Proceedings of GLOGIFT 07
November 15-17, 2007
UP Technical University
Noida, pp. 403-428

REVERSE SUPPLY CHAIN - CURRENT PRACTICES IN INDIA AND DEVLOPEND COUNTRIES – A DETAILED STUDY

V K Gupta*

ABSTRACT

There is more interest in reverse supply chain (or reverse logistics) now than ever before. Business Corporations are beginning to make serious investments in their reverse logistics systems and organizations. Given the volume of returned products experienced in some industries, it is not surprising that the firms in those industries consider returns a strategic and core competency. It appears likely that companies in industries that generally do not place much value on good reverse logistics practices, will, over the next few years, find that making investments in their return systems will enhance their profitability. It is clear that for many firms, excellent reverse logistics practices add considerably to their bottom line. In Europe, there is a strong trend toward producer product take-back. In some countries, industries are under voluntary take-back programs, in which the government and industry have agreed to targets that the industry will attempt to meet. If these targets are not met, these industries may find themselves violating mandatory targets. In few cases, the Government does the collection, as in the Swedish battery industry. A network of facilities is organized and run by the Swedish auto industry, for example. In other cases, companies are left to create their own infrastructure. Depending upon the situation, in some cases the industry bears the cost while in others the user pays for disposal at the time of the product's purchase, or combination of above.

Keywords: Reverse supply chain, Reverse logistics, Battery

Introduction

Reverse Supply Chain includes all the activities required for the reverse flow. The difference is that reverse logistics encompasses all of these activities as they operate in reverse. Reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal. Re-manufacturing and refurbishing activities also may be included in the definition of reverse logistics. Reverse logistics is more than reusing containers and recycling packaging materials. Redesigning packaging to use less material, or reducing the energy and pollution from transportation are important activities, but they might be better placed in the realm of "Green logistics". If no goods or materials are being sent "backward," the activity probably is not a reverse logistics activity. Reverse logistics also includes processing returned merchandise due to damage, seasonal inventory, restock, salvage, recalls, and excess inventory.

It also includes recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery. Products are obviously still streaming in the direction of the

* Professor, Lal Bahadur Shastri Institute of Management, Delhi

end customer but an increasing flow of products is coming back. For instance, the automobile industry is busy changing the physical and virtual supply chain to facilitate end-of life recovery (Boon et al., 2001; Ferguson and Browne, 2001). Besides this, distant sellers like e-tailers have to handle high return rates and many times at no cost for the customer. It is not surprising that the Reverse Logistics Executive Council has announced that US firms have been loosing billions of dollars on account of being ill-prepared to deal with reverse flows (Rogers and Tibben-Lembke, 1999). The return as a process was recently added to the Supply-Chain Operations Reference (SCOR) model, stressing its importance for supply chain management in the future (Schultz, 2002). While some actors in the chain have been forced to take products back, others have pro-actively done so, attracted by the value in used products. One way or the other, Reverse Logistics has become a key competence in modern supply chains. In this paper, we present a content analysis of reverse logistics issues. Reverse Logistics has been stretching out worldwide, involving all the layers of supply chains in various industry sectors. While some actors in the supply chain have been forced to take products back, others have pro-actively done so, attracted by the value in used products. Reverse Logistics has become a key competence in modern supply chains. In this paper, there is a content framework focusing on the following questions with respect to reverse logistics: why? what? how?; and, who?, i.e. driving forces and return reasons, what type of products are streaming back, how are they being recovered, and who is executing and managing the various operations. These four basic characteristics are interrelated and their combination determines to a large extent the type of issues arising from the resulting reverse logistics system

Literature Review

From time to time, researchers have devoted a lot of effort to study the concept of Reverse logistics. Some of the studies that have been reviewed for the purpose are discussed here:

Olaf Schatteman [1] has explained the basic concept of Reverse logistics and its commercial importance in the economy of USA , which is figured as 4% of the total logistics cost of USA which was $ 35 billion in 2001 and in 2001 the average customer return across retailer was 6 % .Then he told about the characteristics of reverse logistics , that is under what all scenarios does reverse logistics occurs and how could this concept could be used as an attacking weapon in the war of success by the companies. Then he explained the importance of Collecting the right information to allocate and accurately calculate debits and credits which is crucial for manufacturers and distributors. According to Edward .J. Marien [2] as more and more industries are discovering that it pays to be proactive on environmental issues—as opposed to passively waiting to be regulated into action. They've found that it makes good business sense (to say nothing of the positive societal implications) to recycle and reuse their products after the consumer is done with them. It spotlights the efforts of the paint industry, which while facing difficult challenges has recorded some early successes. One central lesson learned from this article was that for source reduction to achieve optimum competitive advantage, cross-functional inter-company reverse business systems need to be in place. These reverse business systems must embrace such areas as re-manufacturing operations, marketing and pricing, accounting and finance, and inventory management as well as the reverse transportation and logistics functions. Margarete Seitz [3] stressed on the fact that in a product recovery environment, the process of transporting, handling and returning of used products from the (end-) customer to a processing facility plays a major role. Reverse logistics is often seen as the most complex activity within product recovery management, as products have to be collected and delivered from many locations (end-users) to one processor (recovery plant). Re-manufacturing is just one of many recovery options. However, in comparison to others, for example recycling, it offers the transformation of end-of-life products and components into products with an 'as good as new' condition through machining, rewinding, refinishing or similar operations. It further differs from repairing, re-using, and reconditioning, due to the fact that remanufacturing also recovers the value originally added to the raw material. Harold Krikke [4] deals with the use of mathematical optimization (or: operations Research) models in logistics, in view of new developments in reverse logistics on the one hand and chain logistics on the other hand. The mathematical model can be programmed in a computer and after data are entered the computer optimizes the problem and gives numerical results. Originally developed in the Military, Operations Research (OR) has developed into a full management discipline, with many applications. However, OR is often criticized for occupying itself with 'non realistic' problems, preferring mathematical beauty over a sense of (business) reality.

Reverse logistics is a (re-) new(ed) area in logistics concerning the logistics of take back and recovery of discarded packages and products. In the old days economic motives were dominant and only valuable waste was recycled, while nowadays environmental concern is the driving force. Moreover, recycling was traditionally the domain of small scale specialized firms, where now Original Equipment Manufacturers (OEMs) are held responsible for proper take back- and recovery systems. As per Marisa P. de Brito and Rommert Dekker [5] while some actors in the chain have been forced to take products back, others have pro-actively done so, attracted by the value in used products One way or the other, Reverse Logistics has become a key competence in modern supply chains. He proposed a content framework focusing on the following questions with respect to reverse logistics: why? what? how?; and, who?, i.e. driving forces and return reasons, what type of products are streaming back, how are they being recovered, and who is executing and managing the various operations. These four basic characteristics are interrelated and their combination determines to a large extent the type of issues arising from the resulting reverse logistics system. David Diener, Eric Peltz [6] shared on **v**alue recovery in the form of the return and repair of reparable spare parts involves large amounts of time as well as inventory investment for the Army. This research defines metrics to evaluate the retrograde processes and establishes a baseline of performance based on fiscal year 2000. In that year, approximately 603,000 individual unserviceable Class IX items valued at almost $2 billion were handled Army-wide by organizations below depot repair activities. Almost half of those items were repaired and returned to serviceable stocks; many were relatively inexpensive items. A significant dollar value also left Army inventories in the form of disposals or condemnations, although the bulk of the items were individually of low value. According to Frank Schultmann, Bernd Engels, [7] in Germany, a battery decree prescribes measures for collecting and recycling spent batteries. They developed a hybrid approach to establishing a closed-loop supply chain for spent batteries that combines an optimization model for planning a reverse-supply network and a flow-sheeting process model that enables a simulation tailored to potential recycling options for spent batteries in the steel making industry. Alicia Culver [8] says Government faces enormous costs in handling computer waste, as equipment often has to be replaced every few years. Computer owners are likely to face even higher waste management costs now that several states have moved to restrict the disposal of computer monitors (and televisions) from trash incinerators and landfills because these items contain up to 8 pounds of lead and other toxic chemicals. Bette K. Fishbein,[9] found that **t**he term "extended producer responsibility" (EPR) was coined early in this decade by Thomas Lindhqvist to describe a policy then emerging in Europe and now sweeping the industrialized world. Lindhqvist, a Swedish professor of environmental economics, defined EPR as the extension of the responsibility of producers for the environmental impacts of their products to the entire product life cycle, and especially for their take-back, recycling, and disposal. In practice, the term has mostly been used to describe producer responsibility "post-consumer" - after products have been discarded at the end of their useful life. As such, EPR shifts the responsibility for discarded materials that would otherwise be managed by local government to private industry, thereby incorporating the costs of product disposal or recycling into product price. First mandated in Germany in 1991, EPR policies are now spreading around the world and are the focus of heated policy debate. A concept called "EPR" also exists in this country, but with some marked substantive differences. In 1996, the President's Council on Sustainable Development recommended an EPR policy of "extended *product* responsibility," which it defined much more broadly as the shared responsibility of government, consumers, and all industry actors in the product chain for all the environmental impacts of a product over its life cycle, with no emphasis on the producer's unique responsibilities or on the post-consumer stage. As per Eric Marks [10] Dell is recalling 4.1 million notebook computer batteries made by Sony Corp. due to overheating and fire risks. This represents the largest recall in Dell's history, affecting 2.7 million notebook computers in the United States. And it isn't just a record for Dell; the recall is the largest in the history of the consumer electronics industry. For its part, Apple issued a recall for 1.8 million iBook and PowerBook laptop batteries, also made by Sony Corp. The recalls expose an aspect of the supply chain that has gained prominence in recent years: reverse logistics. Reverse logistics is the product distribution process traced backward — from the consumer to the manufacturer. It involves processing product returns because of damage, recalls, excess inventory, end of life, and other factors. Plus, it not only involves products but the packaging of those products as well.

