

Recapturing The Value Through Reverse Logistics Practices: A Review

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INTRODUCTION

Reverse Logistics: - "Is 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."

Table 1 : Comparison Forward and Reverse Logistics

S.N.	Issues	Forward Logistics	Reverse Logistics
1	Forecasting	Straightforward	More difficult
2	Distribution	One to many points	Many to one point
3	Product quality	Uniform	Not uniform
4	Packaging	Uniform	Always damaged
5	Destination	Routes are clear	Routes are unclear
6	Disposition	Option clear	Option not clear
7	Pricing	Relatively uniform	Depends on many factors
8	Speed	Importance recognized	Importance not recognized
9	Cost	Easily visible	Less directly visible
10	Inventory Management	Management consistent	Management not consistent
11	Product Life Cycle	Manageable	Issues more complex
12	Negotiation	Straight forward	Complicated
13	Marketing	Methods well known	Methods complicated
14	Process Visibility	More transparent	Less transparent

✿ **Size of Reverse Logistics :** Reverse logistics costs are accounted for approximately four percent of total logistics costs. Applying this mean percentage to Gross Domestic Product (GDP), reverse logistics costs are estimated to be approximately a half percent of the total U.S. GDP. This would account to approximately (\$11,667.515 Billions x 0.5%) \$ 58.34 Billion in 2004 in the U.S. alone. It is estimated that reverse logistics costs account for almost one percent of the total United States gross domestic product and is rapidly becoming an integral component of retailer's and manufacturer's profitability and competitive position. Product returns are the most common aspect of reverse logistics, yet most companies do not handle returns well because it is not a part of their core competency. The Center for Logistics Management at the University of Nevada conservatively estimates that 6 percent of all goods may be returned, but concedes that the true number may be closer to 8 percent.

WHY DO PRODUCTS RETURN BACK INTO THE SUPPLY CHAIN?

- ✿ Products that have failed, but can be repaired or reused.
- ✿ Products that are obsolete, or at the end of leasing life, but still have value.

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- ✿ Unwanted and unsold products on retailer's shelves.
- ✿ Products that have been recalled.
- ✿ Parts and sub-assemblies of products that can be reused, either because they are perfectly good (no trouble found), or that can be repaired or reworked.
- ✿ Products, materials, and goods that have been thrown away, but can be recycled and reused.

TYPES OF RETURNS

- ✿ **Parts And Subassemblies:** The return of parts and sub-assemblies generated by field level pull-and-replace or module repair by technicians.
- ✿ **Consumables And Materials :** These include chemicals, paper, glass, and other consumables that cannot be reused directly, but must be recycled and fully processed before they can be reused.
- ✿ **Whole Unit Equipment And Products:** Whole unit returns usually include technology coming off lease, or trade-ins on new product sales, obsolete products, or whole units requiring major repair that cannot be done in the field.

LITERATURE REVIEW

✿ In **2001, René B.M.de Koster, Marisa P. de Brito and Majsa A.van de Vendel** in their paper titled, *“How To Organize Return Handling: An Exploratory Study With Nine Retailer Warehouses”* explored the factors contributing to the decision of combining vs. separating inbound and outbound flows during the return handling process. They did so through a comparative analysis of the operations in nine retailer warehouses. They established relations between **1)** serving stores and the transport phase decision; **2)** return volume and the receipt at the warehouse; **3)** the market for returns and the storage decision. Further, they mentioned that there is a need for research on issues of monitoring, control and efficiency in return handling.

✿ In **2002, Juan Pablo Soto Zuluaga and Helena Ramalhinho Lourenço** in their paper titled, *“A Recoverable Production Planning Model”*, developed a model. Their model took advantage of the synergies of integration, developing a model for global production planning that generates the optimal production and purchasing schedule for all the companies integrating a logistic chain. In the second part of the paper, they incorporated products' returns to the first model proposed, and analyzed the implications they had over the model. To solve the model, they combined optimization and simulation procedures. Further, they mentioned that it would be also interesting to use the optimization+simulation process in a strategy, where at each period, optimization or heuristic procedures will be given a feedback by the simulation process, resulting in a plan that was more accurate to the possible behavior of the products returned.

