

Missing Link in Sustainable Supply Chains: Reverse Logistics

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Abstract

With constantly greater competition and an unrelenting business environment marked by high raw material and fuel prices, businesses are searching for a way to gain competitive advantages in a fierce global market. Two topics that are becoming catch phrases these days are global corporate citizenship and sustainability. In this thesis, we focus on businesses involving supply chains; systems of organization for the activities involved in moving a product from supplier to consumer. For many supply chains, returns and unsold merchandise fall into the category of operations referred to as “reverse logistics.” After researching past and present supply chain practices, we show that sustainability and green supply chains is an area of growing interest but special attention to green reverse logistics is rarely observed. Green reverse logistics emerges as an area of future business attention and academic research.

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Global Corporate Citizenship

Compared to a decade ago, practicing good global corporate citizenship is now a priority for countless businesses across all industries. It is considered extremely important for companies to be good corporate citizens, and business leaders consider it critical for their company to engage with shareholders, the communities which surround their businesses, and others affected by and interested in what they do.¹ According to Klaus Schwab, Executive Chair of the World Economic Forum, global corporate citizenship is the “conviction that companies not only must be engaged with their stakeholders but are themselves stakeholders alongside governments and civil society”.² The idea commits international business leaders to sustainable development and addressing paramount global challenges such as climate change, public health care, energy conservation, and the management of scarce resources such as water. In addition to impacting the lives of global citizens, these issues increasingly affect businesses as well, and ignoring them may hurt a company’s bottom line. Because good global corporate

¹ Schwab, Klaus. “Global Corporate Citizenship”. Foreign Affairs Magazine. January/February 2008. www.foreignaffairs.com.

² Schwab, Klaus. “Global Corporate Citizenship”. Foreign Affairs Magazine. January/February 2008. www.foreignaffairs.com.

citizenship is in any company's best interest, it is a sustainable idea and will continue to have great influence in addressing global issues as well as business practices.

One of the ways the increasing emphasis on global corporate citizenship has manifested itself in the business world is through various green initiatives. These often include specific goals that a corporation vows to attain in a specific time frame, and range from lowering office energy consumption to increased operations efficiency to recycling as part of waste management.³ Top managers are paying increased attention to these issues not only because of their social impact and outcomes, but because they often result in many other advantages such as reducing the company's carbon footprint resulting in cost savings along multiple dimensions.⁴

Due to the constant pressure on companies to reduce cost and maintain a competitive advantage in the market as well as the recent economic recession, and with ever-increasing energy prices, managers are starting to use global corporate citizenship and green initiatives to lower their business costs and thus help out their struggling bottom line. Many companies, such as Clorox, Johnson & Johnson and Toyota have publicly set energy reduction goals, while others such as Procter & Gamble intend to reduce the energy intensity of their supply chains. Companies are attracted to these initiatives because they translate directly to dollar savings,

³ Urlaub, Julie. "8 Green Business Initiatives for 2011". Jan 11 2010. Sustainability: Business, Life, Environment. Taiga Company. blog.taigacompany.com.

⁴ Baier, Paul. "Why Energy Reduction Goals are Moving up the Corporate Agenda". Mar 15 2011. ClimateBiz. www.greenbiz.com.

which make them easier to implement and usually benefit the business financially in the long run.⁵

Another benefit of taking action to become a greener company is an improved brand or company image.⁶ Becoming environmentally friendly has become such a widely debated topic that business leaders find themselves under pressure from many stakeholders- employees, customers, consumers, supply chain partners, competitors, investors, government, and the society overall⁷- to take action on sustainability. By paying attention to global environmental issues, companies can win big with their shareholders and more importantly their customers, and improve their overall image and boost their company value over competitors.

Corporations have many opportunities to improve the sustainability of their operations. This paper will discuss the importance of the reverse logistics aspect of a company's supply chain, and the potential for increased value from more sustainable reverse logistics. Currently, companies in the United States are estimated to be losing \$1 billion annually in returns due to loss of value from returned products, meaning that reverse logistics comprise a total of 0.5% of the total U.S. GDP.⁸ Given their magnitude, "reverse supply chains deserve as much attention at the corporate level as forward supply chains, and should be managed as business processes

⁵ Baier, Paul. "Why Energy Reduction Goals are Moving up the Corporate Agenda". Mar 15 2011. ClimateBiz. www.greenbiz.com.

⁶ Berns, Maurice et al. "Sustainability and Competitive Advantage". MITSloan Management Review. Fall 2009. 51:1, 23.

⁷ Berns, Maurice et al. "Sustainability and Competitive Advantage". MITSloan Management Review. Fall 2009. 51:1, 24.

⁸ Guide, V. Daniel R., Terry P. Harrison, and Luk N. Van Wassenhove. "The Challenge of Closed-Loop Supply Chains". Interfaces. Nov/Dec 2003, 33:6, 5.

that can create value for the company”.⁹ Additionally, current trends in the retail industry, such as a dramatic increase in online selling, also increase the importance of reverse logistics. While business can conserve costs by offering online shopping, the returns rate is over 40%, which is over eight times the average retail store. Thus, vendors have no choice but to develop a more effective returns management process, or risk losing not only their customers’ loyalty but a significant portion of their revenues as well.¹⁰ Sustainable supply chain practices cannot ignore issues related to proper management and structuring for supply chains, which will be discussed in the following section.

Supply Chain Management

Supply chains greatly vary in their specific organization across different companies and industries, and often include any combination of activities that transform natural resources, raw materials, and components into a finished product that is deliverable to the end consumer. Operations and supply management (OSM) is defined as the “design, operation, and improvement of the systems that create and deliver the firm’s primary products and services”, and is the operations function that oversees and manages a firm’s supply chain. Operations and supply processes can be categorized into planning, sourcing, making, delivering, and returning, which are the main functions whose combination generally constitutes a supply chain.¹¹

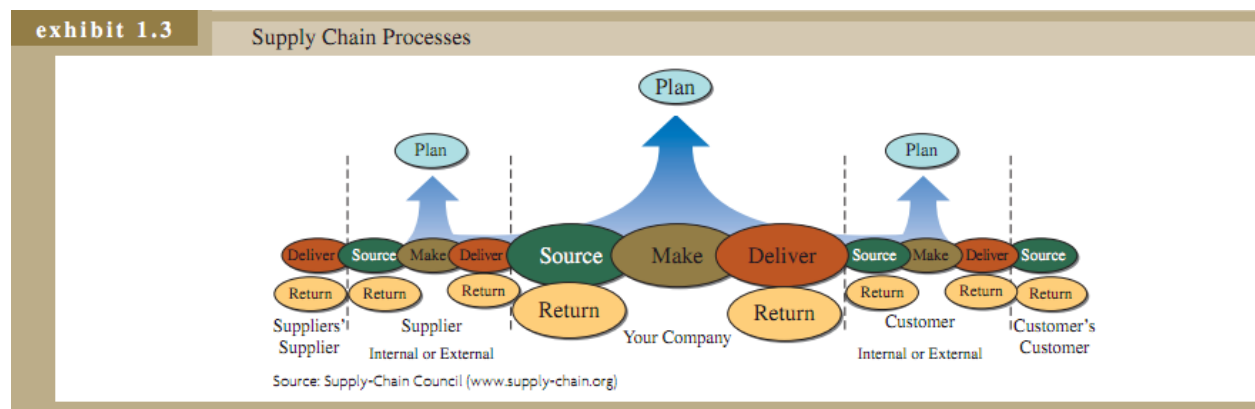
⁹ Blackburn, Joseph D., Guide V. Daniel R. Jr., Souza Gilvan C. and Wassenhove Luk N. Van (2004). “Reverse Supply Chains for Commercial Returns”. *California Management Review*, 46:2, 6-22, 17.