The cost of reverse logistics equals about half of one percent of the U.S. gross domestic product. Think big here. In 2004 this amounted to roughly $58 billion. Reverse logistics is increasingly becoming part of a total product and customer experience model, especially in the consumer-electronics-driven economy we live in.

Research Methodology

Research Design

1. **Type of study**

   The entire study has been carried out in two phases:

   a) *Exploratory:* It aims at examining the secondary data for analyzing the previous researches that have been done in the arena of Reverse Logistics . The knowledge thus gained from this preliminary study forms the basis for the further detailed Descriptive research. It helped in under standing this concept and how really it is being implemented in the developed nations.

   b) *Descriptive:* The study has been carried out wherein various companies were covered in India which were following this practice of Reverse Logistics in India .The various sectors which they are in and how well are they implementing this and does it add any value to their company by following such practices.

2. **Instruments**

   The instruments that have been used are:

   - *Qualitative Interviews*

Theoretical Framework

Reverse Logistics: definition and scope

Terms like Reverse Channels or Reverse Flow already appear in the scientific literature of the seventies, but consistently related with recycling (Guiltinan and Nwokoye, 1974; Ginter and Starling, 1978). The Council of Logistics Management (CLM) published the first known definition of Reverse Logistics in the early nineties (Stock, 1992):

"...the term often used to refer to the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal." The previous definition is quite general, as it is evident from the following excerpts "the role of logistics in all relating activities." Besides that, it is originated in a waste management standpoint. In the same year Pohlen and Farris (1992) define Reverse Logistics, guided by marketing principles and by giving it a direction insight, as follows:

"...the movement of goods from a consumer towards a producer in a channel of distribution." Kopicky et al. (1993) defines Reverse Logistics analogously to Stock (1992) but keeps, as previously introduced by Pohlen and Farris (1992), the sense of direction opposed to traditional distribution flows. "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 European Working Group on Reverse Logistics, RevLog (1998-), puts forward the following definition Dekker et al., (2003): "The process of planning, implementing and controlling flows of raw materials, in process inventory, and finished goods, from a manufacturing, distribution or use point, to a point of recovery or point of proper disposal". This perspective on Reverse Logistics keeps the essence of the definition as put forward by Rogers and Tibben-Lembke (1999), which is logistics. We do not however refer to "point of consumption" nor to "point of origin." In this way we give margin to return flows that were not consumed first (for instance, stock adjustments due to overstocks or spare parts which were not used), or that may go back to other point of recovery than the original (e.g. collected computer chips may enter another chain). Delineation and scope Since Reverse Logistics is a relatively new research and empirical area, the reader may encounter in other literature terms, like reversed logistics, return logistics and retro logistics or reverse distribution, sometimes referring roughly to the same. In fact, the diversity of definitions with respect to recovery practices is a well-recognized source of misunderstandings both in research as in practice (Melissen and De Ron, 1999). Reverse Logistics concentrates on those streams where there is some value to be recovered and the outcome enters a (new) supply chain. Reverse Logistics also differs from green logistics as that considers environmental aspects to all logistics activities and it has been focused specifically on forward logistic, i.e. from producer to customer (see Rodrigue et al., 2001). The prominent environmental issues in logistics are consumption of nonrenewable natural resources, air emissions, congestion and road usage, noise pollution, and both hazardous and non-hazardous waste disposal (see Camm, 2001). Finally, reverse logistics can be seen as part of sustainable development. The latter has been defined by Brundland (1998) in a report to the European Union as "to meet the needs of the present without compromising the ability of future generations to meet their own needs." In fact one could regard reverse logistics as the implementation at the company level by making sure that society uses and re-uses both efficiently and effectively all the value which has been put into the products.

The border between forward logistics (from raw materials to end user) and reverse logistics (from end user to recovery or to a new user) is not strictly defined as one can wonder about what 'raw materials' are, or who the 'end user' is, in modern supply chains. For instance, used/ recovered glass is a substantial input for new production of glass. A holistic view on supply chains combining both forward and reverse logistics is embraced by the closed-loop supply chain concept (Guide and van Wassenhove, 2003). Recovery practices are framed within the supply chain, and the encircling aspect of the process as a whole is therefore stressed: having either 1) a physical (closed-loop): to the original user (see Fleischmann et al., 1997); or 2) a functional (closedloop): to the original functionality. Thinking in term of closed-loop supply chains emphasizes the importance of coordinating the forward with the reverse streams. Actually, whenever both forward and reverse flows are involved, co-ordination has to be minded (see Debo et al., 2003). This happens, either in closed- or open-loops (the latter refers to when neither the original user or original functionality are in the reverse logistics process).

Characteristics of Reverse Logistics

The reasons for returning products can be distinguished by where the returns initiated. Listed below are the main return reasons for each supply chain partner. Customer not satisfied . Consumers wanting to try a new product will sometimes abuse the 'not satisfied, money-back' guarantee and simply return the product within allotted return period and receive their money back. Installation or usage problems.

Some customers experience problems with installation or usage of their recently acquired products. This is a common problem in the computer industry where in some categories such as CD-ROM drives, return rates of 25 to 40 per cent are not uncommon. Complicated installation procedures and a lack of clear and simple instructions exacerbate the issue. Warranty claims Defective products or parts can be sent back to retailers or the manufacturer for repair. Products might either be dead on arrival, not working according to specifications or cosmetically damaged. This could happen either to the retailer or the end consumer. Alternatively, products might break down during the course of their life cycle.

Table
Percentage of returns by industry

Industry	Percentage
Book publishing	10–30%
Magazine publishing – special interest	50%
Computer manufacturers	10–20%
Direct to consumer computer manufacturers	2–5%
Apparel	35%
Mass merchandisers	4–15%
Auto industry (parts)	4–6%
Internet retailers	20–80%

Source: www.rlec.org

The main issues are :

1. Customers not satisfied
2. Installation or usage problems
3. Warranty claims
4. Faulty order processing .
5. Retail overstock
6. End of product life cycle or product replacement

7. Flaws in manufacture recall programs

Other complications

1. The green factor.
2. Electronic commerce – speed of business transaction
3. Shorter product life cycles
4. Reverse logistics is a complex and underdeveloped area .
5. Attacking the returns challenge

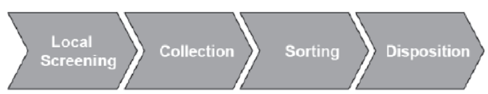
The volume and the method of processing returns drive the total cost of returns. Companies can reduce the costs associated with returns considerably through a number of different ways and even use their capabilities as a competitive weapon.

The most important levers an organization can use to make their returns work best are outlined below. Companies can change the way they are organized to manage returns, alter the way they process returns, use advanced technology to process more efficiently and to prevent returns or ultimately outsource their entire returns supply chain.

- **Improving the process**

The four key steps in return process

The four key steps involved in a returns process are local screening, collection, sorting and disposition.



