to recover used products from consumers for *repair, refurbishing, remanufacturing, recycling and disposal*. For example, consumers replace the toner cartridge found in most laser printers after its useful life of two to three months. They then have the option of buying a replacement cartridge from the original equipment manufacturer (OEM) or a recycled toner cartridge at a considerably lower price. Clearly, if the print cartridge OEM had a reverse supply chain, it could revert this revenue stream from the recycling companies by retrieving used products from the consumer, moving them to a recycling location, and then feeding them back into the distribution channels.

Reverse Supply chain is an area that has potential to not only increase profits in times of stagnant or declining sales but also reduce the bullwhip effect.

There's growing demand to increase the **recycling** content in everything from automobiles to personal computers. This demand is sure to fuel the need for reverse supply chains and enabling technologies. The economic benefits from having a reverse supply chain are clear: The enterprise continues to retain contact with existing customers while providing a valuable recycling service and making customers feel good about themselves.

Importance of Reverse Logistics:

Reverse logistics is important for:

1) Assets utilization (rather we can say re-utilization)
2) Assets recovery (To capture the value, which otherwise will be lost)
3) Profit maximization: Cost reduction through recycling
4) To fulfill the Environmental obligations e.g.: Waste recycling, Hazardous waste management e.g.: Car batteries disposal.
5) Customer Relations Management, e.g. after sales service, buy back guarantee

Application Areas

The list of industries where reverse logistic plays an important role:

1) Publication houses (40-50% by volume): To take back the unsold volumes for reuse.

2) Beverage industries: To collect reuse the empty bottles e.g. Coca Cola & Pepsi

3) Heavy industries: To collect and reuse the waste

4) Consumer goods industry: To fulfill the commitments of after sale service and buy back guarantee.

5) Pharmaceutical industries: To collect the expired formulations and drugs for environment friendly disposal.

6) Automobile industries: To fulfill the commitments of after sale service and buy back guarantee.

Activities involved in Reverse logistics

There are four main reverse logistic processes.

1) Collection

2) Combined inspection / selection /sorting

3) Re-processing or Direct recovery

4) Redistribution.

Collection refers to bringing the products from the customer to a point of recovery. In the **inspection / selection and sorting** phase products are being sorted according to the planned recovery option and within each option, products are sorted according to their quality state and recovery route.

Reprocessing includes:

Repair - Warranty returns needs repair

Refurbishing **-** Large installation, building or other civil object are refurbished after which it is again in a better state.

Remanufacturing/Retrievals **-** Products are dismantled and their parts are used in the manufacturing of the same products (remanufacturing) or of different products (retrieval).

Recycling - In case of recycling, products are processed in order to get the desired quality after which they are being reused e.g paper pulp and glass.

Incineration **-** Products are burned and the released energy is captured.

Direct recovery includes:

1) *Re-use* - End-of-use returns often contain valuable components which can be re-used.

2) *Re-sale* - Supply chain returns (products in good condition) can be sold at a discount rate or at a secondary market.

Redistribution - is the process of bringing the recovered goods to the new users.

Common Reverse Logistics Activities

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

2.2 Reverse Logistics as a Strategic Weapon

When companies think about strategic variables, they are contemplating business elements that have a long-term bottom line impact. Strategic variables must be managed for the viability of the firm. They are more than just tactical or operational responses to a problem or a situation.

Not long ago, the only strategic variables a firm was likely to emphasize were business functions, such as finance or marketing. During the late 1970s and 1980s, some forward thinking companies began to view their logistics capabilities as strategic.
Although more and more firms have begun to view their ability to take back material through the supply chain as an important capability, the majority of these firms have not yet decided to emphasize reverse logistics as a strategic variable.

There is no question that the handling of reverse logistics challenges is an essential, strategic capability. In a celebrated case a few years ago, the McNeil Laboratories division of Johnson & Johnson experienced a very serious threat when someone poisoned several people by placing cyanide inside unopened bottles of Tylenol, a Johnson & Johnson flagship product. This horrible act happened twice in the space of a few years. The second time, Johnson & Johnson was prepared with a fine-tuned reverse logistics system and immediately cleansed the channel of any possibly tainted product. Because Johnson & Johnson acted so quickly and competently, a mere three days after the crisis, McNeil Laboratories experienced an all-time record sales day. Undoubtedly, the public would not have responded so positively had Johnson & Johnson not been able to quickly and efficiently handle its recalled product through its existing system in reverse. Clearly, the Tylenol incident is an extreme example, but it illustrates how reverse logistics capabilities can be strategic, and how they can dramatically impact the firm.

Another example of how reverse logistics can be used by retailers as a strategic variable is by keeping consumer product fresh and interesting. According to quote Dan Eisenhuth, executive vice president for asset recovery at GENCO Distribution System, “Retailers used to liquidate to compensate for ‘screw-ups.’ Today they do it to stay fresh.”
The most important asset a retail store has is its retail space.

To maximize profit per square foot of selling space, stores have to keep the fresh goods visible. Grocery stores, with razor-thin profits of one to two percent, realized long ago that it is critical to keep only products that will sell on the shelf. Supermarkets have to turn their inventories frequently to prevent spoilage loss, and to maximize the return on their space. Now, non-grocery retailers have begun to adapt supermarket ideas to their own businesses.

Grocery retailers started building reclamation centers in the 1970s. These reclamation centers were places where old and non-selling product would be sent. In many instances, reclamation centers would be attached to a store. Later on, supermarket chains began shipping obsolete or bad product to one central reclamation center for processing. These reclamation centers gave birth to the concept of centralized return centers.

Reverse logistics is strategically used to allow forward channel participants—such as retailers and wholesalers—to reduce the risk of buying products that may not be "hot selling" items. For example, a record company developed a program to adjust return rates for various products depending on variables such as name recognition of the individual recording artist. This program produces a win-win environment for both the producer and the retailer, not to mention the consumer, who gets a broader selection. The program gives the company the ability to develop new artist franchises. Had the record company not implemented this program, its retailers would likely be willing to only carry "sure-thing" products.

Another example of the strategic use of returns is the electronic distributor that, during a period of volatile memory chip prices, created a program to help resellers better control their inventory and balance stocks. By allowing resellers to return anything within a reasonable time frame, customers were encouraged to keep inventory low and make purchases just-in-time.

Strategic uses of reverse logistics capabilities increase the switching costs of changing suppliers. A goal of almost every business is to lock customers in so that they will not move to another supplier. There are many ways to develop linkages that make it difficult

and unprofitable for customers to switch to another supplier. An important service a supplier can offer to its customers is the ability to take back unsold or defective merchandise quickly, and credit the customers in a timely manner.

