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Reverse Logistics Performance Indicators: A conceptual Framework for evaluating reverse logistics services

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ABSTRACT : *The growing environmental concern worldwide, forced companies to engage in reverse logistics, such as re-use of products and materials, and recycling. Practically, most of the companies deal with returns of some nature because of issues such as marketing returns, damage or quality problems, overstocks, refurbishing, or remanufacturing. Handling returns present a great challenge for companies, while in many cases becomes a necessity for keeping customers' satisfaction to a certain level. Reverse logistics operations in a supply chain may be considered as an introduction to innovative services of a company's portfolio. They may have an important impact on a firm's strategic performance in terms of market effectiveness, as well as, internal cost efficiency. Through reverse logistics innovation, it may be possible to expand revenue through market growth due to account customization, service augmentation, and improved customer satisfaction. Reverse logistics is becoming an area of competitive advantage. At the same time the drive for `total quality control' has strongly enhanced the interest for performance indicators in many companies. Introduction of these indicators has begun to be of great importance for many products and services too. Performance indicators are the criteria with which the performance of products, services and production processes can be evaluated. Besides, performance indicators are operationalized process characteristics, which compare the efficiency and effectiveness of a system with a norm or target value. Performance Indicators (PIs) provide management with a tool to compare actual results with a pre-set target, and to measure the extent of any deviation. This tool is extremely important for forward logistics, as well as, reverse logistics. Reverse Logistics metrics are essential to managing and improving a Reverse Logistics operation, both for companies and third party Reverse Logistics service providers. Performance indicators are something new in many business areas, and in the field of Reverse Logistics is something that hasn't been discussed much in the literature. In order for companies to be able to assess the success of reverse logistics channels or reverse logistics chain, performance indicators need to be identified and evaluated. Innovative reverse logistics services combined with these metrics, lead to a more responsive organization. The aim of this paper is to develop a framework which will define the metrics that can help to develop successful Reverse Logistics operations.*

Keywords: *innovative services, reverse logistics, performance indicators, quality metrics.*

I. INTRODUCTION

Necessity of performance indicators in Reverse Logistics

During the last decades the diffusion of environmental management techniques along the entire supply chain of a product has become a common way of encouraging improved environmental performance of an industry. Reverse logistics comprehends both the return flow of products, as well as, recovery and recycling activities, the keys to which lie in the generation of profits for companies. Reverse logistics also include other alternatives with this same goal: repair, renovation and reprocessing. Stock et al. (2002) argue that reverse logistics should not be viewed as an extra cost to standard business operations. Instead, they propose that reverse logistics – including the remanufacturing, refurbishing, recycling, reuse, or disposal of goods – should be seen as an opportunity to build competitive advantage. Efficient reverse logistics have the potential for significant positive bottom-line economic contributions, as well as, yielding customer service-related benefits (Rogers and Tibben-Lembke, 1999).

Reverse Logistic services include customer satisfaction, inspection of reverse logistic activities, repacking, relabeling, restocking, warehousing, repricing as used/overstocked or renaming products, financial credit processing, visibility, and transport of products (Fleischmann et al., 1997, Meade et al., 2007). The value of reverse logistics services strongly influence the performance of the supply chain and therefore, reverse logistics services need to be measured through the use of proper indicators. Performance indicators can be recognized in almost any activity that can be measured: it is sufficient to agree on a certain performance and see to which extent this is realized. Metrics are needed to evaluate how work is done and to direct the activities, since what is been measured indicates how companies intend to deliver value to our customers (Ritchie, 2000). Incorrect performance measurement systems can create disincentives and unwanted behaviour. Measurement of the performance of various logistics functions (internal and external) should focus on time, quality, availability,

cost, profit and reliability. These metrics may be financial (i.e. cost and revenue) or non-financial (service and productivity) and should include the critical success factors for all the levels of the business (Ross, 2002).
In this paper first, a brief literature review regarding performance indicators in logistics and reverse logistics is presented. Second, the performance indicators for reverse logistics are selected, and finally, a framework for evaluating reverse logistics services through performance indicators is developed.

Literature Review of Performance Indicators for reverse logistics

Performance indicators are the criteria with which the performance of products, services and production processes can be evaluated. Besides, performance indicators are operationalized process characteristics, which compare the efficiency and/or effectiveness of a system with a norm or target value (Van der Vorst, 2000). Performance Indicators provide management with a tool to compare actual results with a pre-set target, and to measure the extent of any deviation. This tool is extremely important for forward logistics and reverse logistics (Stank et al., 2003). Different methodologies for the categorization of indicators have been presented in many studies, stressing the importance of quality service in the logistics field (Stank, et al. 2003, Van Hoek, 1998, Gunasekaran, et al. 2001, 2003, 2007).