Local Screening

Local screening is done at the point of collection of the returned products. Often products enter the supply chain that should not enter in the first place and cause unnecessary transportation, administration and handling costs. In an ideal reverse supply chain, products are screened at the point of collection according to specifications of the manufacturer. Disposition, however, changes based on the product (or its version), the vendor and the retailer. Therefore, complex decision mechanisms need to be maintained to allow disposition of product based on customer agreement on a product-by-product basis. With the ubiquitous presence of the Internet plenty of opportunities exist to do this in a cost efficient and effective way. This will be discussed in more detail in the Technology section.

A good example of effective local screening is the process implemented by Nintendo, the video game manufacturer. Nintendo rewarded retailers financially for registering the product and name of the purchaser at the time of sale. This allowed the retailer and Nintendo to determine when the warranty of a product had expired and also whether the product was returned within the allotted time window. To facilitate this process, Nintendo designed special packaging with a see-through opening for retailers to scan the product serial number when the product was sold.Another example of innovative local screening is a global copier manufacturer in Europe. It provided its field service technicians throughout Europe with a scanner connected to a handheld device, which determined if technicians had to return their defective spare parts to a central location in Europe for repair or refurbishment or whether they could dispose of the parts locally. On top of the system they worked with colored stickers that indicated the destination of the part to facilitate processing. They were able to reduce half the amount of parts returned through the system, which resulted in significant transport savings.

Collection

There are many different ways to collect the products that are destined to enter the reverse supply chain. Retailers often have to send their return products back to their suppliers' different warehouses throughout the country. Different processes need to be set up to facilitate timely processing of these returns. This can often be very complicated and confusing for both retailers and manufacturers as they are dealing with multiple parties, many of whom are concentrating on getting products out to the customer, rather then back to the source. Many companies have trouble running a logistics system in forward, let alone running one in reverse in parallel at the same time. Some companies have set up central collection centers for collecting and sorting returns, which have proven to be very effective. Ford in the US, for example, is now using one single carrier to handle all its returned spare parts. Simultaneously, it has provided the dealers with one single 800 number for all their issues with returned parts. Subaru of America has gone one step further: it has outsourced the entire returns collection to Roadway Express' reverse logistics subsidiary, Rexsis. The dealers call one toll-free number regardless of the issue and Roadway Express handles all inquiries.

Sorting

Some large retailers have been using centralized return centers (CRCs) for many years. They have selected centralized return centers dedicated to handle their entire reverse logistics operations. The advantages of using centralized return centers are numerous. When a company dedicates an entire facility, organization and system to optimize the handling of returns, benefits arise from a whole range of areas. Some of the key benefits are: efficiency can increase as employees occupy positions full-time and can focus on handling returns only, experience in the sorting process will help employees make better and quicker disposition decisions, and cycle times will improve, resulting in better asset recovery and higher customer satisfaction. GM in the US, for example, has in cooperation with UPS centralized its parts return center. Dealers once returned parts to some 200 locations, which was very confusing. Today all returned parts – 30 000 a month – go to the Orion facility. In any case, whether it happens in a centralized way or not, sorting is a crucial step in the reverse logistics process because employees make decisions on what ultimately happens to the returned product. Complex business rules underlying these decisions need to be updated continuously and designed so that employees can implement the rules easily. Use of bar code scanners connected to a database that contains those business rules speeds up the process and avoids judgmental errors. Information technology is a key in this process and will be discussed in more detail later. In the near future use of radio frequency (RF) tags can automate this process even further. RF tags are already used on expensive products, however their current price does not yet allow them to be applied to mass consumer goods.

Disposition

Three ways to dispose of product can be distinguished: sell as-is, repair or reuse (part of it) and ultimately dispose of the product. Some key activities within each of these categories are:

Sell as-is:

- resale (as new)
- sell via outlet or discount store

– e-auction, and

  – sell to secondary market

Repair or reuse:

– repair

– refurbish or remanufacture

– modify and

  – recycle

Dispose

– scrap

– donate (to charity), and

  – dispose in secure manner (for example, certain drugs).

Disposition should be done to maximize the value of reclaimed goods or dispose of the goods in the most cost-effective way. Below are some innovative ways leading practice companies have adopted to improve the disposition of their returned items.

Create Profit Centers

Some companies have gone as far as to create profit centers around their returns process. This focuses the organization on maximizing the prices they will get for the goods by exploring innovative ways to sell their returned goods. Manufacturers refurbish the product and auction it through the Internet or re-deploy it to, say, outlet stores. A key problem in selling returned goods is price setting. Experts in sales and marketing techniques usually set prices for new products. Returned goods prices are frequently determined through negotiation. However, one thing organizations need to watch out for when reselling their returned items in general, and in particular when setting up profit centers around returns, is annibalization; the returned goods channels can potentially steal clients away from the primary products and channels. A clearly defined channel and pricing strategy needs to take this into account. More brand-sensitive companies for example will take back returns to keep them from being sold through alternate channels, and then sell them in their own highly profitable outlet stores. In the publishing industry, some publishers have contracts with certain authors that prohibit their titles going to alternate channels to protect their 'brand' name.

Change to Leading Practice Organizational Structure

One way of dealing with reverse logistics is to segment the supply chain into separate forward and reverse organizations. If a logistics organization deals with both forward and reverse product flows, the focus will predominantly be on forward product logistics. Often physical constraints, such as the number of docks and processing space in distribution centers, can limit an organization's capability to effectively handle both logistics flows. When executives have to make decisions around shipping new product out versus processing returned goods, the decision is usually made in favor of the first. As mentioned, the creation of profit centers around the returns process is a way of maximizing the value from returned products. Este´e Lauder has, after a very successful reverse logistics project, created a $250 million product line from its return goods flow, now representing the third most profitable product line within the company. Centralized return centers have also proven to be a successful way for companies to handle returns more quickly and efficiently. Cost savings most often are realized in labor, due to scale and dedication, and transport, due to consolidation of freight. Outsourcing is another way of effectively organizing the returns process. Several leading manufacturers and retailers, such as compaq, Thomson, Target and 3M, have very successfully outsourced their returns processes to competent, dedicated solution providers. Ultimately, companies such as Dell have taken structural steps to avoid the majority of returned products by developing a build-toorder or configure-to-order operating model, which addresses the underlying issues of why returns occur in the first place. These business models are, however, not applicable to every industry or product.

Analyse to Prevent Returns

Root-cause analysis should be at the heart of every reverse logistics system. A return goods management system provides a window into manufacturers' faults. Companies need to look beyond the processing of returns to reduce their reverse supply chain cost. The real benefit comes from sharing information with design, production, packaging and other departments on such things as what products are coming back and why they are coming back. This way reverse logistics systems can nip return problems 'in the bud'. Companies that concentrate solely on improving returns processes will miss significant cost saving opportunities. A good reverse logistics system includes proper data collection and effective reporting. To understand a consumer's reason for returning a good, companies must collect structured and consistent data concerning the reason for the return and the product and its condition. With this information, trends should be analysed in individual products and consumer segments to determine root causes. Mitigating the front-end process by providing front-end customer service and technical support can also help companies reduce returns.

Some manufacturers, for example, ask customers for a serial number of their printer when they order cartridges to ensure they receive the correct types. Another good example is Sharp consumer electronics.At one time at least half of the products returned were in perfect working order. To counter this they added simple but effective elements to their reverse logistics program. Through analysing return reasons Sharp could significantly reduce its VCR returns by making products easier to set up. Now, for example, the clock on the VCR is set automatically, the owner's manual has been simplified and customers are encouraged to call a prominently displayed toll-free number when they have installation problems.

Outsource the Returns Process

Outsourcing of the returns process is also occurring on a more frequent basis and seems to be an alternative to avoid high investments in reverse logistics e-capabilities. Manufacturers such as Compaq, Dell, Cisco and 3M and retailers such as Sears have outsourced the handling of the reverse flow of goods. These companies decided the handling of returned goods was not a core competency and saw significant benefits in taking the flow of returned goods out of their distribution centers and placing it into the operations of outsourcers. These outsource suppliers have become specialists in managing the reverse flow of goods and can achieve economies of scale. They are often in a much better position to handle the returned goods and can provide value-added services such as refurbishment.

The Practices Followed in Developed Contries

European Reverse Logistics

As in the U.S., effective management of reverse logistics is still emerging in Europe. In environmental and green issues, Europe appears to be ahead of the United States. For consumer returns, European reverse logistics practice appears to lag behind leading edge American systems. The focus of this chapter is on European environmental and green solutions to discarded products and materials. Throughout Europe, legislation is being passed, placing conditions on what can and cannot be done with a product that has reached the end of its life. For example, a number of European countries have passed legislation requiring producers to collect their products at the end of life. Many believe that it is only a matter of time before similar measures appear in the U.S.