If retailers do not have a strategic vision of reverse logistics today, it is likely that they will be in trouble tomorrow.

Retailers in high-return categories—such as catalog, toys, and electronics—can easily go out of business if they do not have a strong reverse logistics program. Given the competitive pressure on North American retailers, bottom line contributions provided by good reverse logistics programs are important to the firms' overall profitability.

For more than one mass merchandiser included in the research, the bottom line impact of good reverse logistics was large. Another large retailer found that 25 percent of the profit of the entire firm was derived from its reverse logistics improvements during its initial phase.

2.3 Design of reverse supply chain network:

In conventional supply chains, logistics network design is commonly recognized as a strategic issue of prime importance. The location of production facilities, storage concepts, and transportation strategies are major determinants of supply chain performance. Reverse logistics should also be taken into account during the design of the support network such as location and capacity of warehouses, plants, choice of outsourcing vendors, distribution channel and supporting technology. Returns information captured should be integrated with forward supply chain information to achieve optimum planning and reduction of costs. The whole support network can then be designed in such a way that it can service both the forward and Reverse Logistics processes efficiently. This is in line with the concept of a closed-loop supply chain design.

The logistic network structure catering to Reverse Logistics can be divided into two portions:

a) **The Convergent Network:** This is the portion of the network accumulates used products from individual sources and conveys them to some recovery facility. Companies can set up dedicated returned products collection centers at specific locations or collect the products through retailers and distributors.

b) **The Divergent Network:** A divergent network part links recovery facilities to individual customers purchasing reusable products. This portion of the network is very much similar to traditional forward supply chain distribution networks and integration with forward supply chain can be done here for maximized optimality.

Strategic Points In The Design Of Reverse Supply Chain Network:

1) **Acquisition/collection of returned/used products** Managing the collection and acquisition of used &/or returned products potentially accounts for a significant part of the total costs of any closed-loop supply chain. To design the network for collection a company can install several drop points for customers to hand in used products, integrate the reverse flow of used products with other transportation flows or use a direct express

mail system to bypass several stages of the network for fast processing. The type of design depends on different product types and needs of the customers. Retailers and distributors are often used as the points of collection.

2) **Testing/grading operations:** The location of the test and grade operations in the network has an important impact on the flow of goods. It is only after this stage that individual products can be assigned to an appropriate recovery option and hence to a geographical destination. It is important to see a tradeoff between transportation and investment costs at this stage. Testing collected products early in the channel may minimize total transportation distance since graded products can directly be sent to the corresponding recovery operation. On the other hand, expensive test equipment and the need for skilled labor act as drivers for centralizing the test and grade operations.

3) **Reprocessing:** The reprocessing generally requires high investments in establishing the network for reverse logistics. The costs for specialized remanufacturing or recycling equipment influences the economic viability of reprocessing. Integration of product recovery operations with the original manufacturing process can offer economies of scale which involves sharing of locations, workforce, or even manufacturing lines.

4) **Redistribution:** Redistribution stage resembles a traditional distribution network. In particular, we find the conventional tradeoff between consolidation and responsiveness in transportation. If collection and redistribution are combined we can achieve efficiencies in vehicle loading. Redistribution can also be done along with distribution of new products.

INDUSTRY OUTLOOK

3.1 Reaction of different Industry Segments

As these reverse logistics and waste-reduction strategies go from passive to active, they increase value for customers and build loyalty. With consumers becoming more concerned about the environment, firms must look beyond their shipping and receiving docks. They can gain real competitive advantage by rejecting the conventional notion that once the product is out the door, waste management becomes somebody else's problem.

The following section shows how some industries are strategically allocating resources to respond to the reuse and recycling imperative. The classification scheme identified below was developed as a means of identifying how different types of companies are responding to the environmental challenges. The following six categories of companies were identified:

Category A—high-technology companies characterized by high R&D expenditures, low cost of goods, and low logistics costs as a percentage of sales. Firms in this category—such as Eastman Kodak, Hewlett-Packard, and Motorola—have invested heavily in basic R&D for new product development and in process manufacturing R&D. These investments are leading to new products that use less material than the products they replace. And this, in turn, has led to less waste generation and lower logistics costs.

One interesting development finds film and digital processing moving closer to point of need or use, thereby reducing waste generation and improving customer service. Localized film processing has sped up picture processing and reduced costs. Retail clerks now operate in-store micro-production centers, saving transportation, logistics, and operating costs.

Category B—high-technology firms characterized by rapid product obsolescence, high costs of goods sold, and medium to high logistics costs. With their emphasis on minimizing costs to increase margins, these firms tend to leave disposal to consumers and salvagers.

They typically concentrate on distributing to channel members and consumers, who then must deal with product disposal themselves. Among the companies in this category are Compaq, Dell Computer, and Gateway 2000.

Category C—high-technology firms with high R&D expenditures, low costs of goods sold, and low logistics costs as a percentage of sales. These companies typically are experiencing radical change. Companies in this category, which includes IBM, are moving toward smaller processors with lower logistics costs. In the process, they are using fewer resources to distribute goods. These firms generally have less product replacement in comparative time periods than Category A and B firms.

Category D—companies characterized by high-end consumer products shipped direct-to-consumer, low to medium costs of goods sold as a percentage of sales, and low R&D expenditures, but high logistics costs. These firms, which include catalog companies such as Lands' End and Spiegel, are faced with product returns that run 10 to 20 percent of sales. Once the sale is finally complete, the consumer is responsible for product disposition, with many of the items passed on to charitable organizations for reuse. Wastes from shipping materials are minimal. The main challenge is to deal with the after-market returned goods, a costly activity. Competitive advantage lies in knowing how to minimize the costs of returned goods and make it easy for customers at home to "shop" remotely for quality goods. These firms compete with local retail outlets, which make it convenient for consumers to shop for and return goods.

Category E—firms selling low-end consumer durables with high costs of goods sold, high potential for polluting the environment, and relatively low basic and process R&D expenditures.

These companies are highly motivated to find ways of dealing with the after-market.

Indeed, most have been regulated into action. Because of the high costs of goods sold, these industries have established systems to reuse or recycle products in manufacturing processes. Tire and battery manufacturers are among the companies in this category that have done this successfully.