✿ In **2003, Marisa P. de Brito and Rommert Dekker** in their paper titled, *“A Framework for Reverse Logistics”* proposed a content framework focusing on the following questions with respect to reverse logistics: why? what? how?; and, who?, i.e. driving forces and return reasons, what type of products are streaming back, how are they being recovered, and who is executing and managing the various operations. These four basic characteristics are interrelated and their combination determines, to a large extent, the type of issues arising from the resulting reverse logistics system. Further they mentioned, the precise influence of the four dimensions of the framework presented here (why, how, what and who) is still an open question that requires more investigation.

✿ In **2003 again Beril Toktay, Erwin A., Van Der Laan, Marisa P. de Brito** in their paper titled, *“Managing Product Returns: The Role of Forecasting”* discussed ways of actively influencing product returns and they reviewed data-driven methods for forecasting return flows that exploit the fact that future returns are a function of past sales. In particular, they assess the value of return forecasting at an operational level, specifically inventory control. Further, they mentioned there is little research on identifying factors that significantly influence returns flow characteristics. Developing a good understanding of drivers of return flow characteristics would enable better decision making for influencing return flows.

✿ In **2004, P. Georgiadis, D. Vlachos** in his paper titled, *“Decision Making In Reverse Logistics Using System Dynamics”*, reviewed on how System Dynamics (SD) can be a helpful tool when it is used in the reverse logistics field. The paper explains the basic theory of the system modeling and next, it utilizes the reverse logistics model.

Finally, an illustrative example shows how SD modeling can be used to produce a powerful long-term decision-making tool.

✿In 2004, **Subhash Wadhwa and Jitendra Madaan** in their paper titled, *“Decision Making Framework For Modeling An Integrated Reverse Logistics System”*, have proposed an alternative approach that explicitly addresses reverse logistics as an enterprise system and a novel framework for decision modeling for reverse logistics systems that is required to support handling of returned products by opting for suitable re - processing option.

✿In 2005, **Isabel Fernández** in his paper titled, *“Identification of Research Areas Within Reverse Logistics”*, A Focus Group Technique Application was used to find a gap in this area. Two groups - one of researchers and the other of managers with strong Reverse Logistics responsibilities were formed. Ideas Focus group technique was recognized as a suitable research technique when little was known about it . Ideas from both groups were intended to be confronted. It was concluded with a Scope that further research should be devoted to explore what is impeding reverse logistics knowledge and what are the mechanisms by means of which the technology spread could be accomplished most efficiently.

✿In 2005, **Maria Santos , Sylmara Dias , Paulo Almeida Souza** in their paper titled, *“Reflections on Design, Sustainability and Reverse Logistics: PET Packaging Recycling In Brazil”*, analyzed the interactions among the people that take part in PET packaging recycling in Brazil, connecting the fields of Reverse Logistics, Sustainable Product Design, and Social Inclusion. The main contribution of this research was to establish a conceptual alternative to develop products, presenting a discussion on the responsibility of designers and decision makers when performing products, according to the sustainability approach.

✿In 2006, **Mansour Rahimi and Maged Dessouky** in their paper titled, *“Sustainable Reverse Logistics for Distribution of Industrial Waste/By-Products: A Joint Optimization of Operation and Environmental Costs”*, they developed a reverse logistics model, that minimizes the operational and environmental costs of exchanging waste and by-product materials. The network contains firms, value added process centers, disposal centers, and virgin material market. The model output contains the locations of the value added process centers and the material movement that minimizes the weighted sum of the operational and environmental costs. They suggested removing regional boundary constraints and developing a global model, which incorporates international transition of waste materials and recycling activities. In this model, waste materials can be collected from one country and recycled in another one.

✿In 2007, **Lixi Zhang** in his paper titled, *“Vehicle Routing in Reverse Logistics”*, presented a model of VRP with simultaneous delivery and pick-up, highlighting the main differences between traditional vehicle routing problems in forward logistics and those in reverse logistics. Further, he suggested that future research will advance the application of GA of VRPSDP by integrating forward and reverse logistics for pick-up and delivery concurrently with heterogeneous vehicles with different types of goods in the deliveries and pick-ups.

