# Recycling and Reverse Logistics

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*A key element in government efforts to increase recycling has been the development of government based curbside recycling programs. However, this supply based approach to recycling may disrupt the market equilibrium, with potential negative long term consequences. A demand based system may work more efficiently to ensure the long term success of recycling. This paper discusses the idea of recycling as a part of reverse logistics, and suggests how governmental intervention on the demand side may help encourage the development of recycling in the context of a reverse logistics system where supply and demand are more closely aligned.*

## INTRODUCTION

An area of increasing concern, both locally and globally, is the potential negative environmental consequences of waste disposal. Improper waste disposal may result in environmental damage, as well as other unintended consequences. Optimally, U.S. corporations should be encouraged to pursue economic, market-environmental and social goals concurrently (Dover et al. 1997) through structural transformation and effective governance (Gautam, Bansal, and Pandey 2005; Weaver, Rock, and Kusterer 1997). However, corporate governance tends to focus primarily on maximizing shareholder wealth. To the extent that environmental goals are incompatible with maximizing shareholder wealth, it is unlikely that environmental goals will be pursued. However, corporations may pursue environmentally friendly goals if consumers reward such efforts or if governmental entities provide an incentive system which serves to encourage behavior which has a positive impact on the environment.

Researchers have investigated numerous possible strategies aimed at preserving the environment and their impact on consumer behavior (e.g., Dwyer, Leeming, Cobern, Potter, and Jackson 1993). One of the more widely studied areas of environmental preservation has been recycling. Fears of a potential shortage of landfill space in the late 1980's in the United States (Loupe 1990), rising costs of landfill operation due to new regulations, and increasing citizen opposition to opening new landfills all had intensified public interest in promoting recycling in the early 1990's (Consumer Reports, 1994).

In terms of energy and raw material usage, there are several advantages associated with recycling. For instance, creating new aluminum from recycled aluminum requires 90% less energy than producing aluminum from ore. Plastic, newspapers, and glass all require less energy when produced from recycled materials (Frosch and Gallopoulos 1989; Consumers Reports 1994). Production of paper from recycled paper sources also reduces the need for wood products. Similarly, usage of recycled plastic reduces the need for petroleum.

While much effort has focused on encouraging consumer recycling through methods such as curbside recycling pickup, little attention has been given to the best methods to develop overall recycling channels. Traditional marketing channels ensure that products flow from producers to consumers in an efficient manner. The marketplace ensures this efficiency through consumer response to various channel efforts via purchasing behavior. Channel members are rewarded for their participation in the process by receiving a percentage of the end price paid by the consumer. Currently, the consumers who "produce" materials which can be recycled through their consumption activities often receive no payment for placing recyclables in the channel. Similarly, many government entities actually lose money on their efforts to serve as a part of the channel for recycling. Therefore, it may be necessary to rethink the way recycling channels should be developed.

The goal of this manuscript is to examine issues related to reverse logistics and recycling and to suggest governmental based strategies which may best encourage broader based development of logistics systems for controlling reverse bound flows of recycled materials. Logistics systems of this nature should provide additional incentives for consumers to recycle and thus, encourage individuals to engage in more environmentally friendly behavior. Such systems should also recognize and incorporate the environmental costs of not recycling into costs of disposal for non-recycled items.

## REVERSE LOGISTICS AND RECYCLING CHANNELS

An important, but often overlooked, consideration in understanding recycling is understanding the flow of disposed materials. Traditional supply chains use resources derived from the environment, transform such resources to a useable product, and end once the good is distributed to consumers (Geyer and Jackson 2004). Recyclables, however, follow "reverse distribution channels" (Zikmund and Stanton 1971) requiring reverse logistics strategies rather than the use of traditional distribution channels and logistics. The Council of Logistics Management has defined reverse logistics as referring to the "…role of logistics in product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal, and refurbishing, repair and remanufacturing…" (Stock 1998, p. 2). Reverse logistics requires an integrated approach to succeed (Bernon and Cullen, 2007.). As implied by the definition, reverse logistics activities come in different forms. A list of potential reverse logistics activities is reported by Rogers and Tibben-Lembke (1999, p.10) where the activities are categorized as being related to the product itself and/or to the package in which the product comes (See Table 1).