Category F—firms with products that incur low costs of goods sold, relatively low R&D expenditures, medium to high logistics costs, and comparatively little change. These firms generally exhibit little motivation to proactively manage wastes. They tend not to

deal with reverse logistics issues until regulated into action. Among the companies included here are paint manufacturers and producers of beverage containers and shipping, packaging, and unitizing materials. As they bear the brunt of increased regulation, however, these organizations then become highly motivated to manage the after-market to capture and reuse materials in the production process.

Return percentages by industry

Auto industry (parts)	4-6%
Magazine publishing	50%
Book distributors	10-20%
Book publishers	20-30%
Catalog retailers	18-35%
CD-ROMs	18-25%
Computer manufacturers	10-20%
Consumer electronics	4-5%
Electronic distributors	10-12%
Greeting cards	20-30%
Household chemicals	2-3%
Mail order computer manufacturers	2-5%
Mass merchandisers	4-15%
Printers	4-8%

3.2 Industry Snapshots

3.2.1 Publishing Industry

The publishing industry is currently struggling with record breaking returns of unsold copies, a steady decline in adult trade sales, and a compressed shelf life for new titles. Reverse logistics is now more important in the publishing industry than ever. At many firms, good reverse logistics policies and practices represent the difference between profitability and seas of red ink.

Historical Roots

The book supply chain suffers from some problems that date back to business practices developed 70 years ago. During the Great Depression, booksellers could not afford to buy as many books (to sell) as the publishers wanted. To enable retailers to stock more books, publishers began the practice of permitting retailers to send back any books they were unable to sell. Retailers were then able to carry many more titles, thus greatly increasing the selection available to the buying public. Since then, publisher-retailer relationships have followed this model.

This relationship requires the publisher to bear the risk for the books that fail to sell. Publishers encourage retailers to buy large quantities. Retailers know that any books they cannot sell can be returned for full credit, so there is zero or little cost to the retailer for ordering more copies than can be sold. This arrangement is very costly for publishers. Each return costs the publisher 25 cents in transportation, and many books are destroyed that typically cost between $2 to $2.50 to print.

Over time, publishers have come to accept these costs as a cost of doing business. Over the last few years, however, changes in the publishing industry have led to record return rates and losses for publishers.

In addition to buying directly from publishers, retailers also buy books through wholesalers. Retailers generally prefer to buy from the publisher, because these distributors generally charge higher prices. Lately, retailers in most channels have started

gaining more power. In the book supply chain, book distributors have policies in place that limit their return risk, while publishers take the brunt of the return risk. Some publishers will now only sell directly to retailers making a minimum level of annual purchases. Smaller retailers must buy from a wholesaler. Because wholesalers often do not carry a publisher's entire catalog, this is a serious concern for smaller retailers.

Return Problem Symptoms

Sales of hardcover and paperback adult trade books fell by 5.3 percent between 1995 and 1996, to 459 million copies. This was the second consecutive year that the drop in sales was greater than five percent. From 1996 to 1997, total revenues declined 3.4 percent. One publisher canceled over 100 planned titles in 1997. During this period of decreasing sales, the average rate of return in that category hovered at about 35 percent of copies shipped to booksellers. Additionally, the product life cycle of book sales has decreased.

Returns as a Percentage of Gross Revenues

	Average	Range
Adult Hardcover	35.1%	23%-38%
Adult Paperback	25.6%	22%-29%
Juvenile Hardcover	18.7%	13%-23%
Juvenile Paperback	19.8%	13%-23%
Mass Market Paperback	43.5%	37%-51%

The most closely watched category of books is the adult hardcover. Well-known authors that typically dominate best-seller lists usually write these. Sales figures for these books can have an impact on the stock price of a publisher. Return rates in this category have dramatically increased, and are such an area of concern that the publishing industry is devoting more resources to solve the problem.

Root Causes

Several causes exist for the return problems in the publishing industry:

- Rapidly growing retail square footage requires more books
- Chains' size has led to larger print runs
- Chains generally have higher return rates
- Competition for likely best-sellers has increased advances given to authors, requiring bigger runs to recoup initial investments
- Profusion of books in print means more competition
- Shorter shelf lives
- Flat total sales growth for books overall
- Computer models exert downward pressure on shelf life
- "Jam the channel"
- Inventory policy changes—JIT
- Unclear channel position—integration

The largest single factor has been the growth of the large chain stores.

At the same time that retail floor space was growing in the book industry, the customer base for books and many other manufactured items was consolidating. Giant retailers, such as Wal-Mart and Kmart, have become a larger percentage of a publisher's business. As superstores add more space, they are grabbing a larger and larger piece of the book market, and these gains are coming at the expense of independent bookstores. Figure shows the independent bookstores' portion of the market. As late as 1999, independent bookstores held the largest share of the market, with more than 32 percent, only to decline to less than 20 percent by 2004. The number of books sold by discount stores rose by more than 21 percent in 2004.The growth of superstores has given bookstores a more powerful position in negotiations with publishers. In order to secure a prominent display in the superstores, publishers must be able to supply large quantities of books. However, after two weeks in a prominent display, a book may be relegated to a shelf in the back of the store. The large display may include a stack of 100 or more books. When the large display is no longer needed, most of those excess copies are sent back to the publisher for credit.

The result is that the increase in sales at superstores is a mixed blessing for publishers. Independent bookstores sell more than 80 percent of the books they order, while superstores sell less than 70 percent, and discount stores sell about 60 percent. Because independents tend to order a smaller variety, less of each title, and push the books they have in inventory, their return rates are generally lower than those of the superstores. Additionally, independent booksellers have less power in the channel. The growth away from independents to the powerful superstores has exacerbated the return problem in the book industry.

If a store has a large inventory of slow-selling books, it will often want to mark them down to be able to sell them, rather than return them. However, publishers generally believe that marking books down diminishes the value of the product in the customers' eyes. In the publishing industry, it is believed that if the customers expect that all books will eventually be marked down, they will postpone purchases of new profitable books.
Another problem that publishers have is the explosion of titles in the publishing industry. In 1947, when *Books in Print* began collecting data, 357 publishers printed 85,000 titles. By 1997, there were more than 1.3 million books in print, published by more than 49,000 publishing houses in the U.S. Yet, the number of customers that read books has not grown at the same rate. In 1997, sales slid 3.4 percent.[13] The result is that book superstores often dictate reverse logistics policies to the publishers.

Making the problem more financially potent, publishers are gambling on high profile authors with huge advance payments. To compete for these high-profile authors, advances paid are running into the millions of dollars. To justify such high advances, publishers plan initial print runs at least large enough to cover the author's advance. This leads to more copies of the book to distribute, which adds to the problems described above. Unfortunately, many of the authors do not return what the publisher expected.