✿In 2008, **Dusan Stefanovic and Nenad Stefanovic** suggested the methodology for modeling and analysis of supply networks. The goal of this paper was to point out the possibility of establishing relationships between processes in supply networks and functioning of the whole system. As the output, the aggregate of relevant parameters for the evaluation of model functioning were derived. This concept presents the basis of virtual framework for supply network simulation.

✿In 2009, **Guang-fen Yang, Zhi-ping Wang and Xiao-qiang Li** in their paper titled, *“the Optimization Of The Closed-Loop Supply Chain Network”*, developed a model of a general closed-loop supply chain network, which included raw material suppliers, manufacturers, retailers, consumers and recovery centers. The objective of this paper is to formulate and optimize the equilibrium state of the network by using the theory of variational inequalities. The model could also be further extended in several directions. For example, if recovery centers transact with the manufacturers in other supply chains to produce other products, this may lead to *“open”* systems. Another extension of the research in this paper is to integrate the closed system and the open system to the green-supply chain network. They are the authors' intention to explore in future work.

✿In 2009, **Xiaoye Zhou and Miao Zhang** in their paper titled, *“Research on Reverse Logistics Network Design of Household Appliances Based on Green Logistics”*, introduced the connotation of the household appliances reverse logistics, analyzed the characteristics of the household appliances reverse logistics based on green logistics, followed by comparison between household appliances reverse logistics and general reverse logistics; then gave the network

construction elements; and finally, put forward suitable design methods for such a network.

✿ In 2009, Lihong Shi, Houming Fan, Pingquan Gao, and Hanyu Zhang in their paper titled, “*Network Model and Optimization of Medical Waste Reverse Logistics by Improved Genetic Algorithm*”, presented a Mixed Integer Linear Programming model with minimizing costs for medical waste reverse logistics networks. An improved genetic algorithm method with a hybrid encoding rule was used to solve the proposed model. The efficiency and practicability of the proposed model was validated by an application to an illustrative example dealing with medical waste returned from some hospitals to a given manufacture. They further mentioned that future research should be to investigate the performance of the medical waste reverse logistics network including real-data. Also, the study aimed to discuss other heuristic algorithms combined with GA to solve the mixed integer linear programming model in the study.

✿ In 2009, Inmar in his paper titled, “*Automotive Aftermarket Reverse Logistics Opportunities*” provided information that will help assess reverse logistics opportunities within the organization. Part 1 identified known challenges within the physical, financial, and information automotive aftermarket to reverse supply chain flows. Part 2 provided benchmarking information that included results from a survey conducted by the Automotive Aftermarket Suppliers Association (AASA) in 2009, and case study success stories from industries with mature reverse logistics programs.

Application of the information to specific business objectives provided a framework for building a program or enhancing an existing returns program for improved profitability and sustainability.

✿ In 2010, Mehmet Ali Ilgin and Surendra M. Gupta in their paper titled, “*Environmentally Conscious Manufacturing And Product Recovery (ECMPRO): A Review Of The State Of The Art*”, investigated the literature by classifying over 540 published references into four major categories, viz., environmentally conscious product design, reverse and closed-loop supply chains, remanufacturing, and disassembly. Finally, they concluded by summarizing the evolution of ECMPRO over the past decade together with the avenues for future research.

FORECASTING THE RETURNS

The issue of forecasting returns can be taken up under the assumption that all policies concerning returns have been determined and data collection on returns has started. The first step in any forecasting exercise is to build a forecast model that models the variables to be predicted as a function of the explanatory variables. For example, the variable to be predicted may be the return quantity in the next period, and the explanatory variables can be past sales. This forecast model will have a number of parameters that need to be estimated using historical sales and returns data. Once the validation and estimation phase is complete, a fully specified forecast model can be designed. As the second step, forecasts of future returns are made using parameter estimates obtained from this forecast model and historical information.

PLANNING FOR THE RETURNS

When faced with a product failure or any issue that requires products to be returned, answering these five questions gives manufacturers a reliable plan of action:

✿ **Who Controls The Process?** : A plan is only as good as the people who execute it. Create a reliable team that takes responsibility for the plan. Everyone needs to know what their role is and be able to execute the plan on a moment's notice. The returns should be through again a strong supply chain network with Reverse logistics as an integral part.