Researchers have broken logistical activities down into an interaction between traditional forward material flows and new reverse material flows (Fleischmann et al. 1997). These reverse flows have been termed both green logistics and reverse logistics (Bowman 1995), as well as closed loop supply chains, industrial ecology, and life-cycle assessment (LCA) (Geyer and Jackson 2004). The goal of these activities is to recapture waste and unwanted/unusable product. Such logistics systems may generate cost savings for companies (Schwartz 2000, Shear 1997). Design of such systems may be challenging (Lee and Dong, 2008). Corporations may seek to monitor byproducts, residuals and products themselves and channel them into proper network positions for reuse, resale, remanufacturing, recycling or disposal (Johnson 1998). Such decisions are typically influenced by customers, employees, and the government (Alvarez-Gil, Berrone, Husillos, and Lado, 2007), and frequently are championed within a corporation by a key stakeholder (Kumar and Putnam, 2008). Corporations may also seek to initially develop new products which are more easily re-used (Gehin, Zwolinski, and Brissaud, 2008).

Recycling is referred to as the removal of materials from a disposed product or package so that they can be utilized as raw materials for a new product or package. A major concern is that the entire product and/or package will be sent to a landfill, if no recycling is involved. In particular, because the value of an empty soda bottle or used newspaper is frequently not obvious to either consumers or manufacturers, the incentive to recycle may be quite low. Value would accrue to such residual "product" only as a potential raw material input for a new product. In order for recyclables to have value as a potential new raw material, both supply and demand for the material have to be developed. This is where the idea of reverse logistics is of paramount importance.

**TABLE 1**
**COMMON REVERSE LOGISTICS ACTIVITIES**

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

Source: Rogers and Tibben-Lembke (1999, p.10)

Reverse logistics start where traditional supply chains end. Consumers initially purchase an end good such as a newspaper or a soft drink. Once the newspaper is read, or the soft drink consumed, traditionally, the useful life of the product is ended. Consumers then face the decision of how to properly dispose of any waste materials (Jacoby, Berning, and Dietvorst 1977; Olshavsky 1985). Disposal decisions by consumers after using a product can have a potentially significant long term impact on the environment. Such decisions may be impacted by multiple influences, such as convenience of types of disposal, promotional activities advocating at type of disposal method, or financial incentives**.**

## REVERSE "GREEN" LOGISTICS

A related definition of reverse logistics emphasizes both the focus of reverse logistics on the backward flow of materials from customer to supplier and the goals of maximizing value from the returned item or assuring its proper disposal (Rogers and Tibben-Lembke 1999). Industrial ecology and life cycle assessment (Green logistics) encompass the environmental side and have been employed to increase recycling behavior and reduce landfill waste (Brockmann 1999, Geyer and Jackson 2004). Both focus on removing unwanted products and byproducts from the waste disposal market. Reverse logistics and closed-loop supply chains are more concerned with the profitability of such strategies (Geyer and Jackson 2004). In addition to attempting to reduce environmental harm (green logistics), and develop social sustainability (Sakris, Helms and Hervani, 2010), companies are also exploring opportunities to recover value in reverse logistics, (Klausner and Hendrickson 2000, Autry, Daugherty and Richey 2000).

If there is no economic value in reverse logistics, it will be much more difficult to induce companies to participate. From an economic standpoint, provision for and promotion of recycling by governmental entities is often not economically rational, if no economic value is placed on potential environmental damage accruing due to other methods of disposal. In fact, depending on market factors during given time periods, the cost of collection may outweigh the value of the material collected.

A study by Waste Management Of North America, Inc., found that the company received an average of $40 per ton for recyclables collected in curbside programs, but spent an average of $175 per ton to pick up and sort the materials (Grove 1994). When costs outweigh the value of the goods received, subsidies must be provided by governmental entities to maintain recycling. However, subsidies of curbside collection programs typically serve to induce an oversupply of recyclable materials. Curbside recycling programs may therefore serve to increase the quantity of recyclable material supplied above the market-clearing amount. In line with economic theory, as more recycling of materials by consumers occurs, the value of recyclables declines. Therefore, the price paid by those attempting to acquire such raw materials in the marketplace declines. For example, newsprint prices in Seattle WA dropped from $75 per ton before large scale recycling was instituted, to $30 per ton three years later. Likewise, the value of green glass had dropped to zero by 1993, and glass gathered on recycling routes had to be stockpiled. Moreover, waste paper sold for $25 per ton in Seattle before widespread recycling efforts in the U.S. and Germany dramatically increased the supply of waste paper. By 1993, collectors in Seattle had to pay $25 per ton to dispose of waste paper (Richards, 1993). Likewise, rising costs forced New York City to suspend its plastic and glass recycling program when bids from waste haulers rose from $50-$60 per ton in 2002 to a projected $100 per ton in 2003 (Friedman 2004).