The Internet and On-Demand Publishing

At one point, some people believed that bookstores would eventually become obsolete. The vision existed that publishers would sell books directly to people who would download books from the Internet. Interestingly, one of the areas where the Internet has had the largest impact on commerce is in the publishing industry. *Amazon.com* has shown through its success that there are many people who will use the newest communication form, the Internet, to order books, one of the oldest forms of communication.

In the future, the Internet's greatest impact may be on sales of out-of-print books. Because of traditional printing technology, publishers must print a large number of copies of a book at one time to keep costs down. If it is unlikely that future sales will guarantee at least this many sales, the publisher will not print another run of the title, and the book will become obsolete.

Technology is making it possible to print very small runs as small as one copy for a reasonably low cost. The cost is still much higher than the per-copy cost of printing several thousand, but low enough to still be affordable.

Using this technology, a customer can go to a website and request a copy of an out-of-print book. The book will be printed and shipped to the customer the next day. Ingram Books, the United State's largest book wholesaler, have a Lightning Print division devoted to this very business. Their website, *www.ingram.com/Company_Info/lpihtml*, offered 125 titles in July of 1998. They have plans to offer 10,000 titles by the end of 1998. The cost (to the publishers) of making a title available is relatively low, as the company is letting publishers set up titles risk-free at no up-front cost. The publisher will collect royalties on books that would have never been sold otherwise.

3.2.2 Computer / Electronic Industry

The product life cycle of a computer is extremely short when compared to other consumer durable goods, such as automobiles or large appliances. In a business where returns can lower profits by as much as 25 percent, reverse logistics is a serious business. A study completed by Carnegie Mellon University, estimates that approximately 325 million personal computers have become obsolete in the United States in the 20-year period between 1985 and 2005. Out of that number, it is estimated that 55 million will be placed in landfills and 143 million will be recycled. This large number of obsolete computers means that the short life cycle in the electronics industry is a serious problem, and that there are many opportunities to reuse and create some value out of a nearly omnipresent asset.

For many retailers that sell computers and electronics, the percentage of returns is high. Manufacturers have begun to put caps on the amount of product they are willing to take back. These caps are part of a continuous struggle in the channel. Because computers are a complex product, return percentages are high. Consumers do not understand how to operate them and are quick to return the product when it may not be defective. Some categories, like CD-ROM drives, have had return rates of 25 to 40 percent in the past because they were complicated to install and difficult to operate.

Printer returns, on the other hand, have moved down to between four and eight percent because they have become an appliance. The consumer can simply unpack the printer, plug it in and start using it.

For one computer manufacturer, failure to manage the return rates well severely damaged its profitability, and eventually, its ability to go public. This retail channel firm allowed its return rates to get out of line compared with the rest of the industry. Return rates for PC firms included in this research are generally below 10 percent. However, this particular company allowed its return rates to exceed 17 percent.

Many computer manufacturers have put caps on their returns, and allow only a certain percentage of sales to be returned. These policies have been known to fail when a powerful retailer tests them and exceeds the cap. It is difficult to manage powerful

retailers such as Wal-Mart or Target, when manufacturers are dependent on those retailers for a growing percentage of their sales. Some firms started out with an aggressive cap percentage have since eased the percentage to accommodate their retail customers.

One way to minimize the return chain is by building to order. This allows manufacturers to postpone final transformation of the product until the end of the channel, and configure the exact computer that the customer wants.
With postponement, the channel holds very little inventory. This is in sharp contrast to the rest of the industry, which typically will have 30-60 days of inventory pre-sold into the channel.

The manufacturers/retailers that sell directly to the customer and build to order have significantly lower return rates than the rest of the industry. These firms have return rates around five percent, about half of what the rest of the industry experiences. One executive interviewed said, “we send out a million computers. Pretty soon, most of them come back.” The build-to-order model, combined with direct sales, eliminates this problem.

The direct manufacturers/retailers interviewed for this research find that the bulk of their returns is due to quality problems. Most of the returns for manufacturers that sell computers through the traditional reseller’s channel are marketing returns, where the computers did not sell and came through the channel to the manufacturer. Direct manufacturers/retailers have a clear advantage over traditional competitors because of the minimization of returns. Additionally, direct sellers believe that most of their users are higher up the technology curve and therefore are less likely to ship back the non-defective defective machines that stream back to all computer manufacturers. One traditional firm interviewed indicated that nearly half of its bad quality returns were actually working models.

However, each firm's business model dictates how reverse logistics works.
One computer manufacturer that at the time of this writing was just beginning to move to a build-to-order manufacturing model, flooded the market with inexpensive computers. Soon after it jammed the channel with these machines, it changed the rules on returns and price protection. The company decided to not allow any open or closed box returns, and to limit defective returns to one percent of resellers purchases from the previous quarter.
Non-defective defectives were to be returned to the customer for full price. An executive with one of this manufacturer's competitors talked about this development with the research team. "What an interesting concept. First you flood the channel with excess inventory, then you announce that returns are prohibited." This policy is clearly a tentative step in the direction of making return policies more conservative, and places more responsibility downstream in the supply chain. It remains to be seen if this and other similar initiatives will be successful.

Computer manufacturers have developed rebate programs to incent retailers to reduce returns. For example, one manufacturer gives retailers a one percent rebate for return rates between four and seven percent, and up to two and a half percent if returns are less than one percent for that particular retailer.

Some manufacturers have contracted with remanufacturing specialists to develop solutions to this problem. These companies will work with manufacturers, evaluate the root causes of returns, excess, and obsolete machines, and develop methods to control costs and return rates. These specialist firms test, recondition, repair, repack, and then resell the machines. One firm, for example, includes a special manufacturer's warranty. At the same time, the third party can act as the service center for the manufacturer.
Some manufacturers have also hired third parties to perform warranty repair and other service work for retailers that do not have their own service capabilities. These programs have led to lower returns.

Businesses have begun to learn that the largest portion of their profits is derived from the early stages of the product life cycle. This knowledge makes proper product disposition

even more important. One electronics company interviewed for this research said that it made 140 percent of its profits during the first four months of the product's life.

This statement means that in the latter portion of the product life cycle, where sales begin to dwindle, profits are actually negative for this particular electronics firm. This situation is not unusual. In the electronics industry, as in many other industries, product life cycle continues to contract. Retailers realize that they have to get a product through the supply chain quickly, get that product on their shelves, and then move it off the floor before it becomes unprofitable. The backward portion of the supply chain then becomes a priority rather than an afterthought.