German Packaging Laws

The German Packaging Ordinance of 1991

No single piece of packaging legislation has been as widely discussed, nor has had as wide an impact as the packaging laws recently implemented in Germany. The German system is worth examining at in detail because it has been so widely discussed in the popular business press, and has formed the basis for programs in other countries. It is the motivation for pending legislation in the U.S. In 1991, the German *Bundesrat* (the German equivalent of the U.S. Senate) passed the Packaging Ordinance. This legislation mandates that industries organize the reclamation of reusable packaging waste, while local authorities continue to handle the collection and disposal of the remaining waste. Under the legislation, companies must either collect the packaging themselves, or contract with someone else to perform the collection.1 According to Ackerman (1997), the 1991 Packaging Ordinance has four principal components designed to increase producer responsibility for packaging waste:

1. Manufacturers and distributors must accept transport packaging, such as pallets, cartons, etc., and reuse or recycle them.
2. Retailers must accept back secondary packaging, for example, outer packaging, like the box that a tube of toothpaste comes in. Distributors must accept back secondary packaging and reuse or recycle it.
3. For primary packaging, such as a toothpaste tube, the same rules apply as for secondary packaging, unless the industry establishes a collection and recycling system that meets strict governmental quotas for the recovery of each type of packaging (72 percent for glass and metal packaging, 64 percent for paper, plastic, cardboard, and composite packaging).
4. A deposit/refund system is required for beverage, detergent, and paint containers.2 The legislation quickly had its desired effect. For transport packaging (which is 30 percent of the packaging), interest in reusable packaging quickly increased, and the use of secondary packaging quickly fell, although it was ordinarily less than 1 percent of all packaging. The main controversy has been around primary packaging, which represents the bulk of packaging materials.

German "Green Dot" Symbol

Figure 5.1

The Duales System Deutschland (DSD)

To comply with the legislation, 400 companies set up the *Duales System eutschland* (DSD) to try to meet the government's quotas for recycling the different packaging types. The DSD signs contracts with three groups. First, it licenses the use of its "Green Dot" symbol, as shown in Figure 5.1 below, to packaging

producers, who put the logo on their packaging. Secondly, it contracts with private waste haulers and municipal waste collectors to collect packaging bearing the Green Dot. Thirdly, it contracts with industry organizations that guarantee the waste will be recycled. Material is collected from consumers and retailers and sent to secondary materials firms for processing. As much as possible, the material is reused to make new packaging, which will follow the cycle again. However, not all material can be reused. Some is used for producing products. An example of this is making park benches out of soda bottles. Other products will be used as sources of energy. Still other products may be exported.

• Green Dot Program

The Green Dot program is the major focus of the DSD. Their logo is called a "Green Dot," even though on most packaging, it is printed in black ink. In order for a container to be accepted by a participating waste hauler, the packaging must carry the Green Dot of the DSD. In order for a company's packaging to bear the Green Dot, the company must pay a licensing fee to the DSD. The cost for the Green Dot depends on a number of factors. The fees are based on the "producer pays" principle, and take into account sorting and recycling costs for the various packaging materials. For example, the costs for plastic are much higher than those for glass, because of the increased sorting and recycling costs of plastic. In addition, the volume of the product is taken into account. The "producer pays" principle dictates that the company responsible for an environmental situation should pay for the cost of the cleanup. In the case of packaging, theproducer of the packaging should be responsible for the cost of recycling or disposing of the packaging. Obviously, the consumer will indirectly pay for this cost, but ultimately, the producer is responsible for the cost. Exactly which partner in the supply chain must apply for the Green Dot depends upon the type of the packaging. For packaging that is filled with a consumer product such as, for example, a cottage cheese container, the product manufacturer must apply for the Green Dot, not the container manufacturer. For service packaging, like shopping bags, wrapping film, and disposable dishes, the packaging manufacturer must apply. For products that are imported, the German importer or the exporter, if located in the European economic area, must apply. Countries located outside the European economic area cannot apply for the Green Dot. A criticism of the Green Dot system is that it is too expensive. Proponents of the original legislation claimed that recycling would be less expensive than sending products to the landfill. Thus far, recycling has not proven to be cheaper than landfilling. The system ends up costing less than $20 per person.8 While this amount may seem high to some critics, it is much less expensive than many recycling programs in the U.S., which have achieved far lower rates of recycling.9 The startup of the DSD was plagued by a number of problems which may strike any company attempting to set up a new reverse logistics system; although the scope and scale of this system are much greater than most reverse logistics systems will be. All three of the partner groups that contract with the DSD experienced problems. The license fees collected by the packaging producers were initially too low to cover the cost of collecting and recycling the packaging. Also, many firms were slow to pay their agreed-upon licensing fees. As a result, the DSD narrowly avoided bankruptcy in 1993. Afterward, it revised the licensing fees to reflect the cost of recycling each type of waste, and increased pressure on companies to license the Green Dot and make prompt payments. The contracts with the waste haulers were more expensive than anticipated. In two years, the DSD had to sign an agreement with a company in each city in Germany to handle the collection. The waste haulers believed that finalizing agreements in all cities was more important than trying to keep costs down. Another factor which led to higher collection costs was Germany's inexperience with curbside recycling collection. Prior to the packaging ordinance, recycling was done primarily through drop-off locations. The final factor was that the DSD paid for collection on a per-ton basis. This gave the waste haulers no incentive to keep out products that did not belong in the system, which may have accounted for 20 to 40 percent of early collections. As a part of its reorganizing after near bankruptcy in 1993, the DSD gave the waste haulers a per capita ceiling on their revenues for collection. This gave waste haulers an incentive to reduce the amount of extraneous material entering the system. The DSD's hardest problems with may have been the companies it contracted to recycle the collected material. In 1993, projections were for 300 million tons of recycled plastic. Actual results were 400 million tons. Processors were not prepared for such large quantities, and the market for recycled plastics was not yet ready to buy such large quantities. When the recyclers accept plastic, they are obligated to ensure that the plastic is eventually recycled; that is, made into new products. Ideally, the material should all stay within Germany. With supply exceeding demand, prices of recycled plastic dropped dramatically, and large quantities were sent to other European countries, because companies desiring the materials could buy it much more cheaply from German sources than local sources. This caused great problems for the recycling programs of other European countries, and has led to discussions about how much one country's policies should be allowed to impact the recycling efforts of other countries. The other result of the excess supply is that large quantities of plastic supposedly destined for reuse ended up in landfills in southeast Asia, as companies found it cheaper to export the problem than to find a use for it in Germany.

The most interesting response to the flood of material created by the DSD has been the European Union's Packaging Directive, adopted in 1994. Perhaps for the first time anywhere, regulations attempt to restrict the amount of recycling. Under the directive, countries are to recover at least 50 percent of their packaging material, but no more than 75 percent. If countries want to recover a higher level of packaging, they must demonstrate that they have sufficient recycling capacity to handle their own materials.

The other major complaint about the Green Dot program is that it is, in fact, a license for a company to create as much waste as desired. There is no incentive for a reduction inwaste production. Also, there is incentive for companies to explore reusable packaging. For this reason, some local governing bodies resisted the implementation of the program.14 Despite this criticism, the program has succeeded in reducing the amount of packaging waste Germans create. From 1991 to 1995, the amount of recycled packaging used by German consumers decreased by nearly 11 percent, while disposable packaging used in the U.S. increased 13 percent over the same period.

Nokia's Footprint

We see ourselves leading the path, treading lightly as we go

The symbiotic relationship that exists between the people and nature is evident everywhere in Finland. This strong respect and appreciation for the environment appears in Finnish food, art, and literature and is a defining aspect of the culture. As a Finnish company, these traditions have permeated into our company culture and work ethic, impacting all aspects of how we do business globally.

Given the expansive growth of mobile communications, it is important for us to minimize our global environmental impact. Through better product design, closer control of production processes, and greater material reuse and recycling, Nokia incorporates environmentally conscious planning into its overall framework. Our aim is to be an environmental leader in environmental performance.

Identification and elimination of risks and strong financial performance, while maintaining and enhancing stakeholder acceptance, are key concerns here at Nokia. Our environmental efforts are linked to all these concerns and stem from an overall mission to make environmental awareness and protection part of our everyday actions.