There are several metrics in the literature and in business organizations recommended for use in measuring the performance of a SCM system (Gunasekaran et al. 2002, 2003, Folan and Browne 2005, Trebilcock, 2002). Metrics such as service quality, decrease of logistics cost, cycle time of the product, productivity, and freight cost per unit shipped are suitable for measuring the performance of reverse logistics too (Barber, 2008, Li et al., 1999, Larsen, 2000, Parker, 2000, Gunasekaran, 2003).

Reverse Logistic Association identifies and defines the sectors of Reverse Logistics Performance Indicators, which can be used for measuring the performance of reverse logistic supply chain. These sectors are: Customer Satisfaction, Financial Performance, Internal Business Process Perspective, Warehousing, and Transport. (figure1). For each of these sectors Performance Indicators are selected and presented in table 1.

Figure 1: Sectors of Reverse Logistics Performance Indicators
Source: http://www.rlmagazine.com/edition11p50.php

Customer Satisfaction

There has been a general acceptance of relations of service quality with improved supply chain performance (Nitin et al., 2006). As customers become increasingly sophisticated in their purchasing decisions and environmental laws take root, many companies will seek new ways to develop or enhance return systems, in order to achieve customer satisfaction. On the other hand, customer's satisfaction leads to customer loyalty, which is actually the result of an organization creating a benefit for a customer, so that they will maintain or increase their purchases from the organization.

There are many factors that affect customer satisfaction. Li and O'Brien (1999) proposed a model to improve supply chain efficiency and effectiveness based on four criteria: profit, lead-time performance, delivery promptness and waste elimination. Beamon (1999) suggested a system of three dimensions: resources (i.e. efficiency of operations), output (i.e. high level of customer service), and flexibility (i.e. ability to respond to extraordinary customer services requests). Aramyan et al., (2007) has developed a framework for reverse logistics chain performance indicators, which are grouped into four main categories: efficiency, flexibility, responsiveness and traceability.

According to Wisner (2003), customer satisfaction is affected by the behavior of the employees (courteous, knowledgeable, helpful), accuracy of billing, billing timeliness, competitive pricing, service quality, delivery, good value, billing clarity, quick service and flexibility. For the majority of customers quality comes first. Prompt delivery, extra costs and information regarding the available reverse logistic services affect the quality of the reverse logistic services. The customer must obtain sanctions and approvals for the payout, as well as answers to questions in the process, since price escalations irritate customers (Barber, 2008).

Financial Performance

As competitive and economic pressures continue to have a significant impact on the service segment, many companies see the reverse logistics service chain as a process that may be used to manage costs and drive additional revenues through the management and tracking of the return, repair, refurbishment and remarketing of assets (Persson et al. 2002). In addition, many firms are also taking a greater interest in the disposition of spent assets and the ways in which costs can be further contained and additional revenues can be driven out of existing reverse logistics operations. Traditional business performance measures have been mostly financial – measuring rate of return on investment, cash flow and profit margins (Gunasekaran et al., 2007). In financial performance the reverse logistic services of repricing such as used/overstocked or renaming products and financial credit processing are also included.

Typical indicators for financial performance are these which measure how effectively the firm is using its resources, these which measure the extent to which the firm has been financed by debt, these that measure management's overall effectiveness in generating profits and these that measure the firm's ability to maintain its economic position in the growth of the economy and industry (Li et al. 1999).

According to Barrat (2004), performance indicators should relate to both effectiveness and efficiency of the supply chain and its actors, such as the economic growth of the industry. The percentage of sales from recycled or remanufactured products is also important for the financial performance of the reverse logistic chain, an indicator that is proposed by the authors. Reverse flow offers profit margins to the company, increase the number of its customers', help the company to gain different markets, and the above indicator can easily quantify these results of reverse flow.

Internal Business Process Perspective

The strategic focus of the Internal Business Process Perspective is to determine the business processes an organization must excel, in order to satisfy both its shareholders and customers. In this perspective there are three processes included (Bititci et al, 1997). The innovation process, for which the management should choose measures that would enable a business to identify future customer preferences, and deliver new products that satisfy such preferences. For the operations process, management should focus its measures on the efficient, consistent, and timely delivery of products and services to customers. Furthermore, the postsale services process includes time (response time to complaints), quality, and cost (number of customers handled on a service call), warranty, repair, and customer after sale service (Sanders et al., 2002). In the internal business process perspective the service of inspection of reverse logistics activities is also included. Typical indicators are percentage of sales from new products, new product introduction compared to competitors, time-to-market, and many traditional indicators such as quality, productivity, and cycle time (Larsen, 2000). A critical indicator can be the introduction of new products in the supply chain, which will result in the expansion of offered products and services of the company.