The increased supply and corresponding depression of prices may lead to recycling operations losing even more money, thus requiring even higher government subsidies. The cycle will continue until collection flow matches demand. If governments stop subsidizing collections, additional waste will be diverted into either alternative reverse logistics channels or into landfills. Disposal in landfills may be cheaper in the short term, but may lead to higher long term costs. Ultimately, governmental intervention in terms of providing a channel and promotion for recycling may not be the most effective method of encouraging reverse logistics. For example, despite widespread availability of neighborhood recycling in the United States, recycling rates for beverage cans and bottles by 2004 had fallen to the lowest level since the mid-1990’s (Watson 2004).

## REVERSE DISTRIBUTION CHANNEL ISSUES

In an efficient market economy, market prices for recyclables would be based on demand, and would thus affect the supply of recyclables. During periods of high demand, prices would rise to the point that many for-profit organizations would offer economic incentives to providers of recyclables in order to gain a supply of recyclables. However, during periods of low demand, lower prices paid for recyclables would also lower the supply of recyclables. In either situation, market prices would reflect levels of supply and demand. However, the ebb and flow of supply and demand might wreck havoc on attempts by companies to develop an ongoing reverse logistics strategy.

In contrast, with government subsidized recycling channels such as curbside collection, relationships among variables may be dramatically altered. Government recycling collections create a situation where the supply of recyclables tends to be relatively constant, with no adjustment for changes in demand for materials. Consumers place their recycling materials out for collection regularly, as with other waste materials, regardless of the market price for such materials. Thus, during times of oversupply when prices are low, large quantities of excess materials would exist. The materials would either have to be stored, or combined with the other trash. Storage would be a problem with items such as newspapers, which degrade very quickly when exposed to weather, thus reducing the value of newspaper as a raw material to virtually nothing. The costs of a storage facility, along with the cost of financial assets tied up in recyclable inventory would reduce the profitability of such an operation.

If both consumers and producers disregard any potential environmental costs of disposal of goods after the traditional useful life is concluded, consumers may dispose of goods in a manner which may result in environmental costs on a large scale (Geyer and Jackson 2004). A supply loop which collects products after their useful life for their economic value as raw materials for other products may divert a substantial amount of material from landfills and/or incineration (Geyer and Jackson 2004). Optimal design of such a system network is currently an area of intense study (Kara and Onut, 2010) Regardless of how it is designed, such a system requires waste products to have some value. Following the basic economic principles of supply and demand, in order for waste materials to possess value, demand for the materials must exist. Thus, products must be produced which require the waste materials as inputs for producing new materials. In reverse logistics channels and recycling, manufacturers and jobbers are the reverse flow customers of recycled materials collectors. Initial consumers and downstream partners become input suppliers for manufacturers. Consumers and downstream partners must have some incentive to provide this product to the reverse logistics supply chain, or they will undertake the easiest and quickest method of disposal. Consumer collaboration in such an endeavor is critical to its success. Excellent customer service is imperative for success (de valle, Menezes, Reis, and Rebelo, 2009). The resultant reverse logistics supply chain must result in value creation for the ultimate consumer of goods manufactured with the recycled materials.