¹⁰ Mollenkopf, Diane and David J. Closs. “The Hidden Value in Reverse Logistics”. *Supply Chain Management Review*. Jul/Aug 2005, 9:5, ABI/INFORM Global, 35.

¹¹ Jacobs, F.R., and R.B. Chase. Operations and Supply Management The Core, 2nd Edition. Irwin McGraw-Hill; 2010: 6.

Planning consists of the strategic processes needed to run an existing supply chain.

Determining how a firm will meet anticipated demand with available resources and developing metrics to monitor the supply chain and ensure it delivers high quality and value to customers are some of the aspects of strategically planning supply chain operations. When considering sourcing decisions, selecting the suppliers that will deliver the goods and services needed to create the firm's product most efficiently is key, as well as developing and improving the relationship between partners of the firm. Manufacturing is the step where the major product is produced, or the major service is provided. This step requires coordinating workers as well as equipment, and monitoring the productivity of both production elements. Delivering, or logistics processes, move finished products to warehouses and eventually customers, and require a sophisticated tracking system to ensure products are delivered to the right place, in the right quantity, and at the right time. Finally, returning is the process that receives used, defective, or excess products back from customers, and involves many follow-up activities including customer service and support. The interaction of these supply chain activities is illustrated in Figure 1 below.



There are many different players that operations and supply management must coordinate into a coherent supply chain. The processes of planning, sourcing, making, delivering, and returning, while symbolic of a traditional manufacturing supply chain, can also be used to analyze supply chains of companies who primarily provide services instead of goods to consumers. However, regardless of whether a company provides goods or services, the coordination of all of these activities is critical to providing quality products and services at a reasonable cost.¹² In the next section, we discuss the reverse logistics aspect of supply chains. It is one of the areas that, if developed further, would provide extremely useful insight into new opportunities where implementing green initiatives could make a significant impact in the business world given the nature of reverse logistics and how it's integral to every step and each echelon in the supply chain as shown in Figure 1.

Reverse Logistics

Reverse logistics, as defined by scholars Dale Rogers and Ronald Tibben-Lembke, is “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”.¹³ From an environmental standpoint, reverse logistics is important because it focuses primarily on the returns of recyclable or reusable products and materials back into the forward supply chain instead of disposing of them directly, thus reducing the company's carbon footprint.

Reverse logistics can include many activities from processing returned merchandise due to

¹² Jacobs, F.R., and R.B. Chase. Operations and Supply Management The Core, 2nd Edition. Irwin McGraw-Hill; 2010: 10.

¹³ Rogers, Dale S. and Ronald Tibben-Lembke. “Going Backwards: Reverse Logistics Trends and Practices”. 1998. Reverse Logistics Executive Council.

damage to returning seasonal inventory, restock, salvage, recalls, and excess inventory. In addition, it may also consist of recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery.¹⁴ Until recently, executives believed that having an efficient reverse supply chain, thereby making returns easier, would encourage this behavior in consumers, a view which is just beginning to change.¹⁵

Reverse Logistics vs. Forward Supply Chains

There is a substantial difference between forward and reverse supply chains, although they are very closely related, and sometimes combined in a “closed loop supply chain”. The forward supply chain (FSC) is composed of a series of activities in the process of converting raw materials to finished goods. The manager’s objective in investing in the forward supply chain is to improve performance in areas such as procurement, demand management and order fulfillment, amongst others.¹⁶ The reverse supply chain (RSC) refers to the series of activities necessary to retrieve a product from a customer and either dispose of it or recover value.^{17 18} A traditional view on closed-loop supply chains is that they encompass two distinct material supply chains: the forward and the reverse. Generally, the forward chain concerns the flow of physical products from the manufacturer to the customer, while the reverse chain describes the

¹⁴ Rogers, Dale S. and Ronald Tibben-Lembke. “Going Backwards: Reverse Logistics Trends and Practices”. 1998. Reverse Logistics Executive Council.

¹⁵ Chawla, Saty. “Two Steps Forward, One Step Back...”. Infosys. May 2007. www.infosys.com.

¹⁶ Cooper, M.C., Lambert, D.M., Pagh, J.D., 1997. “Supply Chain Management: More than a New Name For Logistics”. *The International Journal of Logistics Management*, 8:1, 1-9.

¹⁷ Prahinski, C., Kocabasoglu, C., 2006. “Empirical Research Opportunities in Reverse Supply Chains”. *OMEGA*, 34:6, 519-532.

¹⁸ Guide Jr., V.D.R., van Wassenhove, L.N., 2002. “The Reverse Supply Chain”. *Harvard Business Review*, 80:2, 25-26.

flow of used physical products from the customer, then acting as supplier, to the remanufacturer.¹⁹

Reverse supply chains differ from forward supply chains in many areas, which make them a unique operations function for companies to focus research and additional investment on. According to Roger Tibben-Lembke, a leading scholar in reverse logistics research, reverse logistics are considered significantly more complex than a traditional manufacturing supply chain²⁰, because whereas forward logistics generally refers to the movement of products from one origin to many destinations, the reverse movement of products is the opposite: from many uncertain origins to a specific destination.²¹ Thus, efficiency of the reverse channel is of great importance for businesses that have higher volumes of returns, for example apparel or electronics companies, because of the amount of money they could potentially be saving by making the process easier for customers, and recovering the remaining value of returned products to increase their bottom line.

One of the major differences between the forward and the closed supply chain is that the customer frequently acts both as a customer for remanufactured products and as a supplier of cores to the remanufacturing company,²² whereas this is not true for traditional forward

¹⁹ Ostlin Johan, Sundin Erik and Bjorkman Mats, (2008). "Importance of Closed-Loop Supply Chain Relationships for Product remanufacturing". *International Journal of Production Economics*, 115:2, 336-348.

²⁰ Tibben-Lembke, R.S., & Rogers, D.S. (2002). "Differences Between Forward and Reverse Logistics in a Retail Environment". *Supply Chain Management: An International Journal*, 7:5, 271-282.

²¹ Fleischmann, M., Bloemhof-Ruwaard, JI, Dekker, R., Van der Laan, El, van Nunen, J.A.E.E., & van Wassenhove, L.N. (1997). "Quantitative Models for Reverse Logistics: A Review". *European Journal for Operational Research*, 103:1, 1-17.