Software Industry

In the software industry, distributors are attempting to cut down retailers' returns by implementing just-in-time delivery. However, retailers generally overestimate demand because there is not much incentive for them to forecast carefully. Software manufacturers want the product on the retailer shelves, and often agree to stuff the channel. The cost of a box of software is low compared to the price. In one extreme example, a software manufacturer contracted with a third party to destroy 50 million copies of one software product. While this particular manufacturer would have preferred to not produce an excess of 50 million, the company believes that it is better to guess higher than lower.

Because of these kinds of practices, return rates in the software industry recently hovered around 20 percent.

Additionally, releasing more software titles forces returns, because the product life cycles of those titles are contracting.

Because their risk is low, some retailers will accept software purchased elsewhere. Other retailers, such as Sears, are trying to reduce returns and improve inventory turnover by reexamining channel relationships. Some of these retailers have begun setting up 30-day return policies.

3.2.3 Automotive Industry

The auto industry is one of the largest industries in the world, dealing with the most expensive consumer goods.

Therefore, it is not surprising that reverse logistics issues have long been a source of consideration. In the auto industry, there are three primary areas in which reverse logistics plays a significant role:

- Salvage of parts and materials from end-of-life vehicles
- Remanufacturing of used parts
- Stock-balancing returns of new parts from dealers

Auto Disassembly

When a vehicle reaches the end of its life, it eventually ends up at an auto salvage yard or auto dismantler. There, an assessment is made of the components of the vehicle. Any parts or components that are in working order that can be sold as is, are removed and sold. Other components, such as engines, alternators, starters, and transmissions may be in fairly good condition overall, but need some refurbishing or remanufacturing before they can be sold to a customer.

Once all reusable parts have been removed from the vehicle, its materials are reclaimed through crushing or shredding.

Shredded metals will generally be reclaimed, but the remaining material, known as fluff, cannot be recycled.

Every year, automotive recyclers handle more than 10 million vehicles. Their efforts supply more than 37 percent of the US' ferrous scrap for the scrap-processing industry. However, roughly 25 percent (by weight) of the material in a car is not recycled in the United States.

Approximately 35 percent of the nonmetal material left after shredding a car is plastic. To reduce the amount of landfilled plastic, firms are trying a number of alternatives.

One part of the problem is that cars are made of so many different types of plastics. Identifying each type of plastic is difficult. Automakers are trying to reduce the number of types used, and to label the parts for easier separation after disassembly. Ford, for example, reduced the number of grades of plastic that it specifies from 150 to 20.

Use of Recycled Materials

To close the recycling loop, automakers would like to be able to use recycled products in their vehicles. However, parts made out of recycled materials are not yet widely available.

When they are available, they may cost more than parts made of virgin materials. However, Ford discovered in one case that once all the costs of using a particular part are considered, a 100 percent recycled part was actually cheaper to use. Unfortunately, this is not the case in every instance.

Because automakers believe that consumers will not pay extra for a vehicle made with recycled parts, additional usage of recycled materials will depend on the rate at which their costs can be brought down. Automakers are making progress in this area, however. Chrysler, for example, recently announced their consideration of a program to take material from pop bottles and use it to make large panels for the body of a car. However, it would initially be targeted for areas of growth in low-priced vehicles, like China and India.

Remanufacturing

The auto industry may be the industry with the longest history of making use of old products. The remanufacturing of auto parts was boosted by the shortage of new parts during World War II, but the recycling of auto parts has been taking place in the industry for over 70 years. In total, 90 to 95 percent of all starters and alternators sold for replacement are remanufactured.

Automakers want to maintain a closed-loop system with their parts. When a vehicle needs a new transmission, it is their hope that the consumer will bring the car to a dealer,

who will replace the old transmission with a remanufactured one. The dealer will send the old transmission (now called a transmission "core") to the automaker for remanufacturing. In this way, the automaker will maintain a stable supply of transmission cores.

Unfortunately for the automakers, there is a lot of leakage from this closed system. To prevent this, the dealers must pay a deposit in the form of a core charge when they receive a remanufactured part. When the automaker receives the transmission core from the dealer, the dealer's core charge is refunded.

Despite these efforts, many parts leave the system. Partly, this leakage occurs because many car owners take their vehicles to auto repair shops outside the automaker's system. The core will then go to the repair shop's supplier.
Another source of leakage can be the dealers themselves.
Despite the fact that the dealer may have paid a core charge for a part, they may still be willing to sell it to another remanufacturer. Many of the third party remanufacturer companies make regular milk runs, during which they stop at dealers and other repair shops and offer to pay cash for any cores. Many dealers will look at a pile of greasy cores sitting in the corner, and decide they would rather take the cash than deal with the hassle of sending the cores back to the automaker.

All automakers interviewed recognize that this leakage is problematic, and are working on ways to improve their reverse logistics processes to eliminate this problem. For example, Ford has begun using a single carrier to handle all of its dealer core returns. Ford dealers can call one 800 number for all questions and issues related to core returns.
The auto parts remanufacturing business can be difficult.

All of the typical problems of reverse logistics are present: varying flows of different products, and many products without packaging. This is not to mention the fact that the products themselves are often coated with grease. However, some remanufacturers have begun using bar coding systems to track incoming products and the progress of these products as they move through their reverse logistics flow.

Dealers' Parts Returns

In addition to collecting cores from dealers, automakers also must collect new, unused products and defective products from dealers.

Although the automakers wish that they could determine the amount and type of parts the dealers will maintain in their inventories, and how many, they cannot. Dealers, as independent businesses, make their own determinations as to which parts they stock. Each year, new car models are introduced requiring new parts. At the same time, fewer older cars are on the road, meaning parts for these vehicles no longer need to be kept in the dealers' inventories.

Because dealers have a finite amount of space in which to store parts, they need to remove the older parts from their inventories to make room for the newer parts.

3.2.4 Retail Industry

The retail industry, under great competitive pressure, has used return policies as a competitive weapon. The greater the pressure, the more innovative the solutions. Within the retail industry, it appears that necessity, indeed, is the mother of invention.

Grocery retailers were the first to begin to focus serious attention on the problem of returns and to develop reverse logistics innovations. Their profit margins are so slim that good return management is critical. Grocery retailers first developed innovations such as reclamation centers.

Reclamation centers, in turn, led to the establishment of centralized return centers.

Over the last several years, retailers have consolidated. Now more than ever, large retail chains are the rule. These large retailers have more power in the supply chain than retailers did a few years ago. In general, the large retailers are much more powerful than the manufacturers. Few manufacturers can dictate policy to large retailers such as Wal-Mart or Kmart. If a manufacturer will not accept returns, it is unlikely that the large retailer will accept those terms easily.