✿ **How To Communicate It?** : All recalls need to be quickly communicated to the internal staff, stores selling your products and end-users. Inform employees! While everyone at the organization needs to be apprized of the situation, the most important people are those who will handle the external communications and those present at the warehouse/receiving center. The first step is to create a checklist of activities that need to be done for communicating outward. Next, identify who needs to be spoken with, and what the priorities are for outreach. The products distributed today are tracked by the case and pallet levels. Lot numbers are typically tracked over a period of time, so the better the time-based view of inventory within each lot, the better limits or controls the organization can have on a recall. If you know that an issue occurred at a certain time, all inventory in the lots affected can be proactively managed. With serialization of inventory, each product is uniquely identified (i.e. timestamps within a lot), so the better the serialization, the better is the visibility in managing product recalls. Dell set up a website so that customers

could enter the numbers on the bottom of their laptop and the site would automatically recognize which batteries needed to be returned. Not only did Dell reduce the numbers of “missed” returns, they were able to communicate with the customer specifically what they needed to do to send products back and proactively let customers know when a replacement product would be available.

✿ **What's Wrong With It?** : Determine the scope of the problem. The key is to have a system in place that diagnoses the problem quickly. Not all recalls are a total loss, so find out what value remains in the products that can be recaptured. Communicate to the end-user what is wrong and how you can correct the issue. Sometimes, all it takes is a replacement part or an upload of a software patch. If there isn't a simple fix, communicate this down to the end-user and be up-front about the worst case-scenario. If you can't define the select set of customers affected, it may be best to send your whole customer base a notice. Customers would rather be forewarned, than not warned at all. So, don't leave any rocks unturned.

✿ **Where Do I Accept It?** : Establishing a central location where all returns are accepted, recorded and assigned a chain of custody is the critical next step in ensuring control over the process. Recalls can often cause chaos. Automate processes so that the receiver knows exactly what to do with products, depending on what's wrong with the product. Good communication is essential at this stage: customers want to know that a credit or replacement is on the way.

✿ **What Do I Do With It?** : There are really only three options: resale, reclamation of critical components or destruction. Each requires systems and infrastructure that will ensure that resolution is complete, regulations are complied with, and that the best possible outcome where loss is minimized is achieved.

HANDLING RETURNS IN THE ENTERPRISE

✿ **Commercial Returns Cases:** Commercial returns occur in a wholesaler or a retailer, where the buyer has a right to return the product, usually within a certain period.

✿ **Service Returns Cases:** Within service systems, returns may originate in three ways.

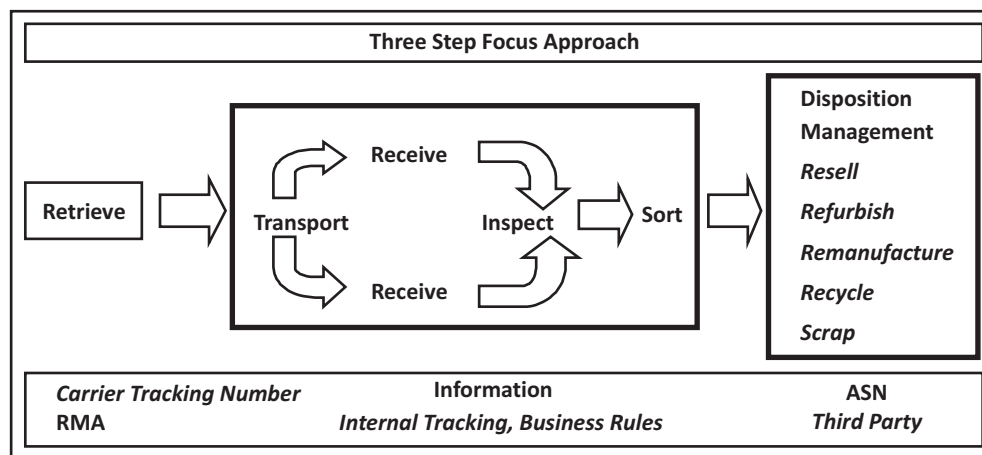
✿ The products themselves may be brought or sent to a center for repair. If the repair is successful, they are brought back, else, a new product or system needs to be bought and the failed one is discarded.