²² Krikke, H., le Blanc, Il, van de Velde, S., (2004). "Product Modularity and the Design of Closed-Loop Supply Chains". *Californian Management Review*, 46:2, 23-39.

supply chains. Additionally, planning for reverse logistics is made much more difficult than planning for forward distribution by the greater uncertainty involved in reverse logistics.^{23 24}

While some concepts from the research of forward supply chains can also be used to increase the efficiency of reverse processes, reverse supply chains generally are more complex and require additional planning on the part of business management. Common activities for reverse supply chains have been established, but are not completely understood in this different context because they vary in complexities and managerial importance from scenario to scenario. This variance is because the nature of returns differs, as they may be at the beginning of the product life cycle, end-of-use cycle or end-of-life cycle. Each type of return requires a reverse supply chain appropriate to the returned products to optimize value recovery.²⁵

Reverse supply chains, in contrast to forward ones, have a considerably more reactive flow, with much less visibility than forward supply chains. In addition, firms generally do not initiate reverse logistics activity as a result of planning and decision-making on the part of the firm, but in response to actions by consumers or downstream channel members. Especially in a retail context, future planning and forecasting for reverse logistics are made difficult because individual customers ultimately initiate reverse logistics activities.²⁶ Because reverse logistics

²³ Guide, V.D.R. Jr, Jayaraman, V., Srivastava, R. and Benton, W.C. (2000). "Supply-Chain Management for Recoverable Manufacturing Systems". *Interfaces*, 30:3, 125-42.

²⁴ Flapper, S.D.P. (1995). "On the Operational Logistics Aspects of Reuse". *Proceedings, 2nd International Symposium on Logistics*, July.

²⁵ Guide, V.D.R. Jr, Jayaraman, V., Srivastava, R. and Benton, W.C. (2000). "Supply Chain Management for Recoverable Manufacturing Systems". *Interfaces*, 30:3, 125-42.

²⁶ Tibben-Lembke, R.S., & Rogers, D.S. (2002). "Differences Between Forward and Reverse Logistics in a Retail Environment". *Supply Chain Management: An International Journal*, 7:5, 271-282.

are so unpredictable, it is difficult for managers to concretely plan for their execution, making this an area that still has huge potential to make a significant impact on business practices.

Benefits of More Efficient Reverse Logistics

From simplifying an operational process to optimizing a supply chain to minimize fuel costs, there are many ways to make a business more sustainable and environmentally friendly. However, regardless of which angle a business chooses to approach greening their reverse logistics from, they are going to benefit their company in many ways, from increasing their revenues to securing industry first mover advantages, which will give them a competitive advantage over their rival competitors.

First and foremost, the most important benefit that can be gained from a more sophisticated reverse supply chain is additional revenue. Companies whose supply chains include a well-developed reverse logistics section are much more likely to successfully restore returned products to their manufacturing or wholesale facilities, where they will potentially gain revenue from secondary sales or mass sale to secondary channels of distribution. During the current tough economic times, this is a great tool to employ to boost sales and improve net income, without sacrificing increased expenses to offset the gains.²⁷

Another additional value that can be realized from more efficient take-back logistics is a decrease in the costs of the goods that are sold to consumers. In addition to raw material and manufacturing costs, a product's cost included overhead costs, which can include potential handling costs if a product is returned. By making the company's reverse logistics more

²⁷ Mollenkopf, Diane A., and David J. Closs. (2005). "The Hidden Value in Reverse Logistics". Supply Chain Management Review, 9:5, 34.

effective, these overhead costs can be decreased, which would decrease the overall cost of goods sold, and increase profits from revenues as well.²⁸

Another monetary gain that can be accomplished with better returns management is an improvement in the company's asset turnover ratio. The asset turnover ratio measures the dollar amount of sales that is generated from the firm's assets, determining how efficiently assets are used to create revenue. If returns are better managed, losses from returns can be minimized, and the greatest amount possible will be recovered from every item that is returned by consumers. This will maximize the value of the company's assets against their liabilities, and since returns will be generating secondary profit, it will help the business produce the greatest amount of sales and improve their asset turnover ratio.²⁹ Since this ratio is one of the most important, and looked at by analysts who are reporting on the financial situation of a company, this will help firms look more efficient and therefore more attractive to potential new shareholders.

In addition to monetary gains, a more efficient reverse supply chain can bring other potential benefits to a company. Customer service is very high on most corporate mission and value declarations, as pleasing customers is the most highly effective way to keep them loyal to buying more products from the same company. By assuring as much ease as possible in the returns process, companies can gain valuable customer satisfaction and loyalty, and ensure that

²⁸ Mollenkopf, Diane A., and David J. Closs. (2005). "The Hidden Value in Reverse Logistics". Supply Chain Management Review, 9:5, 36.

²⁹ Mollenkopf, Diane A., and David J. Closs. (2005). "The Hidden Value in Reverse Logistics". Supply Chain Management Review, 9:5, 36.

those customers will not leave them for a competitor due to lacking an efficient returns mechanism.^{30 31}

As new environmental legislation gains momentum in the European Union as well as the United States, there are increasingly larger penalties for non-compliance with these new regulations. By implementing environmental measures and greening some aspects of their operations processes, companies can not only gain advantages by becoming more environmentally friendly, but also by avoiding penalties for contributing to CO₂ emissions and other actions that contribute to global warming.³² Avoiding monetary penalties will also be a benefit by decreasing potential costs that could erode the company's bottom line and financial position in the industry.

Looking at reverse logistics from a different perspective, a more efficient reverse supply chain provides an advantage to a company by presenting it with a guaranteed disposal system for returned goods or goods that are at the end-of-life stage in their value chain. By having secondary channels established through which products can be distributed to outlet stores or otherwise removed from the primary supply chain, a company can ensure that returned products will have a place in the company's operations. Guaranteed disposal reduces the

³⁰ Tibben-Lembke, Ronald S. (1998). "The Impact of Reverse Logistics on the Total Cost of Ownership". *Journal of Marketing Theory and Practice*, 6:4, 51.

³¹ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 486.

³² Tibben-Lembke, Ronald S. (1998). "The Impact of Reverse Logistics on the Total Cost of Ownership". *Journal of Marketing Theory and Research*, 6:4, 54.

pressure on firms that have large disposal costs, by providing a channel that will eventually dispose of returned products after all possible value has been extracted from them.³³

Since companies are just starting to realize the benefits of more efficient and sustainable reverse supply chains, embracing these new reforms to traditional operations management could pose an additional advantage for first movers. By committing to sustainable innovations, companies can capitalize on first-mover advantages, such as charging royalties for licensing technology. Developing manufacturing capabilities that a competitor would be unable to copy, at least not copy quickly, the company would be able to take advantage and increase profits to offset their initial investment in the project. Thus, the firm would gain a head start on the next generation of technologies, as well as create proprietary information that would provide them a competitive advantage in the global marketplace.³⁴

After developing first-mover advantages, a company could expand their initial gains to reach economies of scale when it comes to product returns and reverse logistics. As a company develops a new technology, and it becomes successful, this will lead to lower prices, subsequent improvements in the technology, and eventually to the release of the technology to the mass market.³⁵ As a corporation develops these economies of scale, other benefits will

³³ Tibben-Lembke, Ronald S. (1998). "The Impact of Reverse Logistics on the Total Cost of Ownership". *Journal of Marketing Theory and Research*, 6:4, 54.

³⁴ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 486.