## GOVERNMENTAL INFLUENCE IN RECYCLING CHANNELS-SUPPLY SIDE LOGISTICS

To a large extent, governmental entities have assumed the role of middlemen in the distribution process involving recyclables. Governmental entities have developed a number of marketing strategies to encourage consumers to recycle materials. Two key areas of emphasis have been the provision of curbside pick-up of recyclables and implementation of widespread promotional campaigns. Location of collection centers is a critical determinant of recycling behavior (Aras and Aksen, 2008), thus curbside recycling should significantly increase recycling behavior. In the year 2002, 8,875 curbside recycling programs were offered in the United States alone (Watson 2004). Implementation of curbside recycling pick-up has been shown to generate significant increases in recycling behavior of consumers (e.g., Reid, Luyben, Rawers, and Bailey 1976; Jacobs, Bailey, and Crews, 1984; Spaccarelli, Zolik and Jason 1989-90; Folz and Hazlett 1991; Vining and Ebreo 1992; Derksen and Gartrell 1993; Reschovsky and Stone 1994). However, while curbside recycling offered by communities reduces the effort necessary for consumers to recycle, in and of itself it does not necessarily encourage recycling behavior. Because consumers typically gain no direct financial reward from recycling, and pay no direct cost related to potential environmental damage, consumer recycling behavior may be a function of other factors, rather than financial factors. Consumers may become bored, or find recycling inconvenient, and reduce levels of recycling. For example, recycling volume in Seattle by residents of single family homes fell by 3% from 1995 to 2001 (Watson 2004).

Promotional efforts are widely used by governmental agencies to promote recycling, although they have not proven to be consistently effective. While some researchers have found positive effects of promotional campaigns of recycling behavior (e.g., Reid, et al. 1976; Jacobs, et al. 1984; McGuire 1984; Burn and Oskamp 1986; Spaccarelli, et al. 1989), others have not found such efforts to be effective (e.g., Humphrey, Bord, Hammond and Mann 1977; Kok and Siero 1985; DeYoung 1988-89; Vining and Ebreo 1992; Folz and Hazlett 1991; Howenstine 1993; Reschovsky and Stone 1994).

Typically, financial incentives are not offered by governmental entities as part of their strategy in promoting recycling, although researchers have reported that these incentives often have the strongest effect on recycling behavior (e.g., Geller, Chaffee, and Ingram 1975; Witmer and Geller 1976; Hamad, Cooper, and Semb 1977; Diamond and Loewy 1991, DeYoung 1993; Howenstine 1993). In contrast, financial incentives are typically provided by for profit collectors of recyclables.

## IMPACT OF GOVERNMENTAL INTERVENTION

As discussed earlier, municipalities and governmental agencies have provided widespread promotion and curbside recycling services to promote increased recycling. However, it is not clear that such entities have closely examined the potential effects of such a strategy on recycling. Such marketing activities decrease the cost to customers of recycling by minimizing effort required, while attempting to develop a social norm whereby recycling is a behavior which is perceived as a positive good for the environment. The perceived value of recycling is thereby increased by promotional activities, and the perceived cost of recycling by consumers is decreased by return convenience. Thus, the normal functioning of the marketplace is influenced by government interventions that may cause disruptions in the marketplace for recyclable materials.

However, some governmental intervention may be necessary. Market conditions may be weak motivators for both consumers and corporations. This is especially true to the extent that environmental costs are not included in the market, which has typically been the case. Not developing effective reverse logistics may destroy opportunities for networks to develop reusable items through remanufacturing and recycling vectors leading to asset recovery (Fleischmann et al 2000).

## FIRM BASED LOGISTICS

Firms may seek to develop reverse logistics due to a sense of environmental responsibility. Environmental responsibility goes beyond the traditional drive for opportunistic profits (Andel 1997). Environmental responsibility means developing strategies that protect the environment. Effective reverse logistics programs are environmentally responsible due to the proper storage, collection, disposal, and repair of products as well as the continuous improvement approach of minimizing waste, developing green products, and reusing packaging and pallets (Blumberg 1999). Such programs protect ecosystems that encompass the external environment are often overlooked in traditional discussions of strategic planning and analysis (Fuller 1999). Environmental responsibility has been shown to enhance firm relationships without affecting performance regardless of firm size (Miles et al. 2000). Developing an effective reverse logistics program may be the key to enhancing performance as well as relationships (Daugherty, Myers, and Richey 2000). Social irresponsibility is driven by opportunistic strategic approaches to emerging and existing markets. Such strategies are associated with negative externalities that are often positive in the short-term and negative in the long-term (Harvey and Myers, 2001). While dumping toxic metals into landfills may be much cheaper for a firm in the short term, such behavior may result in extremely costly long term negative consequences to people living near such a landfill.