Our key environmental focuses are

- substance management
- energy efficiency
- take back and recycling

Our driving principles incorporate lifecycle thinking in everything we do. This ensures minimal environmental impact from start to finish, beginning with the extraction of raw materials and ending with recycling, waste treatment, and the reintroduction of recovered materials into the economic system.

An eco-efficient approach The seven principles of eco-efficiency defined by the World Business Council for Sustainable Development combined with lifecycle thinking guide the development, production, and delivery of Nokia products and solutions. These seven principles are:

- minimizing energy intensity
- minimizing the material intensity of goods and services
- extending product durability
- increasing efficiency of processes 46
- minimizing toxic dispersion
- promoting recycling
- maximizing the use of renewable resources

Nokia' s Sustainable Products Wouldn't it be great to use your phone feeling 100% sure it's environmentally sound?

Our environmental efforts are incorporated into every stage of the lives of our products. We take a proactive approach when considering the various areas of our environmental impact. Our environmental activities are a part of our business strategy, ensuring competitiveness, product effectiveness, demand-supply market alignment, cost effectiveness, and customer satisfaction.

Environmental efficiency is taken into account in all stages of product design. We focus on material efficiency, environmentally sound materials, disassembly, recycling, and other end-of-life (EoL) practices and energy consumption.

Sustainable Practices

Sustainable environmental practices extend all the way to you the consumer

We see the environment as being everyone's responsibility. These pages talk about our environmental actions taking place throughout our production and operation process and efforts that we promote and support to our consumers.

Take a look at this quick overview how the environment can be affected by virtually every step of a mobile phone's lifecycle, including production, its use, and eventual disposal.

Reverse Logistics and the Environment

Many companies first focused on reverse logistics issues because of environmental concerns. Today, some are concerned only with reverse logistics as it relates to returning product to their suppliers. However, in the future, environmental considerations will have a greater impact on many logistics decisions.

For example

- Landfill costs have increased steadily over recent years and are expected to continue to rise;
- Many products can no longer be landfilled because of environmental regulations;
- Economics and environmental considerations are forcing firms to use more reusable packaging, totes, and other materials;
- Environmentally motivated restrictions are forcing firms to take back their packaging materials, and
- Many producers are required by law to take back their products at the end of their useful lifetime.

Each of the trends discussed in this chapter will have significant implications for reverse logistics decision-makers. Disposing of unwanted products is becoming a more closely monitored activity. In the United States, the traditional method of simply placing items in a landfill is neither as simple nor as inexpensive as it once was. As the number of municipal landfills in the United States continues to shrink, and as regulations affecting landfills become more stringent, the cost of placing items in landfills has risen steadily. Increased restrictions have focused on implementing or instituting greater measures to protect human health and the environment. This has resulted in the closure of many facilities, and higher costs at others. Another area of increasing regulation is the determination of what items can be placed into a landfill. Products such as cathode ray tubes (CRTs), for example, can no longer be placed in landfills. Throughout Europe and the United States, legislation is being considered placing conditions on the legal disposition of products that have reached the end of life. In Germany, new laws dictate that the producer of a good must bear responsibility for the final disposal of the product. In some states in the U.S., similar measures are being proposed. For example, many states require retailers of vehicle batteries to take back used batteries. In places where legislation does not force a manufacturer to take back the product, products are not being allowed into landfills. In some cases, this will likely force the establishment of a system to collect these products.

Green Logistics and Reverse Logistics

An important distinction must be drawn between reverse logistics and a very related subject that we will refer to as green logistics. Reverse logistics, as we defined in Chapter 1, refers to all efforts to move goods from their typical place of disposal in order to recapture value. Green logistics, or ecological logistics, refers to understanding and minimizing the ecological impact of logistics. Green logistics activities include measuring the environmental impact of particular modes of transport, ISO 14000 certification, reducing energy usage of logistics activities, and reducing usage of materials. Some green logistics activities can be classified as reverse logistics.

For example, using reusable totes and remanufacturing are both reverse and green logistics issues. However, there are many green logistics activities that are not reverse logistics related. For example, reducing energy consumption, or designing a disposable package to require less packaging are not reverse logistics activities. Designing a product to use less plastic would not be a reverse logistics activity, but designing a product to make use of reusable packaging would involve reverse logistics.

Landfill Costs and Availability

Landfill Technology

Waste disposal has not changed dramatically since the fifth century B.C., in ancient Greece, where people were responsible for carrying their own garbage to the town dump. During the time of the Roman Empire, people in cities shoveled their garbage into the streets, where it was collected by horse-drawn wagons, and taken to a centrally located open pit. Dead animals and people were placed in a pit outside of the city due to pungent odors. These methods lasted only as long as the Roman Empire. They collapsed during the Dark Ages, and were not yet reinstituted during the Renaissance. During these times, trash was generally discarded without much thought given to its effect on people and the environment. A survey done in 1880 showed that only 43 percent of major American cities had some minimal type of garbage collection. By the 1930s, this number had risen to 100 percent.

1. Until the 1950s, waste disposal still consisted primarily of burying waste in a large pit. Spontaneous combustion sometimes occurred. Sometimes the waste would intentionally be burned to reduce volume. By the mid-1950s, the need to analyze groundwater downgradient from landfills was recognized, and by 1959, the sanitary landfill was the primary waste disposal system used in American communities.
2. In a sanitary landfill, also known as a controlled tip, refuse is sealed in cells formed from earth or other materials. The modern landfill is different from the dump of the past in the way the material is covered. By the 1950s, it was recognized that covering the material with a layer of soil would reduce its attractiveness to animals, and reduce odor problems. Often, this layer was not deep, and plants were encouraged to grow on it. As studies continued of landfills' effects on water quality, it was learned that rain and other water were seeping through the landfill, contaminating the water table. This contaminated water is called leachate. To reduce water contamination, caps of a nonporous material are now placed on top of the landfill to reduce the amount of leachate generated. Also, a liner of nonporous material is added to the bottom of the landfill to reduce the amount of leachate escaping. In the landfill of the 1990s, systems are used to collect leachate at the bottom of the landfill, before it slowly seeps out through the nonporous material. To capture methane and other gases produced by decomposition, collection systems must be put into place

Landfill Availability

For a number of years, there has been a perception of an impending shortage of landfill space. In 1988, it was believed that nearly half of the metropolitan cities on the East Coast would have no further landfill capacity by 1990.Although this claim has not been borne out, there has been a steady decline in the number of landfills. In 1986, the Environmental Protection Agency's Office of Solid Waste developed a list of municipal solid waste landfills (MSWLFs). Municipal solid waste includes household waste, and some industrial wastes, such as office paper and pallets; but does not include construction waste, car bodies, and industrial process wastes that might be disposed of in landfills.This was the first time such a list had been compiled. In this original list, 7,683 MSWLFs were listed. When the list was updated in 1992, the number of landfills had declined to 5,345. When the list was revised in 1995, the number of municipal solid waste landfills had declined to 3,581. However, it should be noted that during this period, the new requirements for proper cover for a closed landfill went into effect, and this regulatory change led to the closure of many landfills.Although the number of landfills has been shrinking at a significant rate, it is the actual amount of landfill space available, and how long it will last that is the primary concern. Many smaller landfills closed because they were not able to afford the cost of being compliant with new regulations. According to the EPA's Municipal Solid Waste Factbook, 29 states have 10 years or more of landfill capacity remaining, 15 states have between five and 10 years of landfill capacity remaining, and six states have less than five years of landfill capacity remaining.

Obtaining information on the rate at which new landfills are being created is difficult, but as to whether there is a landfill crisis, the EPA has a short answer. Despite the fact that the number of landfills has been decreasing, the capacity has remained "relatively constant…. New landfills are now much larger than in the past."

Cost of Landfill Usage

Along with the perception of rapidly depleting landfill space, there has also been a perception of rapidly rising prices for landfill usage. In the industry, the standard basis for comparing the cost of landfill is the tipping fee. A tipping fee is the cost charged to dispose of a ton of waste.As we have seen above, the perception of rapidly depleting landfill space has not been borne out by the facts. However, in the case of landfilling costs, the perceived trend is very real. According to the EPA, the national average tipping fee in the United States increased from $8 to $31.50 from 1985 to 1996, an increase of 294 percent. This is an annual growth rate of 9.4 percent. Since 1985, the Pennsylvania Department of Environmental Protection has collected data on tipping fees in Pennsylvania, which show an almost identical trend. According to their data, the average tipping fee in Pennsylvania has grown by 300 percent between 1985 and 1996, increasing from $11 to $44 per ton. Although nationwide prices and some regional prices show a long, slow, upward trend, in some regions, prices have gyrated wildly. After declaring bankruptcy in 1994, Orange County tried to raise revenues by increasing tipping fees from $23 to $35. Because there is excess dump capacity in the region, many of its customers took their garbage to cheaper dumps elsewhere. To increase business, the rate was subsequently dropped to $19 per ton.The fluctuating cost of landfilling has also caused plans for huge new household waste dumps to be dropped after tipping fees failed to stay above the projects' breakeven points.