In some exceptional cases, retailers will make allowances for a manufacturer's products that they believe are not replaceable with similar products.

Returns reduce the profitability of retailers marginally more than manufacturers. Returns reduce the profitability of retailers by 4.3 percent. The average amount that returns reduce the profitability among manufacturers is slightly less, at 3.80 percent.

FUTURE TRENDS AND CONCLUSION

Future Trends

4.1 Recognition of Reverse Logistics

It is clear that in the future, more firms will lavish considerable attention on reverse logistics. Many firms have only become aware of the importance of reverse logistics relatively recently, and have yet to realize the strategic importance that reverse logistics can play.

To reduce the cost of reverse logistics, in the future, firms will need to focus on improving several aspects of their reverse logistics flows:

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

One of the easiest ways to reduce the cost of a reverse logistics flow is to reduce the volume of products it is asked to carry. There are two aspects to this. First, products that do not belong in the flow should be prevented from entering. Secondly, once products have entered the flow, they should be dispositioned as quickly as possible.

4.2 Reducing the Reverse Logistics Flow

To reduce the flow of products into the reverse logistics system, there are a number of promising new technologies that can be used to make sure that every product that enters the reverse logistics flow is one that should be in the system.

4.2.1 Product Life Cycle Management

Good reverse logistics management can be considered part of a larger concept called product life cycle management. In the future, it is likely that leading edge companies will begin to emphasize total product life cycle management. The product life cycle management concept means that the firm provides the appropriate logistics and marketing support based, at least in part, on where the product is in its life cycle.

The core of the product life cycle concept is that all products have a finite life and move through various stages. Typically, a product life cycle curve is divided into four distinct phases during its life as a live product. Those four phases are introduction, growth, maturity, and decline.

Product volume increases through the introductory and growth phases. As a product moves through the life cycle to maturity, sales level off and begin to decrease. In the declining stage, sales drop and profits derived from the product diminish. Products in various stages of the life cycle require different types of management and support. Logistics management needed in the introduction phase is much different than the support requirements when the product is at maturity. Additionally, the supply chain management necessary at the end of a product's life varies from other stages.

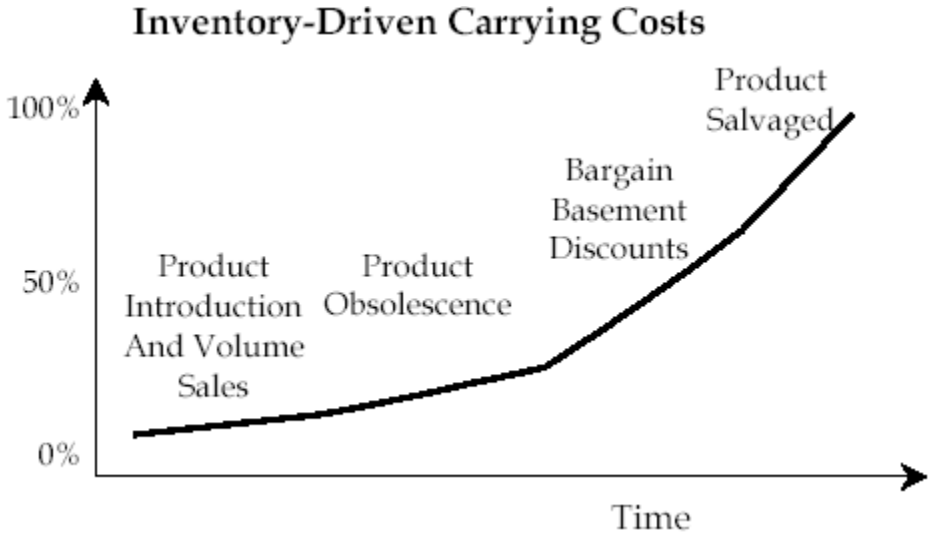
The product life cycle is not uniform across products and industries. It is a theoretical device that can be useful. However, it is difficult to identify where a real product is in the life cycle once it moves past the introductory and growth stages. The firm has to look for demand turning points. These can only be seen if the firm clearly understands past history and the marketplace.

Unfortunately, the focus for the marketing and logistics organizations at many firms is only on the early and middle portions of the product life cycle. The mission of the logistics and marketing organizations is much clearer early in the life cycle. Product roll-out, volume build, and the support associated with these portions of the life cycle, are their primary concerns. Sometimes, it is difficult for a company to admit that a product is at the end of its life.

Decisions are postponed because the organization believes that a little more life can be breathed into a product. The sales and marketing organizations may attempt to conceal a sales decline. They may believe that a decline in the sales of a product means that they are not performing their job properly.

As the product approaches the end of its life, the cost of holding inventory increases. Inventory carrying costs consist of expenses such as the cost of money, insurance, taxes, shrinkage, warehousing, and obsolescence. As the product moves through the life cycle and reaches the end of its selling life, obsolescence costs increase from very low to 100 percent. Warehousing costs associated with the product will also continue to accumulate. This means that a firm cannot correctly use only one inventory carrying cost across the total life of the product. In Figure, an inventory carrying cost scenario is presented.

It is as important to manage products well at the end of their life as it is in the beginning. As can be seen from the figure, it may be more important to manage inventory well at the end of a product's life than at the beginning. At the end of a product's life, it is likely that it will enter the reverse logistics flow. Good reverse logistics is a critical piece of product life cycle management. As the life cycle moves past volume sales, the firm needs to begin to clear the channel through the utilization of good reverse logistics practices. Plans must be made for the end of product life, as well as thinking about the other stages of the life cycle.



If a firm can plan many of the management elements around the end of a product's life, instead of merely reacting late to obsolete inventories, the total profit derived from a product will be greater.

4.2.2 Information Systems

In order to handle reverse logistics better, firms will need to improve their reverse logistics information systems. the reverse logistics environment is different enough from the forward channel that information systems developed for the forward channel do not generally work well for reverse logistics.

Most return processes are paper-intensive. Automation of those processes is difficult because reverse logistics processes have so many exceptions. Reverse logistics is typically a boundary-spanning process between firms or business units of the same company. Developing systems that have to work across boundaries add additional complexity to the problem. To work well, a reverse logistics information system has to be flexible.

Information systems should include detailed information programs about important reverse logistics measurements, such as store compliance, return rates, recovery rates, and returns inventory turnover. Some of the systems for controlling returns will obviously require significantly expanded and improved information systems.