Traditional supply chains focus on input control or demand side management (Dover et al. 1997; Pp. 327-8). These systems/programs often make limited attempts to reclaim waste and unwanted products. Often, the approach is to factor an allowance into the pricing structure, thus paying to dispose of the waste and unwanted products. If products are disposed of in an environmentally irresponsible way that allows firms to maximize profits, there is little doubt that environmental irresponsibility will be the norm. The absence of after-market support and rework/remanufacturing/recycling operations may damage brand or corporate image.

## NECESSITY FOR GOVERNMENTAL INTERVENTION

While the preceding discussion has demonstrated how corporations implementing reverse logistics systems might be environmentally responsible without decreasing firm financial performance, many corporations remain focused solely on maximizing profits without considering externalities. But while the cost savings to the aluminum industry from recycling makes the development of reverse distribution channels cost effective, this situation does not occur in all industries. To the extent that developing reverse distribution channels is not cost effective, firms will typically not develop such systems without governmental intervention. As Diamond (2005, p. 483) notes, “It is easy and cheap for the rest of us to blame a business for helping itself by hurting other people. But that blaming alone is unlikely to produce change. It ignores the fact that businesses are not non-profit charities, but profit-making companies, and that publicly owned companies with shareholders are under obligation to those shareholders to maximize profits, as long as they do so by legal means."

## DEVELOPMENT OF REVERSE DISTRIBUTION CHANNELS

Where the costs of recycling are less than the value of the materials recycled, the marketplace itself will develop effective and efficient reverse distribution channels. Where the materials to be recycled have little or no value, governmental intervention will be necessary in terms of laws requiring recycling, or subsidies for recycling.

Because economic factors have substantial effects on supply of recyclables (e.g., McGuire 1984, Folz and Hazlett 1991) use of government intervention to help develop free market mechanisms would lead to more efficient coordination of supply and demand. While the net effect of governmental entities spending vast amounts of time and energy on promoting and implementing curbside recycling programs may, in fact, cause discontinuities in the efficient workings of the recycling marketplace, government efforts to increase the value of recyclable materials may induce entrepreneurs to develop reverse distribution channels which effectively and efficiently decrease the amount of waste materials placed into landfills.

With extensive governmental support on the demand, rather than the supply side, the recycling market could operate more freely. As the government increases demand for recyclables, the marketplace would ensure that prices for recyclables would rise. This rising price would make it economically feasible for private organizations to develop channels to collect recyclables. Private organizations could then develop a system of financial incentives for consumers or local governments to encourage recycling. Promotional activities could be increased when prices for certain recyclables were high, and decreased when prices declined. Such incentives would induce consumers to deliver their recyclables to collectors, or induce local governments to form collection systems in order to generate revenue. Thus, the demand would determine supply of recyclables, instead of supply operating independently of demand. High prices for recyclables would "create" a supply of recyclables (Stipp 1994).

The first step in development of an incentive based system to induce recycling is to determine the value of recycling (or, alternatively, the cost of waste disposal in landfills). While landfills may have long term environmental costs, the actual operational costs are typically much less than a recycling operation. A cost of environmental degradation needs to be determined for items that are not currently recycled, but which could be recycled. Governments can then impose this cost on the purchase of such a product. This will allow consumers to make an informed choice between two items, based on total costs. Such a pricing mechanism would allow proper functioning of the marketplace.

This "waste disposal fee" for producers of all products which are not recycled would generate funds which could be used to provide a monetary incentive to recycle those products that can be recycled, and to focus on developing products which are recyclable. Currently, non-recyclable products may have a cost advantage over recyclables. However, a tax on non-recycled product waste would effectively eliminate the cost advantage accruing to manufacturers who were, in the long term, contributing to environmental degradation. This would allow the previously more expensive recyclables to compete in the marketplace.

As an example, assume a manufacturer can produce a beverage in an aluminum can, or in a non-recyclable container. While using the aluminum container might initially be more costly, if a waste disposable fee was required for each non-recyclable container, the aluminum container would become a cheaper alternative. Such as system would therefore encourage producers to use product containers which were recyclable. As use of such containers grows, the demand for the empty recyclable containers would increase. This would then create an efficient reverse distribution system.

Such a system could be facilitated by using the current bar coding system to keep track of disposal of containers. Using information from production, disposal, and recycling of such containers would enable government entities to determine proper waste disposal fees. This would also allow tracking of a product throughout the current distribution system, as well as back through the reverse distribution system.