³⁵ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 486.

include better salvage prices, lower disposal costs, and reduced transportation costs, all due to the increase in efficiency of reverse supply chain operations.³⁶

A more global advantage of having a superior reverse supply chain is an enhanced company and brand image among the firms in the industry. Through increased environmental care, companies can capture customer satisfaction and loyalty, which will aid them in continuing to improve their position in the market, as well as stabilize their financial performance. Loyal customers are the greatest investment due to their power to act as brand ambassadors, and introduce the company to other people who have not engaged with the company in the past. Thus, the company will possibly end up capturing additional market share and expanding their presence in the market, which is a great advantage not only from a business standpoint, but from an environmental one as well, since they will be spreading sustainable practices to more people throughout the industry.³⁷

Green Supply Chains: State-of-the-Art

Throughout the past decade, new trends have continued to emerge in the area of global corporate citizenship that are pushing the boundary to achieve even higher levels of corporate sustainability. One trend that is swiftly gaining attention from both researchers and managers is green supply chain management (GrSCM). Many companies have dedicated themselves to generally becoming more environmentally friendly, and supply chain management is one area where green initiatives can make a noticeable impact on a business.

³⁶ Tibben-Lembke, Ronald S. (1998). "The Impact of Reverse Logistics on the Total Cost of Ownership". *Journal of Marketing Theory and Research*, 6:4, 54.

³⁷ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 486.

GrSCM is still a relatively new idea, which highlights how introducing new sustainability practices can have positive effects on a company's value creation, specifically through their supply chain. Green supply chain management initiatives can be implemented in various operational areas, including procurement and supplier relations, product design, energy conservation, efficiency and cost cutting, as well as network design.^{38 39} While some of these frameworks are currently being applied to both forward as well as reverse supply chains, albeit in different contexts, there are some that are still only utilized in forward operations, and the following analysis aims to shed light on those gaps in the current literature.

Retail giants such as Wal-Mart have proven that a collaborative and more efficient supply chain can create a ripple effect, and have an exponentially greater impact than any single internal greening effort.⁴⁰ Motivating better performing suppliers is another advantage of pursuing a greener supply chain from a business standpoint. As the nature of supply chain management processes results in growing economies of scale as well as increased dependencies and complexity in product development and distribution, competition among suppliers increases greatly. Supply chains of international companies are extremely complex, and as shortcomings of suppliers in all sectors is becoming increasingly well documented, the "implementation of sustainability initiatives creates an opportunity to further focus and rationalize supply chains by eliminating low performers". Focusing on a fewer number of suppliers will enable more rigorous sustainability performance criteria to be met, while meeting the needs of the marketplace as well. These initiatives would also give companies an

³⁸ Berns, Maurice et al. "Sustainability and Competitive Advantage". MITSloan Management Review. Fall 2009. 51:1, 24.

³⁹ "A Look at Green Supply Chain Within North American Business". APQC. Bearing Point.

⁴⁰ "A Look at Green Supply Chain Within North American Business". APQC. Bearing Point.

opportunity to stabilize and advance business relationships with their suppliers through a sustained, mutually advantageous partnership.⁴¹ The use of supplier relations in reverse logistics is currently not as well developed. However, because the use of third party companies is required for such activities as returns logistics, waste management, and recycling, this could be an area where reverse supply chains could benefit from borrowing a practice common to their forward-flowing counterparts.

Product design for green supply chains has potential to be one of the most important areas for managers to concentrate on when they are designing their sustainable supply chain. It is a relatively new field, but can draw upon decades of related experience from design for serviceability, or design for maintainability and other areas. Ideally, product design would be aimed at a combination of eventual remanufacturing and/or recycling, with the challenge being that it is not clear at the beginning of the design stage exactly which process(es) you are designing for. “A designer’s goal is to create a product that will be returned to the producer, has a large number of reusable components, and requires minimal disassembly, with required retrieval, disassembly, and remanufacture processes that are easy and inexpensive”.⁴² Designing products for green supply chains is also complicated by the fact that postconsumer returns can occur years after the product was designed, when technology and business conditions have more than likely changed.⁴³ Product design specifically for reverse processes such as remanufacturing has started in some industries, such as the cell phone and other

⁴¹ Yosie, Terry F. “Greening the Supply Chain in Emerging Markets: Some Lessons From the Field”. Nov 2008. World Environment Center. GreenBiz Reports: 5. www.greenbiz.com.

⁴² Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 44.

⁴³ Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 40.

electronic industries, but has not become widespread elsewhere, even though product design is an area that can have a significant impact on reverse operations for a multitude of products.

Efficiency and cost cutting are two large components of building a successful green supply chain. The potential business value of greening a company's supply chain can be immense, and reduced business costs and greater efficiency are the main benefits to be gained from taking steps to increased sustainability. With the current rising energy costs, as well as high resource and raw material inputs, companies are provided with a more direct incentive to decrease the costs of their operating practices. Companies also often have high cost structures embedded in their operational functions which result not only from reliance on previous generations of technology or operating standards, but practices that result in a higher than necessary consumption of energy, water, and other inputs.⁴⁴ However, with the adoption of green measures for supply chains, managers are able to decrease the environmental impact of all the above-mentioned supply chain components, and overall decrease their company's carbon footprint while improving efficiency by simplifying their overall manufacturing and logistics process. Efficiency and cost cutting practices can be implemented for the forward as well as reverse supply chains, however it has been much more common in the forward operations and rarely utilized for reverse.

Conserving energy is one of the main goals of managers who are greening their company's supply chain. Because energy conservation often has a significant impact on cost cutting as well, managers turn to conserving energy as one of the first ways to start their

⁴⁴ Yosie, Terry F. "Greening the Supply Chain in Emerging Markets: Some Lessons From the Field". Nov 2008. World Environment Center. GreenBiz Reports: 4. www.greenbiz.com.

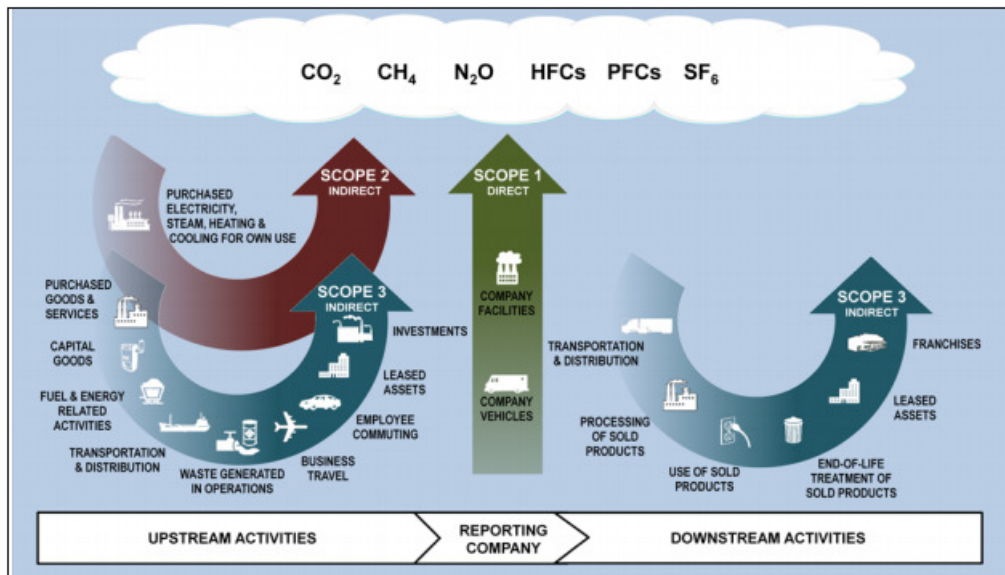
greening process. Energy conservation can be effective in a number of different operating processes that range from research and development priorities, building design and maintenance, heating, ventilation and air conditioning systems and storage facilities, to product distribution. Specifically, companies can reduce the environmental impact of their supply chain through decisions on enhanced sourcing and inventory management practices to reduce waste, converting wastes to by-products, reducing the use of hazardous materials and recovering valuable materials and assets through efficient product take back programs.⁴⁵ The advantages to pursuing green energy conservation policies can include mitigating business risks, reducing costs, preserving business continuity, and enhancing market access and degree of business strategy freedom.⁴⁶ Once again, energy conservation can be applied to both forward and reverse operations, but has not been as utilized in reverse as it could be to make a real impact.