Warehousing

Warehousing facilities and operations play a vital role in the overall supply chain process, which includes reverse logistics. Warehouses should achieve both efficiency and effectiveness in supply chains, and provide some perspective on current challenges. The proper operation of the warehouse can turn the loss due to the cost of disposal into a profit for the company, as well as, improving customer satisfaction (Dabholkar, 2000). At a company that operates reverse logistics, any item that has been returned is received into the warehouse and stored until it is examined for repair or enter the next hub in the reverse logistics channel. This shows the extremely high value of warehouse space, for reverse logistics operations. Reverse logistics services such as repackaging, relabeling, restocking are also included in warehousing. Some performance indicators of warehouse for reverse logistics are the cost of the process to receive back product, productivity (volume received per man-hour), quality of returned products, quality of the package of the products, and cycle time (time taken to process a return to the next hub of reverse logistics channel) (Beamon 1999, Parker, 2000). We believe that critical indicators can also be the cost of the collection, which increases warehousing costs, as well as the quality of the returned products, which affects time and materials that will be needed for the processes of repackaging and relabeling.

Transport

The role of transportation in reverse logistics is essential as, inbound and outbound transportation are the lifeblood of reverse logistics operations. The services of transport of the returned products, the redistribution as well as the visibility are also included in transport. Without proper transit of returned goods from the point of consumption to the processing service centers and then shipping the remanufactured products to new customers, reverse logistics operations cannot be sustained. The transportation of various raw materials and products in different stages of their manufacture is a very complicated process that involves many firms, places, and miles. Transportation costs play, an important role in the viability of the entire reverse logistics system (Hobbs, 1996). If the transportation cost is prohibitive, the viability and profitability of reverse logistics systems will be severely curtailed.

Section of Reverse Logistics performance evaluation	Performance Indicator	Literature
Customer Satisfaction	knowledgeable employees, helpful employees	Nitin et al. (2006)
	competitive pricing	Aramyan (2007), Barber (2008)
	service quality	Barber (2008)
	delivery	Beamon (1999), Li et al. (1999)
	quick service	Thonemann (2002)
	flexibility	Beamon (1999), Wisner (2003)
	Customer loyalty	Nitin et al. (2006)
Financial Performance	effectiveness in generating profits	Persson (2002)
	ability to maintain its economic position in the growth of the economy and industry	Barrat (2004)
	Decrease of logistics cost	Li et al. (1999)
	Return on Investment	Gunasekaran (2007)
	% of sales from recycled or remanufactured products	*Proposed by the authors*
Internal Business Process Perspective	new product introduction in order to expand reverse logistics services (compared to competitors)	*Proposed by the authors*
	Cost of the process, quality	Franceschini (2000)
	Innovation	Bitici et al. (1997)
	Quality control of the process	Li et al. (1999)
	Cycle time of the product	Larsen (2000)
	Response time to complaints	Sanders et al. (2002)
	Number of customers handled on a service call	Sanders et al. (2002)
Warehouse	cost of the process to receive back product	*Proposed by the authors*
	productivity (volume received per man-hour)	Parker (2000)
	quality of returned products	*Proposed by the authors*
	quality of the package of the products	Van de Vorst (2000)
	Cost of disposal	Dabholkar (2000)
	cycle time (time taken to process a return to the next hub of reverse logistics channel)	Beamon (1999), Parker (2000)
Transport	% utility of cargo capacity or truckload	Lai et al. (2002)
	transit time	Hobbs (1996)
	freight cost per unit shipped	Gunasekaran (2003)
	number of units delivered over a period of time and different points of loading	Lambert et al. (2000)
	combination of forward and reverse flow regarding the allocation of products	*Proposed by the authors*

A performance indicator for reverse transport can be the percentage utility of cargo capacity or truckload. Other, obvious indicators include transit time, freight cost per unit shipped, number of units delivered over a period of time and different points of loading, and combination of forward and reverse flow regarding the allocation of products. (Franceschini et al. 2000, Perlman, 2009) Finally an important indicator is the combination of forward and reverse flow of the products, as it can minimize transportation costs and multiply customers' satisfaction at the same time, an indicator that is proposed by the authors.