In addition to this disposal fee, another option for encouraging recycling would be development of a system of environmental credits, which could be traded in the open marketplace. Entities which have products which are very difficult to recycle could buy credits for recycling from firms which specialize in recycling. This would make recycling a valuable commodity in and of itself, thus encouraging reverse distribution channels to be developed.

The goal of effective reverse/green logistics programs is sustainable development through ecological protection. If the protection of the environment has a large value to consumers, that value must then be reflected in the products consumers choose. A product choice favoring products which are recyclable and/or reusable will encourage the production of such products. However, the value (cost) of environmental impact of products must be included in the initial purchase price. Otherwise, the economic value of developing reverse distribution chains will be minimal. With a waste disposal fee incorporated into the price of new products, recyclable materials gain value relative to non-recyclable containers and packaging. This increased value of recyclables would lead to the development of an efficient reverse logistics channel in the marketplace. As an example, the innate value of aluminum cans has led to the development of numerous channels for reverse distribution of aluminum cans. One almost never sees aluminum cans "laying around" for any length of time, as the reverse logistics channel insures they will be collected and turned in for cash.

## CONCLUSION

Governmental entities have encouraged increased recycling through marketing efforts concentrated on promotional and distribution factors. In terms of distribution, governments have set up curbside recycling collection routes to facilitate recycling by consumers. However, these efforts have proven quite costly. Such efforts might even be counterproductive to the long-range goal of reducing waste and saving energy. Such efforts might discourage the free market for-profit recyclers and the network supporting those firms, as well as upsetting the balance of supply and demand.

Governmental entities might better encourage development of reverse logistics channels by developing a system of financial incentives or penalties to increase demand for recyclables. Such strategies might result in development of more efficient reverse logistics channels, with less cost to the government, while also reducing environmental degradation which might occur due to improper disposal of waste.

## REFERENCES

Alvarex-Gil, M. J, Berrone, P, Jusillos, F. J. & Lado, N. (2007). Reverse logistics, stakeholders' influence, organizational slack, and managers' posture. *Journal of Business Research,* 60, 463-479.

Andel, T. (1997). Reverse logistics second chance for profit: Whether through refurbishment or recycling, companies are finding profit in return products. *Transportation and Distribution*, 38(7), 61-6.

Aras, N. & Aksen, D. (2008). Locating collection centers for distance and incentive dependent returns. *International Journal of Production Economics*, 111, p. 316-333.

Autry, C. W., Daugherty, P. J., & Richey, R.G. (2001). The challenge of reverse logistics: Electronics catalog retailing. *The International Journal of Physical Distribution and Logistics Management,* 31 (1), 26-37.

Bernon, M. & Cullen, J. (2007). An integrated approach to managing reverse logistics. *International Journal of Logistics: Research and Applications*, 10, (1), p. 41-56.

Blumberg, D. F. (1999). Strategic examination of reverse logistics and repair service requirements, needs, market size, and opportunities. *Journal of Business Logistics*, 20 (2), 141-59.

Bowman, R. J. (1995). Green logistics. *Distribution,* 94 (6), 48-52.

Brockman, T. (1999). 21 warehouse trends in the 21st century. *IIE Solutions*, 31 (7), 36-40.

Burn, S. M. & Oskamp, S. (1986). Increasing community recycling with persuasive communication and public commitment. *Journal of Applied Social Psychology*, 16 (1), 29-41.

*Consumer Reports* (1994). Recycling: Is it worth the effort?, 59 (2), 92-8.

Collier, J. B. (2000). Recycling in Middle East and North Africa. *Environment Matters, Annual Review*, 46-9.

Daugherty, P. J., Myers, M. B., & Richey, R.G., (2002). Information support for reverse logistics: The influence of relationship commitment. *Journal of Business Logistics*, 23 (1), 85-106.

Derksen, L. and Gartrell, J. (1993). The social context of recycling. *American Sociological Review*, 58 (3), 434-42.

DeYoung, R. (1988-89). Exploring the difference between recyclers and non-recyclers: The role of information. *Journal of Environmental Systems*, 18 (4), 341-51.

____, (1993). Changing behavior and making it stick: The conceptualization and management of conservation behavior. *Environment and Behavior*, 25 (4), 485-505.