A large part of successful green supply chains is being able to measure quantitatively the impact of new greening policies on the business and the environment as a whole. While some attempts have been made to develop a system for successfully measuring the exact carbon footprint of one business, the process is still in the early developmental stages, as legislation slowly emerges to direct the process and standardize it to make it widely useful in the business world. Recent studies have involved companies that are attempting to measure their carbon footprint by estimating emissions across a product's life cycle as well as their overall company value chain, and using that data to measure the magnitude of their contribution to global greenhouse emissions. However, once again reverse logistics are a small to barely existent part

⁴⁵ Environmental Accounting Project. "The Lean and Green Supply Chain: A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance. EPA. Jan 2000. iii-iv.

⁴⁶ Yosie, Terry F. "Greening the Supply Chain in Emerging Markets: Some Lessons From the Field". Nov 2008. World Environment Center. GreenBiz Reports: 4. www.greenbiz.com.

of the discussion, and are often left out of carbon footprint calculations. The chart below depicts the operational activities included in emissions calculations, and although “end-of-life treatment of sold products” is mentioned, it is only a miniscule part of the whole supply chain.



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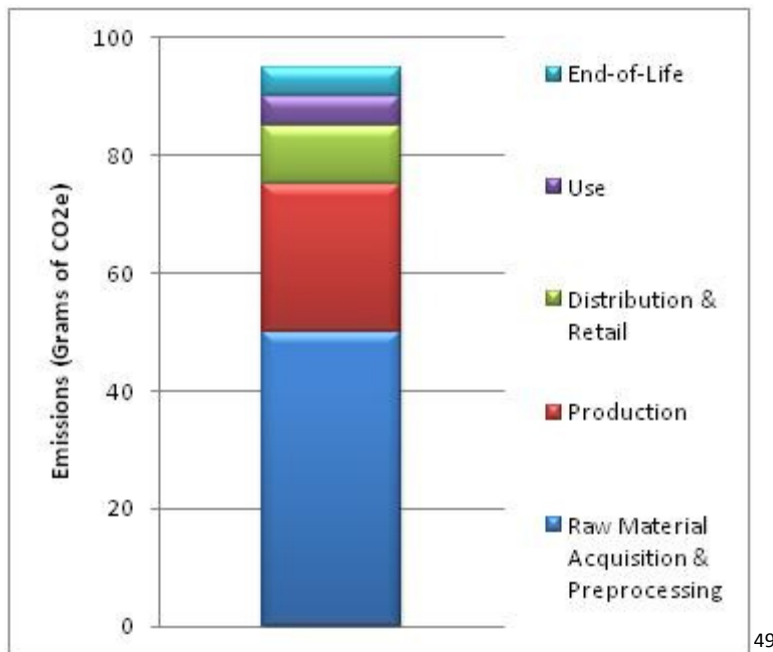
Emissions Type	Scope	Definition	Examples
Direct Emissions	Scope 1	Emissions from operations that are owned or controlled by the reporting company	Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment
Indirect Emissions	Scope 2	Emissions from the generation of purchased or acquired electricity, steam, heating or cooling consumed by the reporting company	Use of purchased electricity, steam, heating or cooling
	Scope 3	All other indirect emissions that occur in the value chain of the reporting company, including both upstream and downstream emissions	Production of purchased products, transportation of purchased products, use of sold products

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⁴⁷ The Greenhouse Gas Protocol Initiative. “Corporate Value Chain (Scope 3) Accounting and Reporting Standard”. Executive Summary. <http://www.ghgprotocol.org/files/ghg-protocol-scope-3-standard-executive-summary1.pdf>.

⁴⁸ The Greenhouse Gas Protocol Initiative. “Corporate Value Chain (Scope 3) Accounting and Reporting Standard”. Executive Summary. <http://www.ghgprotocol.org/files/ghg-protocol-scope-3-standard-executive-summary1.pdf>.

The graph below also illustrates the component parts of a carbon footprint calculation for a specific company, but once again, end-of-life treatment is only a small part of the whole estimation, while reverse supply chain operations are not specifically mentioned at all.



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The most recent advances in greenhouse gas protocols and initiatives have begun developing standards, such as the Scope 3 Standard developed by the Greenhouse Gas Protocol Initiative, which will enable companies to include in their carbon footprint estimations operations activities such as value chains, outsourced activities, supplier manufacturing, and the use of the products they sell, and offer recommendations on how to make these processes more green. However, once again the research is focused on forward supply chains, and while end-of-life cycle products are mentioned as a contributor to carbon footprints, there is no explicit discussion of how these reverse supply chain logistics can be made greener.

⁴⁹ The Greenhouse Gas Protocol Initiative. "Sixty Corporations Begin Measuring Emissions from Products and Supply Chains". <http://www.ghgprotocol.org/sixty-corporations-begin-measuring-emissions-from-products-and-supply-chains>.

Network design is another significant component in greening a supply chain, as the specific design of the chain will determine the environmental as well as financial effects on the company. According to leading academics Ferguson and Souza, reverse logistics is one of the most crucial components of a more sustainable supply chain, because it collects used products from end users; consolidates, inspects, and sorts them as needed; and transports them for various recovery options. The nature of the used product and type of recovery has a major bearing on the structure of reverse logistics, as well as decisions such as who should take on the collection activity, which collection strategy to employ, and how much it is going to cost.⁵⁰ While the field of reverse logistics has been extensively studied separately, less study has been done on the integrated design of forward and reverse networks, and how efficient reverse logistics can be beneficial to a green supply chain.⁵¹

Although popularity of research and management implementation of green supply chain management initiatives is on the rise, it is still a field that focuses mainly on upstream and downstream activities of the forward supply chain of a company. The majority of the green supply chain discussion still focuses on the forward logistics of supply chains, and largely ignores the reverse activities involved. With the exception of Ferguson and Souza, who acknowledge that reverse logistics are necessary to design properly when building a green supply chain, most other research does not integrate a discussion of reverse logistics into their supply chain analysis. Whereas forward supply logistics are extensively researched across

⁵⁰ Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 69-76.

⁵¹ Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 86.

different products, companies, and industries, no such distinctions are made when discussing the design of reverse logistics.

Next we focus on our limited findings on the current state of the art in green reverse logistics.