✿ If one needs a continuous functioning of the product or the system, one may directly replace the system or part by a spare one. The failed system or part is then repaired later, after which, it will enter the inventory of spare systems or parts. Finally, in order for such a replacement scheme to be successful, service engineers need to have replacement parts with them to do the repair.

✿ The leftover parts needed to be returned to the parts warehouse.

✿ **End- of-use Returns Cases** : This return reason concerns items that are only temporary needed by a user. The product may either be leased, rented or temporary given into the authority of the recipient. The latter is the case with

Figure 1 : A Typical Three Step Focus Approach Of Reverse Logistics



Source: http://www.rlmagazine.com/img/edition04_ups.jpg

distribution items, that is, products like containers, bottles, railcars and crates, which are used for distribution purposes.

✿ **End-of-life returns cases :** Products and systems not only age intrinsically, but also because their environment puts higher requirements on them. This is especially the case for computers and electronic equipment. End-of-life returns, if they are that aged that their functionality (if available) is far below actual standards, may still function satisfactorily and hence, they can be used as source for spare parts for similar systems.

NOTABLE APPLICATIONS OF REVERSE LOGISTICS

✿ Refilling of LPG gas cylinders by petroleum companies like IOC, HP etc.

✿ Refilling of Glass bottles for cold drinks like Coca Cola, Pepsi etc.

✿ In case of Alloy Steel bars supplied to auto and engineering industries, the manufacturing plants have to frequently take the goods back on account of composition variations or internal defects in product and reprocess or resale to other types of users from warehouses or taking these right back to the Manufacturing facility.

✿ Occasional recall of cars by major Auto suppliers when some defects are found in transmission, chassis or other parts of automobiles for repair or refurbishing.

✿ Waste and packing material recycling is now being strictly enforced in many countries led by Germany. Here, the FMCG manufacturers have jointly promoted the Dealers System Deutschland (DSD), with common funding, for collection packaging waste of FMCG Products.

✿ Buyback of old batteries are now mandatory as per the government norms.

CASE STUDIES

PHILIPS: CASE STUDY

Philips Australia and Philips New Zealand dramatically improved accuracy and responsiveness in their transactions with product repairs, using an ECN-developed online claim validation, invoice and payment management system.

✿ **The Business:** Philips in Australia and New Zealand is a leading healthcare, lifestyle and technology company, with an annual turnover of more than \$500 million. Its consumer electronics products range from LCD & Plasma TV, home and portable entertainment systems to PC products, phones and household appliances.

✿ **The Issue :** Philips needed to replace the manual, paper-based warranty claim/invoicing and payment system it operated with 450 accredited repair centres in New Zealand and Australia.

✿ **The Reason:** One in four invoices from repairers contained basic errors or lacked key data such as model and serial numbers, sale or failure dates, part numbers, hours worked and customer contact details. With most repaired products already returned to their owners by the time invoices went to Philips, it became very difficult and time consuming to obtain the corrected data.

✿ **The Result:** Because of the delays and related expenses in gathering and re-checking the revised data, the result was lengthy processing (and ,therefore, invoice payment) delays often up to several months, and additional costs to Philips. This also caused cash flow problems for the repair centres and Philips wasn't able to accurately track trends in product interventions that were happening in the field.

✿ **The Solution:** Using ECN's Internet-based solution, Philips repairers now enter repair information into a system that has built-in validation processes that check each claim for accuracy and completeness in real time. Through this advanced validation process, invoices that have been approved automatically by the system are transferred directly via EDI to Philips' financial management systems for timely payment to the repairers. The repairer also receives instant notification of acceptance of the claim. As the data now has a very high degree of accuracy, it can be confidently used to identify and act on product repair patterns, and Philips staff (including the customer help desk) can use the system to view, track, trace, manage and archive claims.

✿ **The Benefits :** Philips has slashed error rates and saved \$300,000 per year in direct costs - and its processing and payment approval process now takes less than one day, not months, which means improved cash flow for the repair network and accurate data that Philips can use for statistical analysis.