Diamond, J. (2005). *Collapse: How Societies Choose to Fail or Succeed.* Viking (Penguin Group), New York, New York.

Diamond, W. D. & Loewy, B. Z. (1991). Effects of probabilistic rewards on recycling attitudes and behavior. *Journal of Applied Social Psychology*, 21 (19), 1590-607.

doValle, P, Menezes, J., Reis, E. & Rebelo, E. (2009). Reverse logisitcs for recycling: The customer service. *International Journal of Business Science and Applied Management,* Vol 4, (1), 1-17.

Dover, R, Ditz, D. Feath, P., Johnson, N., Kazloff, K., MacKenzie, J. J. (1997). *Frontiers of Sustainability: Environmentally Sound Agriculture, Forestry, Transportation and Power Production*. Washington D.C.: Island Press.

Dowlatshahi, S. (2000). Developing a theory of reverse logistics. *Interfaces*, 30 (3): 143-55.

Dwyer, W. O., Leeming, F., Cobern, M. K., Porter, B .E., & Jackson, J. M. (1993). Critical review of behavioral interventions to preserve the environment: Research since 1980. *Environment and Behavior*, 25 (3), 275-321.

Fleischmann, M., Bloemhof-Ruwaard, J. M., Dekker, R., van der Laan, E., Van Nunen, J. A. E. E., &. Van Wassenhove, L. N. (1997). Quantitative models for reverse logistics: A review," *European Journal of Operations Research*, 103 (1), 1-17.

____, Krikke, H. R., Dekker, R. & Flapper, S. D. P. (2000). A characterization of logistics networks for product recovery. *Omega,* 28 (6), 1-14.

Folz, D. H., & Hazlett, J. M. (1991). Public participation and recycling performance: Explaining program success. *Public Administration Review*, 51(6), 526-32.

Friedman, A. (2003). Recycling redux," *Planning*, 69 (10), 4-9.

Frosch, R. A., and Gallopoulos, N. E. (1989). Strategies for manufacturing. *Scientific American*, 261 (3), 144-52.

Fuller, D. A. (1999). *Sustainable marketing: Managerial-ecological issues*. London: Sage Publications.

Gautam, S. P., Bansal, Y. K, & Pandey, A. K. (2005). *Biological Diversity : Current Trends*: 1st ed., New Delhi, Shree Publishers & Distributors.

Gehin, A., Zwolinski, D., and Brissaud, D. (2008). A tool to implement sustainable end of life strategies in the product development phase. *Journal of Cleaner Production*, 16, 566-576.

Geller, E. S., Chaffee, J. L, &. Ingram, R. E. (1975). Promoting paper recycling on a university campus. *Journal of Environmental Systems*, 5, 39-57.

Geyer, R., & Jackson, T. (2004). Supply loops and their constraints: The industrial ecology of recycling and reuse. *California Management Review,* 46 (2), 55-73.

Grove, N. (1994). Recycling. *National Geographic*, 186 (1), 92-115.

Hamad, C. D., Cooper, D., & Semb, G. (1977). Resource recovery: Use of a group contingency to increase paper recycling in an elementary school. *Journal of Applied Psychology,* 62 (6), 768-72.

Howenstine, E. (1993). Market segmentation for recycling. *Environment and Behavior,* 25 (1), 86-102.

Humphrey, C. R., Bord, R. J., Hammond, M. M., & Mann, S. H. (1977). Attitudes and conditions for cooperation in a paper recycling program. *Environment and Behavior,* 9 (March), 107-24.

Jacobs, H. E., Bailey, J. S., & Crews, J. I. (1984). Development and analysis of a community based resource recovery program. *Journal of Applied Behavioral Analysis*, 17 (Summer), 127-45.

Jacoby, J., Berning, C. K., & Dietvorst, T. F. (1977). What about disposition? *Journal of Marketing*, 41 (2), 22-8.

Johnson, P. F. (1998). Managing value in reverse logistics systems. *Transportation Research Part E: Logistics and Transportation Review*, 34 (3), 217-27.

Kara, S. S. & Onut, S. (2010). A two-stage stochastic and robust programming approach to strategic planning of a reverse supply network: The case of paper recycling. *Expert Systems and Applications,* doi:10.1016/j.eswa.201002.116, p. 1-9.