Garbage Generation

Even though there is no immediate threat that garbage will begin to pile up in the streets, landfills and landfill usage are going to be important issues in the near future. Americans generate garbage at an astounding rate. Solutions must be developed. A few facts about Americans' ability to generate garbage:

- Every year Americans use 75 billion disposable paper cups.
- King Khufu's great pyramid in Egypt is built of more than 3 million cubic yards of stone. The Great Wall of China is built of 120 times as much material. The Fresh Kills Landfill on Staten Island, New York, is run by the New York City Department of Sanitation. According to estimates, in the very near future, the total volume of the landfill will exceed that of the Great Wall of China.
- The current rate of garbage production in the United States is hard to comprehend. The

average American generates 4.34 pounds of garbage per day. According to a 1987 study, the then-current U.S. annual waste generation was 228 million tons, which is an amount sufficient to cover an area 654 miles square 10 feet deep.

- The EPA projects that from 1995 to 2000, the annual rate of garbage generation per person in the U.S. will increase from 4.34 to 4.42 pounds per person per day; a modest increase of two percent. Because of increased recycling efforts, however, the amount heading for landfills is expected to decrease over this period, from 2.47 pounds per person per day to 2.38 pounds, a reduction of 3.6 percent. Given the rate at which Americans generate waste, landfill alternatives must be developed.

Extending Landfill Capacity

With increasing regulations on the location, construction, and operation of landfills, opening a new landfill has become difficult. The "not in my backyard" (NIMBY) sentiment among people living in the location of a proposed new landfill adds to the dilemma. Additionally, the NIMTOO, "not in my term of office," phenomenon makes the problem worse. As creating new landfills becomes more difficult and more expensive, communities are trying to find new ways to prolong the lives of their existing landfills by reducing the volume of material that goes into them. It appears that the amount of garbage being sent to landfills is shrinking at a rate faster than the rate of population growth. According to the EPA, the number of tons of garbage sent to landfills (in millions of tons) in 1970 was 87.9. The number grew to 132 million tons in 1990, but had declined to 118 million tons by 1995. There are also some regional indications that the amount of garbage being sent to landfills is decreasing. In 1990, California's landfills disposed of 40 million tons of garbage. In 1996, that numberhad been reduced to 32.8 million tons. In 1970, 73 percent of all waste was sent to a landfill. By 1995, that number was down to 57 percent.23 The reduction in material sent to the landfill has been achieved by increasing the amount of material that is dealt with in other ways, through recycling, composting and incineration. Although the amount of material that is incinerated has grown steadily over this period, as a percentage of the waste stream, it has declined from 20 percent to 16 percent.

The decline in landfill and incineration is a result of large increases in the percentage of the waste stream that is being recycled or composted. In 1970, less than seven percent of the waste stream was recycled or composted. In 1995, 27 percent of the solid waste stream was recycled or composted.24 Of this, roughly five percent of all waste in the United States is composted, and roughly 22 percent is recycled. Nearly all states have ambitious goals of the percentage of waste that should be recycled. Rhode Island has the highest long-term recycling goal, at 70 percent.25 Recycling programs are available in the major cities in all states.

Landfill Restrictions

Restrictions on what can be placed in a landfill are a key factor to the longevity of America's landfills. Some items, like CRTs, are banned because placing them in a landfill will present a long-term health risk. Others are banned because they take up too much space and can be better dealt with using other methods.

As of 1993, 44 states had bans on telephone books being placed in landfills, and 23 states had laws banning grass clippings and yard waste from landfills.26 These are but two of the many items which have been forbidden from being placed in landfills because they can be dealt with so much more effectively in other ways. Telephone books can be recycled. Yard waste can be composted. However, either of these options becomes impossible once the products have entered the landfill. Agencies charged with collecting waste have set up additional systems to collect materials that have efficient alternate waste disposal possibilities.

Disposal Bans and Reverse Logistics

In many places, the definition of a hazardous material is being expanded. In Minnesota, for example, it has been ruled that automotive shocks and struts cannot be placed in landfills, and it is expected that other states will follow suit in the near future.27 For automotive shocks and struts, this new restriction has resulted in a perceived new opportunity. One major manufacturer of automotive shocks and struts has begun a program to collect used shocks and struts and reclaim the materials contained in them. Motivated by the landfill ban, the manufacturer began studying the feasibility of collecting the used shocks and struts. Once the study was begun, the company quickly concluded that a substantial market existed for some of the specialized steel used in the manufacture of the shocks and struts. The company also realized that such a program would give it significant, beneficial exposure as an environmentally friendly company. On this basis, the company is proceeding with the implementation of a nationwide program to reclaim the products. Various computer components are banned from landfills, including circuit boards with high lead content. The computer components representing the largest problem are the cathode ray tubes (CRTs) in computer monitors. CRTs, which have been banned from landfills by the EPA since 1992, 28 contain traces of lead, phosphorous, cadmium, and mercury. When CRTs are crushed at trash-compacting facilities, the lead and other particles become airborne, posing a health risk to sanitation personnel and those living nearby. Experts believe that the magnitude of this problem will only increase. The Gartner Group predicted that between 1992 and 1996, 50 to 70 million personal computers would be discarded. A Carnegie Mellon study predicts that 150 million personal computers will be heading for landfills by 2005, because they cannot easily be recycled.29 The disposal cost for these machines alone will exceed $1 billion, excluding the cost of creating a hole large enough to contain them. If a one-acre hole were dug to bury this many personal computers, it would be three and a half miles deep enough room to stack about 15 Empire State Buildings end to end.The size of the future PC disposal problem can also be considered in the following way. Currently, there are 324 million PCs in use around the world. If all of these were placed in a landfill one acre square, the hole would need to be 6.7 miles deep, nearly as deep as the Mariana Trench. Pallets are another landfill-banned product. It has been estimated that there are 1.6 billion pallets in the United States, enough for every American to have six pallets. This year alone, nearly 400 million pallets will be produced, which requires a tremendous amount of wood. It also poses a serious disposal problem. A third of U.S. landfills will not accept pallets, and others charge extra fees for disposing of pallets. Burning the pallets is not necessarily the answer, either. In Wisconsin, a large building products company was fined $1.7 million for illegally disposing of incinerated pallet waste. These are but a few of the products banned from landfills.

Across the country, the following products have been banned from landfills in one or more states: motor oil, household batteries, household appliances, white goods, paper products, tires, thermostats, thermometers, fluorescent lights, and some medical and electrical equipment. The number of products prohibited in landfills is only expected to increase in the future. As in the case of automotive struts, each one of these bans will present a new reverse logistics opportunity.

Transport Packaging

Although it does not receive much attention in the trade press, the usage and impact of transportation packaging, pallets, drums, gaylords, boxes, etc., is a significant portion of the total packaging used globally each year. As described in section 6.1, many governmental bodies are placing restrictions on the ways that transport waste may be disposed. A companies in Germany are responsible for taking back all of the transport packaging of the products they sell. In the United States, legislation does not exist nationally, and very few statutes concerning transport packaging exist. However, transport packaging is a significant issue for many companies.

Consider a few facts

- Of the 1.6 billion pallets in the United States, each year, pallet recyclers will process more than 170 million pallets for recycling, representing 2.6 billion board feet, of which 2.3 billion board feet will be reused to make new pallets.
- Although wood is the most common material for pallet construction, plastic pallets currently represent about 3 percent of the market, but are estimated to be growing by as much as 30-40 percent per year.
- Each year, $15 billion worth of corrugated fiberboard is sold in the U.S. alone, generating more than 24 million tons of waste. In some U.S. cities, the cost to dispose of corrugated can be as high as the cost of purchasing it. The rising cost of purchasing and disposing of transport materials is leading many companies to consider reusable transport packaging.