✿ Philips also:

- ✿ Has real-time access to information on product issues and opportunities;
- ✿ Has a single, integrated system that copes with the diversities of its marketplaces (such as different products and warranty periods in New Zealand and Australia);
- ✿ Can load updates and other changes easily, keeping its repairers up to date on new products, product changes and pricing information;
- ✿ Has been able to redeploy its staff to more valuable roles within the organization.

PANASONIC GETS A SMART SOLUTION FOR PRODUCT RETURNS: A CASE STUDY

✿ **Business Objective:** Consumer electronics supplier Panasonic needed a better way of controlling product returns, which could see goods being sent back to its warehouse incorrectly by retailers.

✿ The Issue:-

✿ Panasonic required an alternative solution to the paper-based process of handling product returns, which was causing problems for their warehouse staff, finance department, retailers and consumers. A headache for many manufacturers of consumer goods is providing a simple way for everyone in the supply chain to handle product returns.

✿ For Panasonic, and the retail chains it supplies, this was causing an expensive confusion of returned goods arriving at Panasonic's warehouse without the proper checks by retailers and without complete paperwork.

✿ **The Solution :** Panasonic has found a solution in ECN ERL® - or Enterprise Reverse Logistics® - from supply chain and logistics specialist The ECN Group.

ECN ERL® (Enterprise Reverse Logistics) is an online service which guides retailers through a step-by-step process to all Panasonic's repair and return policies for each one of its thousands of products. ECN ERL has simplified the process by allowing manufacturers like Panasonic to put their policies and rules for numerous products on a single website, which works out the right actions for the return in the website and can also have multiple suppliers doing the same - thus allowing retailers and others to view and use one site. Panasonic has been quick to adopt ECN ERL, and is gradually bringing its retail partners onto the system.

"Retailers have to try to keep staff informed about how different brands handle returns. One of the benefits of this system will be you go to the one website and all suppliers' policies, all their steps and procedures, are all laid out for them and they just have to put the data in the web site where ERL will work out the right actions for them." For Panasonic, the system has introduced more rigour and efficiency into the processing and payment of credits. Retailers and repair agents have also gained visibility of the process.

Panasonic tried out ECN ERL with retailer Appliance Shed, which has three Auckland stores. John Green, who looks after returns for the chain's Glenfield store, gives the system a ringing endorsement.

"For a weekend, if you get a customer with a problem that you're not quite sure how to handle, the website will give you suggestions of how to tackle it. It will give you a decision there and then about whether a product needs to be repaired or replaced, whereas otherwise, you'd have to tell the customer to wait till Monday," Green says. *"In that respect, it's very satisfying for both the customer and ourselves."*

Jayne says Panasonic has been able to input business rules into ECN ERL for thousands of their products, with prompts for the retailer to eliminate issues caused by the end user. The system then leads the retailer down the right repair or replacement path, depending on product type, price and warranty terms.

✿ Business Benefits

- ✿ Reduced costs through efficiencies in freight, repair, and the correct and visible application of processes.
- ✿ Better service for retailers and consumers.
- ✿ Products sent to correct local repairer, rather than turning up at the warehouse.
- ✿ Consistent process by all retailers and other agents handling Panasonic returns

Panasonic also has commercial clients who buy products directly from Panasonic. As they don't have a store to return products to, they call the Panasonic call centre. The call centre then uses ECN ERL to process the return, extending the

benefits of the system to these commercial clients too.

Store returns are also an issue for Panasonic. This can be where the wrong product is delivered by Panasonic to a retailer, or it gets damaged in transit. These returns are different from consumer returns and have different decision points and rules. ECN ERL has a separate wizard for store returns, which reflects the different rules Panasonic and its retailers have. However, just like consumer returns, ECN ERL applies Panasonics rules to each store return via the same ECN ERL web site.

CONCLUSION

To arrive at a strategic framework for improved Reverse Logistics practices, it is needed to understand that it leads to more profitability and improved customer satisfaction. It will even be accounting towards increased social responsibilities by the enterprises as there are serious issues of landfills and environment. A strong Reverse Logistics must be an integral and essential part of Supply Chains. This will lead to increased credibility of the enterprises. Further DFX strategies for manufacturing can be framed in context to environmental Designs. Issues of inventory management in case of mass customization scenario, perishable goods, buy back contracts, quantity flexibility contracts can be provided with strategic framework of Reverse Logistics.

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