Green Reverse Logistics: State-of-the-Art

In the business world today, there is a conscious emphasis on the concept of a reduce-reuse-recycle hierarchy to ensure that sustainability is one of top priorities of every company. Waste reduction is a very popular way for businesses to cut down on their carbon emissions, as well as extending the life cycle of their products to ease the impact the company has on the environment. In 2006, 67.5% of municipal waste went directly to landfills or incineration facilities, and although that is a high number in comparison to the ideal goal, it also means there is a market for second hand products that do not get disposed of immediately. Thus, remanufacturing products has emerged as one of the best ways for a company to lessen its carbon footprint, as well as improve their overall business practices.⁵²

Business managers face several disposition decisions when deciding what to do with product returns. Landfilling is one of the simplest forms of disposal; however it is illegal for some products that are considered toxic such as electronic equipment or batteries, which are not allowed in landfills in the majority of states in the United States. Another option for managers is incineration, which has the advantage of minimizing the amount of solid waste that goes to landfills, and is also often used for energy recovery. It is a very important option for

⁵² Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 10.

businesses in countries that have limited land areas for landfilling, although it is not used as much in the United States. However the major drawbacks of incineration are that it significantly contributes to harmful emissions and pollution. Recycling is a disposition option for returns with limited or no functionality remaining, and whose materials can be economically separated in an environmentally friendly manner. Recycling is optimal for certain products, such as outdated appliances, whose new replacements consume much less energy. Parts harvesting implies recovering selected parts from returns, which is not only an economic option but also saves the company up to 80% compared to sourcing new parts from a supplier. Resale (as-is) is an attractive option if a secondary market exists for the returned product, for example for used IT equipment or electronics. Internal reuse is sometimes an option, but does not include any form of refurbishing to the returned product. Remanufacturing or refurbishing is the only value-added option for returned goods, and has the potential for higher profitability among disposition decisions. This process may include disassembly, cleaning, repairing, replacing parts, and reassembly, and sometimes light remanufacturing.⁵³ (For the purposes of this paper, we do not consider there to be a significant difference between remanufacturing and refurbishing.)

Among all the above-mentioned disposition decisions available to managers, refurbishing and remanufacturing have emerged as the most widely used operations to promote green reverse supply chains. Remanufacturing is a green reverse operation because it extends the product's useful life, and instead of sending it to the landfill or incinerator upon its return from the customer, the product can be remade through the value-added processes of

⁵³ Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 4-5.

remanufacturing. While remanufacturing provides economic benefits to a business in the form of recovered revenue, it most importantly has environmental benefits such as extension of product's life cycle, reduced energy, and reduced material consumption.⁵⁴

An area of business where green reverse logistics, and especially refurbishing, have become an integral and successful part of the supply chain is the cell phone industry. Proper implementation of reverse logistics systems can result in better customer loyalty and reduction in operational costs due to reuse or remanufacturing of some parts. The reason cell phone makers have been able to capitalize on these benefits is that it is an industry with a very high growth rate, and a short product life cycle. Global sales of cell phones in 2003 were 470 million, and increased to almost double that figure in the next five years. "This outstanding market success, together with the short average lifetime of cell phones, made them a great target of environmental activism, policy, and research..."⁵⁵ For this reason, cell phones are currently one of the few electronic products, if not the only one, that have a thriving reuse market. Currently, about 65% of cell phones are being reused, meaning that more handsets are being reused than recycled. Reuse in this context can include various levels of reprocessing, from refurbishment which typically indicates modest reprocessing, to remanufacturing which is a more substantial level of reprocessing. Generally, these reprocessing procedures are carried out by third party enterprises, as opposed to the original manufacturers. Whether a cell phone can be reused or must be recycled depends on factors such as its functional level, cosmetic condition, and market for that specific make and model. Because the secondary market for cell phones

⁵⁴ Ferguson, Mark E., and Gilvan C. Souza. (2010). Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press, 5.

⁵⁵ Geyer, Roland, and Vered Doctori Blass. (2009). "The Economics of Cell Phone Reuse and Recycling". The International Journal of Advanced Manufacturing Technology, 47:5-8, 515.

currently enjoys a healthy profit margin, the green reverse logistics of refurbishing and remanufacturing practices will more than likely continue to develop in this industry.

The apparel industry is another example of an industry where the importance of reverse logistics cannot be understated. Currently, the volume of returns of apparel is 19.4%, which is more than three times the average retail returns rate of 6%. In addition, online apparel sales have the highest return rate of any product in the entire retail industry with 35-40% of purchased products being sent back to the manufacturers.⁵⁶ Return rates for high fashion have also climbed to the 35% mark⁵⁷, making the apparel industry a prime example of the need for a sophisticated and highly developed reverse supply chain network. The apparel industry has an overall large negative impact on the environment, due to the length of the manufacturing process. Energy uses from providing fuel for agricultural machines and electricity in production have a significant carbon footprint, and are only augmented by the chemicals used in agriculture, especially of cotton, as well as in dyeing processes.⁵⁸ Barriers to recycling clothing are also present, making it difficult to offset the detriments to the environment. Recycling apparel by shipping to third world country markets has the downside of not only putting local African second hand apparel businesses out of business due to foreign competition, but also increasing the environmental footprint due to shipping garments halfway around the world.⁵⁹ There are several companies in the industry however, that have been successful in recycling their unwanted textiles, including H&M and Patagonia. Following a press scandal surrounding

⁵⁶ Chawly, Saty. (2007). "Two Steps Forward, One Step Back...". Infosys. www.infosys.com.

⁵⁷ Hammond, Jan and Kristin Kohler. (2002). "In the Virtual Dressing Room Returns are a Real Problem". Harvard Business School. Working Knowledge.

⁵⁸ Allwood, Julian and Soren Eliebaek Laursen et al. "Are We Well Dressed". University of Cambridge institute for Manufacturing. www.ifm.eng.cam.ac.uk.

⁵⁹ Britten, Fleur. "Is Recycling Your Old Clothes Worth It?". The Times Online. www.thetimesonline.com.

their disposal of excess merchandise, H&M has become one of the leading retail stores in garment recycling, with 1.9 million tons of unwanted textiles being recovered in 2009. Their current recycling technique is to use unwanted items from the previous season to create new fashions that are in high demand.⁶⁰ Patagonia, on the other hand, uses actual material recycling of old garments to create new products. Their “Common Threads Recycling Program” facilitates the collection of long underwear, polartec brand garments and Patagonia cotton tees, which feed into the Patagonia supply chain to make new garments. This also makes Patagonia the first company to recycle their competitors’ garments, and with the start of the program, nearly a third of the company’s garments will be recyclable.⁶¹ Both of these companies are using recycling methods to reduce the size of their carbon footprint, and in an industry with some of the highest return rates, are making a significant difference as well as paving the way for these practices to become increasingly widespread.

Conclusion

The efforts to increase the sustainability and greening of reverse supply chains clearly differs across industries, and even inside a specific industry, greening practices are often not standardized. Through analyzing previous research, several trends of greening supply chains emerge for forward logistics. Leading the green initiatives for forward supply chains are waste reduction practices, energy conservation, and refurbishing of returned products, which are the activities that managers turn to first when attempting to increase their sustainability ratings.

This may be because their effects can be clearly quantitatively measured, and thus

⁶⁰ Cheeseman, Gina-Marie. “H&M Creates Clothing Line Made Out of Leftover Pieces”. Guardian. www.guardian.co.uk.

⁶¹ News. “USA: Patagonia Announces Major Expansion of Garment Recycling Program”. 27 Jan 2007. Fibre2Fashion. www.fibre2fashion.com.

demonstrated to the public, or because they have a more direct effect on cutting costs. Either way, these trends are leading the efforts in the business world to attain higher standards of environmental friendliness. While greening trends are emerging for forward supply chains, these developments have yet to emerge on the reverse logistics side of the debate.