Reusable Transport Packaging

Although environmental reasons have factored heavily in many firms' switch to reusable transport packaging, for some, it is simply a matter of economics. Reusable containers are generally much more expensive than single use packaging. However, if a reusable container is reused a number of times, the per-trip cost of the reusable container quickly becomes less expensive than the disposable packaging. A number of case studies cite companies' significant savings from using environmentally friendly packaging. For Johnson & Johnson, the payback period on reusable gaylords, both domestic and international, for inter-plant shipments was three to six months. John Deere & Co. experienced a two-year payback on its reusable crate program, which has subsequently been expanded to its retail outlets in the U.S. Although many case studies have discussed companies that successfully implemented reusable container programs, few cases have been completed about companies that investigated the use of reusable containers and determined them to be uneconomical. One interesting example is the Harley-Davidson Company's decision not to use returnable crates for delivering motorcycles to dealers, after exploring the possibility of their use.

Reusable Container Types

Reusable shipping containers are available in many shapes and sizes; many different materials. Custom containers can be designed to suit any particular need. Over the years, corrugated boxes have set the standard for all other packaging. Corrugated is lightweight, strong, easy to handle, and inexpensive. Therefore, it is not surprising that the majority of reusable shipping containers is plastic, wood, or metal replacements for corrugated boxes.

Plastic

In many applications, plastic is the lightest and cheapest option. Plastic reusable containers generally come in two styles: rigid and collapsible. Rigid plastic containers come in a wide variety of sizes, but are most commonly found in sizes slightly larger than a box of copy paper. Rigid plastic containers come in two primary types: with or without integral lids. Those without integral lids can be stacked in a nested fashion. This reduces storage space and transportation costs. Integral lids often consist of two plastic flaps, one on either side of the opening, that interlock in the middle when the box is closed. This provides added protection for the contents.

When the box is open, the flaps hang down on the outside of either side of the box. Unfortunately, these flaps can be obstructive and cause the containers to turn in the material handling system, if the system is not properly designed to handle the containers.

Collapsible plastic containers are also available in a wide variety of sizes, but the most commonly used is the size of a pallet. When standing, these containers are the size of a typical gaylord. The four sides fold down flat, which leaves the container the size of a very thick pallet. The sides are typically held in place in the upright position with snapping locks. The bottom is of pallet-type construction to allow easy handling with a forklift truck.

Wood

Wooden containers are most commonly found in palletsized gaylords. As with large plastic only consideration in a decision about reusable containers. Many of the company's costs related to handling, transporting, and tracking shipments and materials will be heavily affected by a change to reusable containers. Transportation costs are a major stumbling block to reusable containers. They tend to be heavier than the corrugated materials they replace. Because shipping costs can be weight-related, this translates into higher outbound transportation costs. If trucks "weigh out," that is, they are filled to their maximum weight limit, the extra weight of reusable containers means that fewer units can be put on each truck, which also means higher shipping costs. However, in some cases, reusables reduce transportation costs. When one major manufacturer switched to returnable containers for appliances, the containers were strong enough to be double-stacked, unlike the expendable corrugated cartons they replaced. In addition to adding weight, "cube" utilization may not be as good with reusables. A company will typically only invest in a relatively small number of different sized containers. Disposable materials may offer a wider variety of sizes.

Ergonomics

Ergonomics must play a role in container selection. Some materials are much heavier than others. A gaylord-sized wooden container can weigh over 100 pounds, which is too heavy for a single person to comfortably lift on a regular basis, which means two people or a forklift are needed. Also, the contents of some larger sizes cannot comfortably be reached without repositioning the container. Reusable containers often offer an ergonomic advantage over disposable containers. Most collapsible plastic gaylords offer a drop-down panel in one side of the container. Once the level of parts in the container drops below the bottom of this door, the container can be opened. .

Other Costs of Utilizing Reusables

Although many companies consider materials and transportation costs, many fail to adequately consider all of the other costs involved in a returnable program. In addition to the costs of sending and getting back the containers, other handling costs include cleaning, repairing, storing and sorting the containers.

Unfortunately, reusable containers do require some maintenance. Once the containers return, they may need to be cleaned before they can be used again. Some types may need to be inspected before they are reused, to prevent the use of damaged containers. When damaged containers are discovered, either at an inspection station or on the line, provisions for repairing or replacing the damaged containers are needed. As containers reach the end of the useful lives, replacements will have to be purchased. For both the producer and the consumer of the containers, the cost of storing the containers must be considered. As the source of the containers, the company implementing the use

- Forward Transportation Costs
- Reverse Transportation Costs
- Container Inventory Management
- Inspection
- Cleaning
- Repair
- Storage
- Sorting
- Adapting for Future Use

Costs of Utilizing Reusable Containers

Somewhere, space must be found for this purpose, which would lead to an increase in costs. Also, additional labor will be incurred in storing and moving the containers. The consumer must have space to store empty containers waiting to be sent back to the producer.

Managing Containers

One unpredictable cost is tracking the containers. In theory, the task should be easy: containers go to the customers, and they return. If there is only one customer that the containers are sent to, this task may be easy. However, if that customer is also receiving reusable containers from other supply chain partners, there is a very real chance that the containers may be kept or stolen. A dairy in Southern California retains a private investigator to find and capture milk crates.

For example, GENCO Logistics has developed a stand-alone software package that traces individual reusable containers for Wal-Mart. Wal-Mart uses the system to track containers that are used to transfer returned goods from stores to a returns processing center. Using the system, Wal- Mart is able to track the progress of an individual container from the store, through the carrier, until it reaches the returns center.As this example illustrates, companies are beginning to realize that there can be benefits to enlisting a third party company in helping to manage reusable containers. Some companies, like Wal-Mart, require a software package to help them manage their stock of containers. Other companies are turning their container management over to third party companies, entirely. The idea of allowing a third party to manage a company's stock of reusable shipping materials is not new. For many years, CHEP has been maintaining a stock of pallets used by companies around the world. Although many reusable container projects prove to be beneficial, this is not always the case. In 1995, a study at the Amsterdam Free University traced the use of reusable plastic totes in the dry grocery goods distribution industry. Currently, plastic totes are the standard means for products shipped from manufacturers to distributors, and from distributors to retailers. The study looked at all system costs, and concluded that using one-way cardboard containers is the most efficient way to distribute products. The authors explain that the cost of maintaining the necessary pool of containers, storing, cleaning, checking for damage, etc., are large enough to offset any long-term lower cost of the units.

Success Factors

Although no two reusable container programs are alike, there are a number of factors that have a significant impact on the likelihood of success of a given program.

1. *Transportation Distances.* The shorter the distance that containers are hauled, the lower the cost of the program. Shorter distances will obviously reduce transportation costs. Also, shorter distances mean fewer containers in transit at any given time, which translates to reduced need.
2. *Frequent Deliveries.* The shorter the time between deliveries, the fewer containers will then accumulate between trips. The fewer containers piling up at either end of the relationship, the fewer containers that need to be purchased, and the less space that will be needed for storage. Also, the longer those containers spend gathering dust at the customer, the greater the opportunity for damage and losses.
3. *Number of Parties Involved.* The fewer parties involved, the easier it is to keep track of containers, and the less opportunity for lost containers. To manage a system with many partners, some companies try to assign each container to a particular partner, and maintain a separate closed-loop with each partner. This makes it easy to know which partner has a particular container, but creates a number of other administrative problems.
4. *Number of Sizes Needed.* As the number of different sizes of container increases, better cube utilization can be obtained, which leads to lower transportation costs. Unfortunately, using many container sizes generally means that more containers must be purchased, to guarantee availability of the needed size. In addition, more containers must be handled and stored at each location.
5. *Partner Buy-In.* The other half of the relationship may incur a significant amount of additional work as a result of a change to reusable materials. If the consumer is also sending material to the supplier, the consumer may benefit significantly from the change.

Product Take-Back

A number of societal changes regarding the environment are having a profound impact on reverse logistics, as shown above. In general, there appears to be a trend toward greater restrictions and limitations on what may be placed in a landfill, as well as how and where a product may be disposed. As a result of these changes, companies have begun to examine new ways to regain value from products once they have reached the end of their useful lives. In some cases, the impetus is strictly economic, as with companies that reclaim the copper and other valuable materials from electronic components. In other cases, a change in environmental laws can alter the economics of recovery. In the landfill section, a strut manufacturer was discussed. Legislation was passed in one state preventing their product from being landfilled. This led the manufacturer to profitably recover the materials in its product. Finally, in some places, laws force the manufacturer to take responsibility for proper disposal. In some cases, legislation mandates that manufacturers must be willing to take back products from consumers after the products have reached the end of their lives.