Even if such systems do not materialize, firms will develop better reverse logistics information systems in the future.

Additionally, useful tools such as radio frequency (RF) are helpful. New innovations such as two-dimensional bar codes and radio frequency identification license plates (RFID) may soon be commonplace.

4.2.3 Gatekeeping Technology

In order to improve gatekeeping, front-line employees need good information about which products to allow into the reverse logistics flow. Accomplishing this task is not easy. It is made more difficult because many front-line employees who are making gatekeeping decisions are often inexperienced employees working at or near minimum

wage. Retailers are loath to incur significant costs training these employees, because employee turnover tends to be high. More training would certainly improve gatekeeping, but using a significant amount of training on an ongoing basis would not be cost-effective.

If it is not feasible to provide the gatekeepers with a high level of training, many manufacturers have sought to "bulletproof" the returns process by providing materials for the employees to follow when taking a return. Such materials would let the employee know what products can be returned, for how long after purchase, and what parts should be included with the product.

4.2.4 Web-Based Gatekeeping

Some retailers are investing in gatekeeping systems. One solution that seems promising is an Internet or intranet web page that guides the employee through the returns process for each product. When a customer returns a product, the employee scans the UPC bar code on the product. The computer system asks the manufacturer's system for the returns procedure for the particular product. A web page appears, which steps the employee through the returns process for that product.

4.2.5 Electronic Data Interchange

Another important technology is Electronic Data Interchange (EDI). While many processes within an organization may be automated, it hard to marshal the resources to implement all of the EDI transaction sets that a firm might wish to have. Obviously, for most companies the reverse flow would not be among the first to adopt and implement.

4.2.6 POS Registration

In some cases, manufacturers are willing to accept customer returns for a limited period of time after the initial purchase. If a retailer attempts to return a product to the manufacturer after this period has expired, the manufacturer will not give the retailer credit. In this type of situation, the retailer needs to know exactly when the product was purchased.

A technology that can provide this information is point of sale (POS) registration. In a POS registration system, the retailer scans the product's serial number at the time of sale. The retailer electronically sends the serial number and the sale date to the manufacturer. The manufacturer keeps on file the serial number, the sale date, and the name of the store that sold the product. When a customer tries to return a product at a later date, the retailer phones the manufacturer to learn if the product is within the warranty period.
If a web-based returns system like the one above is implemented, this function could be included in the web page. After the employee scans the product UPC, a web page appears that instructs the employee to scan in the product's serial number. The web page accesses the database, and tells the employee whether the product was purchased at the retailer's store, and if it is possible to return the product.

Such a system nearly eliminates products being improperly returned. In the case described, the manufacturer pays the retailer fifty cents for every product registered. Clearly, this system comes at some cost to the manufacturer. In addition to the cost of registering the products, the manufacturer must also bear the considerable cost of developing and implementing such a system.

Despite the cost of such a system, for some products, the benefits can be great. The benefits will be greatest for high value products with short life cycles. When a product has a short life cycle, the customer may have a greater incentive to try to return a product beyond the authorized warranty returns period. When a new version of a product is released, many customers want to return the old version for a new version. If too much time has passed since the purchase for the manufacturer to authorize the return, some customers will try to abuse the returns system. The more frequently a new version of the product comes out, the greater customers' incentive to abuse the system. Also, the higher the value of the product, the greater customers' incentive to abuse the system.

4.2.7 Radio Frequency Identification (RFID)

Keeping track of where reverse logistics products are and where they are going can be time consuming. Many products do not have their original packaging, or the packaging

may be damaged. In this case, it is very difficult to use RF scanners to track the movement of products through the reverse logistics flow.
Radio Frequency Identification (RFID) is a relatively new technology that may prove beneficial in these situations.

Typical methods for identifying products are passive. In order to know if a particular product is present, the only way to find out is to go out into the warehouse and look to see if it is there. RFID, in contrast, is a more active form of identification. A very small, very low powered radio transmitter is installed in each product, broadcasting a very faint signal. Despite its small size, an RFID "tag" contains a battery that can send out a signal for years. The signal is strong enough, that receivers in a warehouse can pick it up. Each product can send a different signal. You could build 10 million computers, and install an RFID "tag" in each one, and each one could have a different signal.

There are two ways to use RFID: passively and actively. In passive RFID, a "sentry" at the entrance to the warehouse records the identification of each product as it enters the warehouse. Then, its ID is also registered when it leaves the building. Any items that have entered, but not left the building must still be in the warehouse. In active RFID, receivers are placed throughout the warehouse. To find out if a particular item is in the warehouse, the receivers listen to see if the product's signal is being received. If more than one receiver is receiving it, using triangulation, it is possible to determine where in the warehouse the product is.

Using RFID to assist in the management of returned computers might be a good option. Placing an RFID tag on the machine at the time of manufacturing would take away the errors in the paper chain and assist in the life cycle management of the computers.
For certain products, an RFID tag could be placed on the circuit board or embedded in the plastic case of the computer.

RFID has the potential to aid reverse logistics operations in a number of ways. As mentioned, it may be helpful in keeping track of products in the warehouse. The other way it may be beneficial is in gatekeeping. RF tags may be used in recording the ID of

products when they are sold, and this information can be useful in determining which products to accept for return.

4.2.8 Two-Dimensional Bar Coding

Two-dimensional bar coding is another technology that holds promise for reverse logistics operations. Two-dimensional bar coding schemes, such as PDF417 or Maxi-Trac, allow the user to embed much more information in a bar code than one-dimensional systems such as UPC. One-dimensional systems contain a number or code that must be translated by the computer and matched with information already had inside the machine. With two-dimensional bar code systems, the bar code can contain not only a code, but also a description and other text, even as long as Abraham Lincoln's Gettysburg Address. Because reverse logistics transactions and processes are often exception-driven, information required to update the computer may not be able to fit within the limitations of one-dimensional bar codes. This limitation of one-dimensional bar code schemes could mean that for reverse logistics applications, new technologies—such as RFID or two-dimensional bar codes—will become the rule rather than the exception.

4.3 Managing Reverse Logistics Flow

Once products have been allowed into the reverse logistics system, companies must manage the flow of these products to minimize their net impact to the bottom line.

4.3.1 Standardization of Processes

One of the most common difficulties the research team observed with current reverse logistics systems is the lack of standardization of processes throughout an organization. If processes are not standardized, it is very difficult for people in an organization to communicate to each other how to handle reverse logistics problems.