The emergence of these trends, while greening the forward supply chain, creates an added demand for well-developed reverse logistics networks, because the reverse chain is an integral part in such activities as refurbishing and waste management. As greening of forward supply chains continues to develop, it will become increasingly important for companies to integrate their forward supply chains with their reverse logistics. Currently, while both forward and reverse processes have been studied in detail, it is still not clear what the best policies are in order to ensure a smooth interaction between these two parts of a company's closed-loop supply chain.

Managing reverse logistics can be extremely challenging for some organizations, simply because most of their business operations are focused on bringing goods to the shopper, and not bringing them back from shoppers. Managing reverse logistics can be hugely advantageous to a company however, especially due to recent trends such as online shopping, which have placed a greater emphasis on the retailer's return policy and reverse logistics services. Other challenges for companies include disparate systems for each channel of returns, leading to differences in pricing, missing data, or a lack of cross-channel visibility. This limited visibility of work and inventory in their reverse logistics pipelines prevents the business from being able to plan ahead and handle their returns efficiently. This lack of transparency also makes it

impossible to conduct any trend analysis or intelligence to improve the product or returns process for the future.⁶²

In order for reverse logistics to be successful and allow managers to capitalize on its advantages, it will have to be emphasized as an important element of sustainable supply chain practices. It is crucial to integrate reverse logistics with other functional areas that are affected by returned products, which may simply require the creation of tighter linkages between functions to ensure a smooth return process with prompt and correct credits for customers. Regardless of the scope of the necessary integration, however, reverse logistics spans several functional areas and cannot be managed in isolation.⁶³ Because the greening of forward supply chains has a profound impact on reverse logistics as well, the integration of these two areas will be key to developing green practices for reverse logistics as well as forward supply chains.

Reverse logistics is an important supply chain management discipline, but one whose full potential has yet to be realized by many top managers.⁶⁴ More research is needed in order to assess the true cost impact of reverse logistics, because the financial aspect of the discipline is what will highlight the true importance of reverse logistics to top managers and persuade them to invest in a more efficient reverse logistics network. Understanding the true cost drivers of reverse logistics systems is essential to managing reverse logistics effectively and efficiently. An accurate cost analysis will also assist with the precise measuring of a company's carbon footprint, a trend that is becoming prominent in the business world. Because reverse logistics

⁶² Chawla, Saty. "Two Steps Forward, One Step Back...". Infosys. May 2007. www.infosys.com.

⁶³ Mollenkopf, Diane A., and David J. Closs. (2005). "The Hidden Value in Reverse Logistics". *Supply Chain Management Review*, 9:5, 43.

⁶⁴ Mollenkopf, Diane A., and David J. Closs. (2005). "The Hidden Value in Reverse Logistics". *Supply Chain Management Review*, 9:5, 43.

have traditionally not been included in carbon footprint measurements, this new research will enable companies to develop a much more accurate representation of their emissions and develop strategies for their reverse logistics chains that will allow them to make their entire supply chain more sustainable.

Appendix

Appendix A

Importance of Reverse Supply Chains

There are many reasons why there is currently an ever increasing demand for a more sustainable environment. Soaring food prices, rising fuel costs, and the increasingly apparent impacts of climate change are some of the most important. For these reasons, businesses are joining the environmental movement and striving to reduce their environmental impacts across their entire life cycle, as well as attempting to gain commercial benefit from becoming more efficient across their supply chains.⁶⁵ This is where the focus on greener supply chains started, and has continued to grow ever since.

First and foremost, the magnitude of reverse logistics illustrates its importance to business managers. It is currently estimated that about \$100 billion in goods are returned each year, meaning that reverse logistics comprise a total of 0.5% of the total GDP of the United

⁶⁵ Carbon and Environmental Footprint Supply Chain Summit 2008. American Business Conference. www.carbonfootprint-environmental-supplychain.com.

States. This makes reverse logistics a huge sector, and an important area for companies to focus on when making changes to increase their businesses efficiency. With a more efficient reverse supply chain, instead of losing \$100 billion per year in revenue, companies would be able to recover some of those losses by rechanneling the returned goods to consumers.⁶⁶

The rising importance of focusing on reverse logistics can also be attributed to recent trends of the retail industry, such as increasing online selling. Companies that offer online retail to their customers may cut down some of their initial costs by offering the service, but eventually are faced with much higher online return rates than those of regular retail stores. Research has found online return rates as high as 40% for some catalog and online retailers, which is over eight times that of the average retail store. These online vendors have no choice but to develop a more effective returns management process, or risk losing not only their customers' loyalty but a significant portion of their revenues as well.⁶⁷

The necessity for a more well-developed reverse supply chain is also driven by the high level of global competition that exists among companies in similar markets. In some cases, this competition is leading to decreasing profit margins due to overcapacity, as more and more companies are vying for top spots in the industry there is not enough profit to be shared among all members. Together with increasing returns, overcapacity in markets will make returns more

⁶⁶ Guide, V. Daniel R., Terry P. Harrison, and Luk N. Van Wassenhove. "The Challenge of Closed-Loop Supply Chains". *Interfaces*. Nov/Dec 2003, 33:6, 5.

⁶⁷ Mollenkopf, Diane and David J. Closs. "The Hidden Value in Reverse Logistics". *Supply Chain Management Review*. Jul/Aug 2005, 9:5. ABI/INFORM Global, 35.

expensive to handle, and if business processes have not been designed to accommodate them, will lead to losses.⁶⁸

Recently stricter environmental regulations in the European Union as well as the United States mandate that businesses pay greater attention to their global corporate citizenship practices, which is another reason that greening of supply chains has come to the forefront of management practices research.⁶⁹ The European Union has been the leader in developing regulatory legislation for product standards on the market, as well as for chemicals and other hazardous materials. “With its push into new product-based environmental requirements, the EU is breaking ground on a new generation of environmental legislation that looks beyond the environmental impacts associated with production and manufacturing alone”.⁷⁰ The European Union is also serving as a catalyst for similar initiatives in other parts of the world, most importantly the United States.

The recent rise in the interest level of managers in reverse logistics also stems from increased global competition, meaning that companies are forced to reexamine all areas of their operations to try and cut costs and get ahead of their competitors. One of these areas is reverse logistics, and as its potential to reduce costs in increasingly researched, more managers are starting to pay attention.⁷¹ In addition to increased competition, global markets are experiencing decreasing profit margins, because as competition from large global corporations

⁶⁸ Guide, V. Daniel R., Terry P. Harrison, and Luk N. Van Wassenhove. “The Challenge of Closed-Loop Supply Chains”. *Interfaces*, 23:6. Nov/Dec 2003, 5.

⁶⁹ Mollenkopf, Diane A., and David J. Closs. (2005) “The Hidden Value in Reverse Logistics”. *Supply Chain Management Review*, 9:5, 34.

⁷⁰ Hagen, Paul E. (2006) “Product-Based Environmental Regulations: Europe Sets the Pace”. *Sustainable Development Law & Policy*, 64.

⁷¹ Guide, V.D.R., Terry P. Harrison, Luk N. Van Wassenhove. (2003). “The Challenge of Closed-Loop Supply Chains”. *Interfaces*, 33:6, 5.

gets tougher, many other firms simply cannot keep up. However, more efficient reverse logistics may be the answer to gaining the competitive advantage that these companies need in the global market place.