Take-Back Laws in the United States

Some companies have begun to realize the potential marketing benefits of a take-back program. In the U.S., the President's Council on Sustainable Development has begun to study the idea of *Extended Product Responsibility (EPR).* Extended Product Responsibility focuses on the total life of the product, looking for ways to prevent pollution and reduce resource and energy usage through the product's life cycle.

The President's Council on Sustainable Development endorsed the general principle of EPR and said that current voluntary programs seem to be working well. It recommended the adoption of a voluntary system of EPR. Many companies, such as Compaq, Hewlett-Packard, Nortel, Frigidaire, and Xerox have adopted EPR. Also, industrywide programs have been created to recycle nickel-cadmium batteries and auto bumpers. Take-back programs in the United States are not prevalent. However, some are developing. At least 15 states have laws requiring retailers to take back vehicle batteries. Maryland passed a law requiring manufacturers and retailers to set up a system for collecting mercury oxide batteries. Advanced disposal fees (ADFs) are paid by the consumer at the time of purchase to cover the cost of disposing of the product at the end of its life. At least 22 states have ADFs on tires, many states have them on motor oil and some have them on white goods, such as appliances.

Computers

While there is currently no mandatory take-back of computers in the U.S., the U.S. is the world's leading producer and user of personal computers. The U.S. electronics industry has begun to study how to recycle electronic products , and has begun designing an ideal electronics recycling center. The U.S. EPA has begun studying the collection of end-of-life electronics components. So far, it has funded two collection pilots for residential electronic and electrical equipment.

In Japan, by the year 2000, makers of electrical devices will be required to recycle their own products. In response to this coming deadline, IBM Japan began a program to encourage customers to trade their old computers in on a new system. Depending on the age and value of the system being brought in, the customer receives a certain amount of credit. The returned computers will have their processors and hard disks upgraded, and will be returned to stores to be sold.It is estimated that in California alone, more than two million obsolete PCs are abandoned every year. Many charitable organizations have created standards for acceptable and unacceptable computers. In the words of a spokeswoman for Goodwill Industries, a large U.S. charitable organization, "We don't want your junk."

Pet recycling in INDIA by Coca-Cola india As a part of Environment Initiative and Corporate Social Responsibility, Coca-Cola India took the lead in promoting PET recycling with the objective to develop a self sustaining system of recycling post-consumer PET bottles. Coca-Cola India is playing a role of catalyst in promoting the "pulling the bottles" into recycling stream and to ensure viability of the pricing structure at each level. A sustainable value chain has been established starting from Rag Pickers to Scrap Dealers to Collection cum Grinding/Bailing centers to recyclers. The current scenario in India is that 84% of PET consumed by Beverage Industry is being recycled. The company plans to recycle 100 % PET bottles consumed by PET industry by year 2006. Company's effort on PET recycling and RWH has been appreciated by several state pollution control boards.

PET Recycling gaining momentum only because of multi pronged awareness campaign, including Posters, Kiosks, Painted truck backs, Video films, Ads in TV and Cinema halls besides Consumer education at Points of purchase.

Conclusion

Throughout Europe, there is a strong trend toward producer product take-back. In some countries, some industries are under voluntary take-back programs, in which the government and industry have agreed to targets that the industry will attempt to meet. If these targets are not met, these industries may find themselves under mandatory targets. For a reverse logistician, different challenges are present in different countries, in different industries. In some industries, the government does the collecting, such as, in the Swedish battery industry. In some cases, a network of facilities is organized and run by the industry, like the Swedish auto industry, for example. In other cases, companies are left to create their own centers. While if we see this in

Indian scenario than the industries here also do reverse logistics esp. the battery companies, the tyre companies and the MNC's like Motorola, Nokia, Xerox, HP, Dell also follow their global norms of recycling. Coca-cola India also indulges into recycling of his PET bottles and has achieved 100% recycling levels. 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. For Reverse Logistics to be successful, collaboration between the supply chain partners is very important. Technologies like bar- coding and RFID helps in making reverse logistics operations more effective and responsive. While much of the world does not yet care much about the reverse flow of product, many firms have begun to realize that reverse logistics is an important and often strategic part of their business mission. Throughout the course of this research project, many examples of large bottom-line impact were identified. There is a lot of money being made and saved by bright managers who are focused on improving the reverse logistics processes of their company. It is clear that, while sometimes derisively referred to as junk, much value can be reclaimed cost-effectively. While the efficient handling and disposition of returned product is unlikely to be the primary reason upon which a firm competes, it can make a competitive difference. In the developed countries like USA and the countries of EU, the status of reverse logistics is at fairly advance stage as companies studied are taking proactive steps to meet the regulations as well as their obligation under corporate social responsibility

Status In India

1. There are gaps in the system which allow companies to go away from implementing such practices in India scenario;
   - Legislature gaps
   - Awareness gaps
   - Company not following laws
   - The level of Corporate Social Responsibility and Extended Producer Rresponsibility are not as high as in the developed countries

Following Steps Are Suggested

1. Stringent legislation, enforcing the companies to recycle the product and packaging at the end of useful life of the product.
2. Separate laws are required for hazardous waste.
3. Social awareness campaigns need to be started so that companies compelled to follow the regulation and as well as include this in their agenda of Corporate Social Responsibility.
4. The companies should be given incentive for having environmental protection such as for ISO : 14000 certification and it should be extended to the reuse/recycle of products and packages after the use full life.
5. Industries Associations need to take a lead to make the companies aware of reuse/recycle for better utility of resources.
6. Companies specialists in recycling the products should be step up as we have in USA, which only look after the end of the life products, so that the present companies could outsource this task to them.

References

1. Olaf Schatteman, *"Journal of Business Logistics",* vol. 20, 2005

2. Edward . J. Marien, “Reverse logistics as an competitive strategy”.
3. Margarete Seitz, “Reverse Logistics and Remanufacturing in the Automotive Sector”
4. Harold Krikke, “Partnerships in reverse logistics: OR-model building in view of practical developments”
5. Marisa P. de Brito and Rommert Dekker, “A Framework for Reverse Logistics”
6. David Diener, Eric Peltz, “Value Recovery from the Reverse Logistics Pipeline”, Rand Corporation 2004
7. Frank Schultmann, Bernd Engels, “Closed loop supply chains for spent batteries”, Nov-Dec 2003, INFORM
8. Alicia Culver, “Return to vendor: A solution to obsolete computer equipment, 2000, INFORM
9. Bette K. Fishbein, “EPR: What does it mean? Where is it headed? P2: *Pollution Prevention Review”*, pp. 43-55, Volume 8, 1998 John Wiley & Sons, Inc.
10. Eric Marks, “EPR: What does it mean? Where is it headed?,” Nov 2006, Managing Automation
11. T. Bartel. Recycling program for toner cartridges and optical photoconductors. In Proceedings IEEE *Symposium on Electronics and the Environment,* pages 225–228, Orlando,Florida, 1995.
12. P. Beullens, L. N. van Wassenhove, and D. van Oudheusden. Collection and vehicle routing issues in reverse logistics. In R. Dekker, K. Inderfurth, L. van Wassenhove, and M. Fleischmann, editors, *Quantitative Approaches to Reverse Logistics,* chapter 5. Springer, 2003.
13. G.H. Brundland. European union and the environment, 1998. Luxemburg.
14. C. R. Carter and L. M. Ellram. Reverse logistics: A review of the literature and framework for future investigation. *International Journal of Business Logistics,* 19(1):85–102, 1998.
15. M. P. De Brito, S. D. P. Flapper, and R. Dekker. *Reverse logistics: a review of case studies Report Series Research in Management ERS*-2003-012-LIS, Erasmus University Rotterdam,the Netherlands, 2003.
16. M. B. M. De Koster, M. P. de Brito, and M. A. van Vendel. How to organise return handling: an exploratory study with nine retailer warehouses. *International Journal of Retail and Distribution Management,* 30:407–421, 2002.
17. R. Dekker, K. Inderfurth, L. van Wassenhove, and M. Fleischmann. *Quantitative Approaches for reverse logistics.* Springer-Verlag, Berlin, 2003. forthcoming.
18. N. Ferguson and J. Browne. Issues in end-of-life product recovery and reverse logistics *Production Planning & Control,* 12(5):534–547, 2001.