A conceptual framework for evaluating reverse logistics services

The conceptual framework that is proposed in this paper present selected performance indicators for evaluating reverse logistics services taking, into account the four different level of activities of reverse logistics, and are presented in figure 2.The reasons that may cause the reverse flow must be taken into consideration. They have been discussed by many authors (Hillegersberg 2001, Rogers et al. 1998, 1999, De Britto 2002 Halldórsson 2007), and include defective products, return policies, products' specification, inventory volume, environmental laws, expiration date, after sales services, warranty issues and decision for getting out of a specific market.

There are activities that should be performed when a product enters the reverse flow. The four different levels of reverse logistics activities include collection, inspection, recovery, reuse, repair, reclamation of materials, remanufacture, refurbish, recycle and redistribution (Chad et al. 2001; Dowlatshahi, 2000; De Brito et a. 2002; Gonzalez et al. 2004). After the determination of the provided reverse logistics services key performance indicators are developed. The development of the key performance indicators should be specific, measurable, action-oriented, relevant, and timely, forming a balanced set, aligned with strategies, philosophies and incentives, comprehensive and consistent. Once the strategic goals for reverse supply chain are defined, according to business strategy, it's necessary to define the metrics that best suit the objectives in order to implement them, to set rules for collecting, analyzing, and distributing data, as well as, to develop appropriate tools to help decision making. The performance indicators that are used in this framework have been selected and presented in table 1. After their evaluation, necessary modifications and changes are executed in the activities that are not performing according to the set goals.

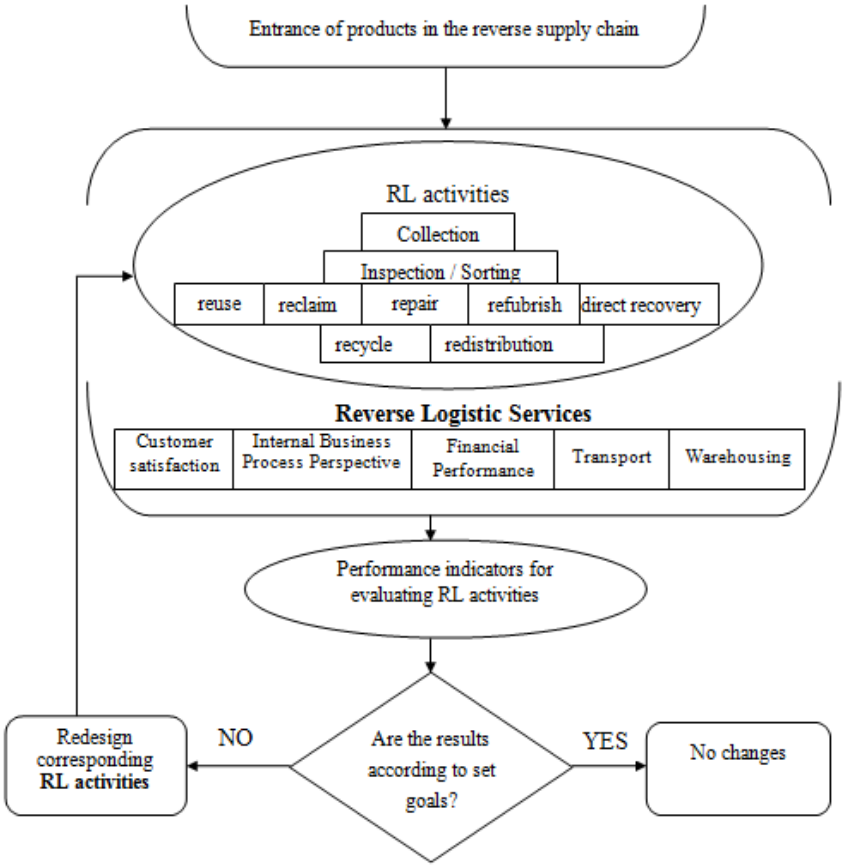

Figure 2: The conceptual framework for evaluating reverse logistics services

II. CONCLUSION

In their book on Supply Chain Management, Handfield and Nichols (1999) state that ‘‘in effect, performance measurement is the glue that holds the complex value-creating system together, directing strategy formulation as well as playing a major role in monitoring the implementation of that strategy’’. Therefore performance measurement is crucial in every chain of the extended supply chain, which includes reverse logistics.The necessity for performance measurement is even bigger in reverse logistics as it is an area that has become a real challenge for managers of the new enterprise environment. By developing suitable performance measures, managers can make right decisions regarding their reverse logistics operations that would contribute to an improved organizational competitiveness. Performance Indicators provide management with a tool to compare actual results with a pre-set target, and to measure the extent of any deviation. In this paper a selection of logistics performance indicators through a literature review was performed, in order to develop a framework for the evaluation of reverse logistics services An empirical research through a questionaire is underway, taking into consideration the framework..

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