Klausner, M. & Hendrickson, C. T. (2000). Reverse-logistics strategy for product take-back. *Interfaces,* 30 (3), 156-65.

Kok, G., & Siero S. (1985). Tin recycling: Awareness, comprehension, attitude, intention and behavior. *Journal of Economic Psychology*, 6 (2), 157-73.

Kumar, S. & Putnam, V. (2008). Cradle to cradle: Reverse logistics strategies and opportunities across three industry sectors. *International Journal of Production Economics*, 115, 305-315.

Lee, D. & Dong, M. (2009). Dynamic network design for reverse logistics operations under uncertainty. *Transportation Research Part E,* 45, p. 61-71.

Loupe, D. E. (1990). To rot or not. *Science News*, 138 (October 6), 218.

McGuire, R. H. (1984). Recycling: Great expectations and garbage outcomes. *American Behavioral Scientist*, 28 (1), 93-114.

Miles, M. P., Covin, J. C., & Heeley, M. B. (2000). The relationship between environmental dynamism and small firm structure, strategy and performance. *Journal of Marketing Theory and Practice*, 8 (2), 63-74.

Olshavsky, R. W. (1985). Toward a more comprehensive theory of choice; in *Advances in Consumer Research*, Elizabeth C. Hirschman and Morris Holbrook, eds., Vol. 12, 465-70.

Reschovsky, J. D.& Stone, S. E. (1994). Market incentives to encourage household waste recycling: Paying for what you throw away. *Journal of Policy Analysis and Management*, 13 (1), 120-39.

Reid, D. H., Luyben, P. D., Rawers, R .J., & Bailey, J .S. (1976). Newspaper recycling behavior: The effects of prompting and proximity of containers. *Environment and Behavior*, 8 (September), 471-82.

Richey, R. G., Daugherty, P. J., Genchev, S. E., &. Autry, C. W. (2005). Reverse logistics: Strategic program timing. *Journal of Business Logistics*, 25 (2), 229-250.

Richards, B. (1993). Recycling in Seattle sets national standard but is hitting snags. *The Wall Street Journal*, 74 (204), (August 3), A1-A4.

Rogers, D. S. and Tibben-Lembke, R. S. (1999). *Going Backwards: Reverse Logistics Trends and Practices.* University of Nevada, Reno: Reverse Logistics Executive Council.

Sarkis, J., Helms, M., & Hervani, A. (2010). Reverse logistics and social sustainability. *Corporate Social Responsibility and Environmental Management*, DOI:110.1002/CSI.220.

Schwartz, B. (2000). Reverse logistics strengthens supply chains. *Transportation and Distribution,* 21 (5), 95-101.

Shear, H. (1997). Reverse logistics: An issue of bottom line performance. *Chain Store Age Executive with Shopping Center Age,* 73 (1), 224.

Spaccarelli, S., Zolik, E., & Jason, L. A. (1989). Effects of verbal prompting and block characteristics on participation in curbside newspaper recycling. *Journal of Environmental Systems,* 19, 45-57.

Stipp, D. (1994). Cities couldn't give away their trash; Now they get top dollar from recyclers. *Wall Street Journal*, 224 (55), (September 19), p. B1-B6.

Stock, J. R. (1998). *Development and Implementation of Reverse Logistics Programs*, Oakbrook, IL: Council of Logistics Management.

Tibben-Lembke, R. S. (1998). The Impact of reverse logistics on the total cost of ownership. *Journal of Marketing Theory and Practice*, 6 (4), 51-60.

Vining, J. & Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *Journal of Applied Social Psychology*, 22 (20), 1580-607.

Watson, T. (2004). Recycling efforts dropping off. *USA Today*, (July 7), 3A.

Weaver, J. H., Rock, M. T., & Kusterer, K. (1997). *Achieving Broad-Based Sustainable Development*, West Hartford, Connecticut: Kumerian Press.

Witmer, J. F., & Geller, E. S. (1976). Facilitating paper recycling: Effects of prompts, raffles, and contests. *Journal of Applied Behavior Analysis*, 9 (Fall), 315-22.

Zikmund, W. G.. & Stanton, W. J. (1971). Recycling solid wastes: A channels-of-distribution problem. *Journal of Marketing*, 35 (3), 34-9.