Good reverse logistics processes begin at the retail store by simplifying returns policies and procedures. These simplified policies and procedures should translate into fewer labor hours dedicated to returns processing. Higher quality decisions should also result because of simplification.

Many companies have discovered that the major benefits of ISO 9000 certification of their forward channel are derived from standardizing all of their processes. Although many firms may not elect to get their reverse logistics processes
ISO certified, as more resources become available, many firms will appreciate the benefit of standardization.

4.3.2 Centralized Return Centers

At a CRC, employees have a much larger volume of products to deal with than they would ever experience at a retail store. This allows employees to develop areas of expertise, which can greatly benefit the firm. In the future, firms will continue to benefit from separating the control of the forward and reverse channels. However, it would seem likely that firms will learn how to handle returns in a CRC that may be at the same physical location as a forward DC. This will allow firms to place their CRCs at the best geographical location, regardless of the presence or absence of a DC.

4.3.3 Third Parties

In the future, many firms may determine that reverse logistics falls into the category of activities, which are best, outsourced.

Firms will realize that efficiently handling the reverse flow and maximizing revenues from secondary markets are specialized skills. Many firms that thirty years ago would have never considered outsourcing their distribution, now find they can significantly reduce costs by using third party logistics providers. In the future, many of these same firms may come to similar conclusions about reverse logistics activities.

4.3.4 Secondary Markets

In the future, firms are likely to find themselves working much more closely with their partners in the secondary market. The current logistics paradigm of moving material from the plant to the finished goods distribution center, and then to the store, will expand to include the passing of this inventory along to the secondary market. It is difficult to predict what the future will hold for the secondary market. From all indications, it will continue to grow. As the secondary market grows, some manufacturers will take measures to increase their control over what happens to their products once they leave the "A" channel.

4.3.5 Zero Returns

In a zero returns program, the manufacturer never again takes possession of a product once it has been sold. The retailer takes responsibility for dispositioning product in accordance with the manufacturer's stipulations. In return, the retailer receives a payment that is intended to reimburse him for the cost of the returned items and for dispositioning the product. By removing the need to handle the returns, the manufacturer expects to save enough costs to more than offset the increased payments to the retailer.

Under some zero returns programs, the store always receives a credit for a certain percentage of sales, no matter how high the return rate. If the credit is six percent, and actual returns are only two percent, the retailer is happy, because it still receives a six percent credit. When the opposite happens, the credit is set at two percent, and returns are six percent, the retailer loses. The idea behind the program is that the credit will be set high enough that it will exceed the average returns experienced by the retailer.

However, given the power held by the large retailer chains, it can be difficult for the manufacturer to prevail against the retailer in this situation.

Unfortunately, given the lax controls that many firms keep over their returns, controls over zero returns programs are lacking. Some manufacturers accuse retailers of double dipping, taking payment from the manufacturer for destroying the product, and then quietly selling the product out the back door to a secondary market firm.

Key Reverse Logistics Management Elements

- Gatekeeping
- Compacting Disposition Cycle Time
- Reverse Logistics Information Systems
- Central Return Centers
- Zero Returns
- Remanufacture and Refurbishment
- Asset Recovery
- Negotiation
- Financial Management
- Outsourcing

Conclusion

After the detailed study of all the four industries in detail we arrive at the conclusion that "Focus on reverse supply chain management can help companies reduce cost and subsequently increase their revenues". Therefore, there is no evidence to reject the Null Hypothesis. **We accept the null hypothesis.**

Reverse supply chain is the last frontier in the supply chain, which remains to be conquered. It is clear that more and more attention is being devoted to the reverse supply chain as companies recognize the critical importance of managing the entire product life cycle. Cost reduction is not the only benefit that can be gained from reverse supply chain.

It helps in understanding why products are returned. Was it returned due to quality problem? Were the stores improperly stocked? Was there a labeling problem? Answering these questions enable a company to go to the root cause of returns, resulting in better engineering, manufacturing or distribution. It also helps to get slow moving products off the shelf, the distribution networks and warehouses. Companies that have been most successful with their reverse supply chains are those that closely coordinate them with their forward supply chains.

Reverse logistics practices vary based on industry and channel position. Industries where returns are a larger portion of operational cost tend to have better reverse logistics systems and processes in place. In the book industry, where great change in the industry structure has occurred in the last few years, returns are a major determinant of profitability. In the computer industry where life cycles are nearly as short as grocery life cycles, the speedy handling and disposition of returns is now recognized as a critical strategic variable. Successful retailers understand that managing reverse logistics effectively will have a positive impact on their bottom line.

Industries that have not had to spend much time and energy addressing return issues are now trying to make major improvements. Now, more than ever, reverse logistics is seen as being important.

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APPENDIX- I : GLOSSARY

"A" channel – the primary sales channel, carrying first quality goods that have not been available elsewhere.
Asset recovery – the classification and disposition of surplus, obsolete, scrap, waste and excess material products, and other assets, in a way that maximizes returns to the owner, while minimizing costs and liabilities associated with the dispositions.
"B" channel – secondary sales channel, for goods that have been through a reverse flow. Can carry first quality goods.
Centralized Return Center (CRC) – a facility where a company's returns are processed.
Controlled Tip – a sanitary landfill where refuse is sealed in cells formed from earth or clay.
Core – a valuable and reusable part or subassembly that can be remanufactured and sold as a replacement part; often found in the automotive industry.
Design For Disassembly (DFD) – designing a product so it can be more easily disassembled at end-of-life.
Design For Reverse Logistics (DFRL) – designing products so that their return flow functions better; designing reverse logistics requirements into product and packaging.
Electronic Data Interchange (EDI) – a system for business-to- business electronic communication.
Gatekeeping – the screening of products entering the reverse logistics pipeline.
Non-defective returns – a non-defective defective returned by a customer.
Outlet sales – products sold at an "outlet" store; typically irregular or off-season products.
Overstock – excess inventory; may be from ordering too much, order cancellations, or product's failure to sell.
Point Of Sale (POS) –the point where ownership of the product transfers to the customer.
Point-Of-Sale (POS) registration – collecting customer registration information for warranty purposes at the time the product is sold.
Return abuse – when a customer tries to return a product at a chain other than where they bought it, or for a price higher than what they paid for it, or after the warranty period has expired.
Radio Frequency Identification (RFID) – a technology in which a tag is attached to each item, which broadcasts a unique, low-frequency radio signal.
White goods – household appliances such as washers, dryers, refrigerators.
Zero returns – manufacturer never takes possession of returns. Destroyed in the field by retailer or third party.