The increase in volume of returns for many companies has also made redefining their reverse logistics a necessity, and not merely a competitive advantage in the industry. As companies strive to offer their customers better services in addition to quality products, their return policies are becoming increasingly lenient to benefit their customers. This significantly raises the number of products in a company's reverse supply chain, and heightens the demand for a more effective reverse system.⁷²

The growth of product leasing is yet another reason that the field of reverse logistics is gaining in importance.⁷³ Similar to consumer returns, products returned at the end-of-use period become a part of the reverse supply chain network of a business. However, unlike consumer returns, end-of-use returns have been used extensively by the customer, and consequently are of an older technological generation, but are still fully functional. Examples of products that may be included in this category are cell phones, which are typically returned for an upgrade by consumers about every 18 months.⁷⁴

Increasing costs are also driving companies into the arms of more sustainable business practices, in hopes that going green will improve the company's bottom line by decreasing

⁷² Guide, V.D.R., Terry P. Harrison, Luk N. Van Wassenhove. (2003). "The Challenge of Closed-Loop Supply Chains". *Interfaces*, 33:6, 5.

⁷³ Mollenkopf, Diane A., and David J. Closs. (2005) "The Hidden Value in Reverse Logistics". *Supply Chain Management Review*, 9:5, 35.

⁷⁴ Ferguson, Mark E., and Gilvan C. Souza. Closed-Loop Supply Chains: New Developments to Improve the Sustainability of Business Practices. CRC Press; 2010, 3.

some of their operating costs. Increasing energy and raw material costs have been the main problem for most companies, especially during the economic recession. With the price of fuel rapidly rising, business operations, especially those involving transportation or shipping, became much more expensive in the last three years. Disposal costs are also on the rise due to fuel prices, as well as environmental regulations that are cracking down on the amount of waste businesses are allowed to produce.⁷⁵ With green initiatives, companies can smooth out their operations to gain efficiency, and therefore cut down on these costs that are shrinking the profits for businesses in industries across the world.⁷⁶

Aside from pure cost cutting advantages, by going green, a company can also gain a competitive advantage in the industry by gaining a good reputation with their customers. As environmental legislation is bringing the issue of sustainability to light, the public is demanding improved performance in sustainability practices from businesses. To take advantage of this public pressure, companies are starting to take action to increase awareness among employees of the firm's triple bottom line. The triple bottom line consists of the "three P's" of people, planet, profit, and covers all the aspects that make a company a good global citizen. By improving their triple bottom line, a company could gain a good reputation among the public, can thus also increase the demand for their products.⁷⁷

⁷⁵ Tibben-Lembke, Ronald S. 1998. "The Impact of Reverse Logistics on the Total Cost of Ownership". *Journal of Marketing Theory and Practice*, 6:4, 54.

⁷⁶ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 483.

⁷⁷ Kleindorfer, Paul R., Kalyan Singhal, Luk V. Van Wassenhove. (2005). "Sustainable Operations Management". *Production and Operations Management*, 14:4, 484.

Managing their reverse logistics can be extremely challenging for some organizations, simply because most of their business operations are focused on bringing goods to the shopper, and not bringing them back from shoppers. Managing reverse logistics can be hugely advantageous to a company however, especially due to recent trends such as online shopping, which have placed a greater emphasis on the retailer's return policy and reverse logistics services. Other challenges for companies include disparate systems for each channel of returns, leading to differences in pricing, missing data, or a lack of cross-channel visibility. This limited visibility of work and inventory in their reverse logistics pipelines prevents the business from being able to plan ahead and handle their returns efficiently. This lack of transparency also makes it impossible to conduct any trend analysis or intelligence to improve the product or returns process for the future.⁷⁸

In light of the recent financial crisis, many companies have looked to become more efficient at what they do, cut costs without decreasing quality, and otherwise make their business more sustainable. In the competitive landscape of rapidly evolving technology, mass production and eroding profit margins, managing the total cost of the supply chain and the composite value of the components is essential to cost reduction and financial survival. Therefore, ignoring the aspect of reverse logistics can not only be extremely costly, it can be fatal to an organization.⁷⁹

⁷⁸ Chawla, Saty. "Two Steps Forward, One Step Back...". Infosys. May 2007. www.infosys.com.

⁷⁹ Mehrmann, John. "Reverse Logistics in Supply Chain Management". Fibre 2 Fashion. www.fibre2fashion.com.

Appendix B

Advantages of Greening Your Supply Chain

A greener supply chain can mitigate certain risks to the company upon its implementation. The incentive to implement GrSCM initiatives comes during a time when awareness of environmental contamination among citizens and policy makers is increasing. In addition, stakeholders as well as markets are pressuring firms to develop sustainable policies; new legal requirements are evolving every day, as are expectations for improved global corporate governance and supplier performance. Decreasing risks from current environmental, health, and safety factors, as well as responding to expectations of stakeholders can contribute to reducing company risk. Thus advancing company-supplier learning and increasing the

operational integrity of business processes across the supply chain can not only mitigate risk but also create business value.⁸⁰

Preserving business continuity is another possible added business value from greening practices. Although more applicable to emerging economies, it can be relevant to countries such as China who are still struggling with distribution of resources. Since emerging markets frequently experience disruption of business operations from interruption of electricity supplies or other natural energy or resource inputs, greener supply chain practices may mitigate some of these disruptions, as well as contribute to emission reductions at the same time.⁸¹

Greening supply chains of a business can also have long term benefits, such as increased market access and freedom to produce products in a market-based system. In most business sectors, companies are competing with consumers for the same resources, such as water or food supply ingredients valuable for producing transportation fuels. By starting green initiatives, such as goals to reduce water consumption in their production processes, companies can reduce the competition for access to a scarce resource and avoid the attainment of their business goals which compete with those of their consumers. This will reduce the risk that a corporation will be involved in a societal conflict or become the focus of political action, and ultimately increase the control they have over their business strategy, as well as avoid the diversion of management time and other resources.⁸²

⁸⁰ Yosie, Terry F. "Greening the Supply Chain in Emerging Markets: Some Lessons From the Field". Nov 2008. World Environment Center. GreenBiz Reports: 4. www.greenbiz.com.

⁸¹ Yosie, Terry F. "Greening the Supply Chain in Emerging Markets: Some Lessons From the Field". Nov 2008. World Environment Center. GreenBiz Reports: 5. www.greenbiz.com.

⁸² Yosie, Terry F. "Greening the Supply Chain in Emerging Markets: Some Lessons From the Field". Nov 2008. World Environment Center. GreenBiz Reports: 5. www.greenbiz.com.

Despite the potential for significant environmental as well as financial gains, some managers still do not focus on GrSCM as an area of opportunity. One reason for this may be that conventional cost accounting systems typically hide the frequency and magnitude of the various environmental costs that companies incur. This issue can be resolved by using environmental accounting techniques, which substantially reduce supply chain costs. By using these new costing methods, companies can more readily identify costs associated with greening their supply chain, such as costs associated with management of hazardous materials, which are not typically captured through cost accounting methods. Once these costs have been identified, companies can more easily analyze cost drivers as well as evaluate alternative cost reduction opportunities.

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