Computers & Industrial Engineering 61 (2011) 561–581

Contents lists available at ScienceDirect

Computers & Industrial Engineering

journal homepage: www.elsevier.com/locate/caie

A reverse logistics decisions conceptual framework ☆

Serge Lambert [a,1], Diane Riopel [b,2], Walid Abdul-Kader [c,*]

[a] Université du Québec à Trois-Rivières, Département de génie industriel, C.P. 500, Trois-Rivières, Québec, Canada G9A 5H7
[b] Departement of Mathematics and Industrial Engineering, École Polytechnique de Montréal, P.O. Box 6079, Station Centre-Ville, Montréal, Québec, Canada H3C 3A7
[c] Department of Industrial and Manufacturing Systems Engineering, University of Windsor, Windsor, Ontario, Canada N9B 3P4

ARTICLE INFO

Article history:
Received 13 January 2010
Received in revised form 23 February 2011
Accepted 23 April 2011
Available online 29 April 2011

Keywords:
Reverse logistics
Conceptual framework
Management
Decision making process

ABSTRACT

This research work proposes a reverse logistics decisions conceptual framework that offers flexibility and covers a wide variety of situations that may arise in the practical working environment. The methodology adopted in this paper is inspired by and taken from the various research papers published in the literature. The proposed framework considers seven important elements of the reverse logistics system. It is divided into three hierarchical levels (strategic, tactical, and operational). By carrying out experimentation with the proposed conceptual model, all three levels were tested in different industrial sectors during its development. Three real-world case studies are presented to test and to show the flexibility and applicability of the framework. The proposed conceptual framework will help practitioners in the field to structure their reverse logistics activities and also help academics in developing better decision models.
© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Reverse logistics (RL) is the process of planning, implementing, and controlling the efficient and 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 (Rogers & Tibben-Lembke, 2001). Moreover, it prevents pollution by reducing the environmental burden of End-of-Life (EOL) at its source (Toffel, 2003). The rise of green concerns makes reverse logistics a time demanding and relevant area of interest. Recycling, remanufacturing, and disposal are the three main factors in this arena for facing the challenges of globalization and sustainability. Available holistic literature and theory on developing a reverse logistics system is still very limited. In general, the related literature and resources found in this area usually lack in-depth insight with respect to the processes that construct such a system.

The directive of the European Union (EU) on Waste Electrical and Electronic Equipments (WEEE) works very effectively on electronic manufacturers for the collection and proper disposal of their End-of-Life (EOL) products. Although different countries have their own regulations for recycling and disposal of by-products and waste, European legislation is generally believed to be more advanced and as such, provides guidelines for other countries. For example, the Japanese government has been following a planned strategy since the early 1990s under the basic 3Rs directive–Reduce, Reuse, Recycle (Department of Trade, 2005).

In addition to green proactive concerns, there are many reasons which may push a company to implement reverse logistics (RL): they may be legal, economic, or commercial. Legal motivations are one of the most effective, but are not necessarily the most welcomed. In the case of the WEEE directive, governments enforce manufacturers to be responsible for the entire lifecycle of their products for the purpose of sustainability. Economic factors act as the second motivation for implementing RL. For example, the case of recycling used cars where the scrap yard takes back the car, removes all valuable components for resale, and sells the rest for its metal value. This process usually generates profits. The EU directive on End-of-Life (EOL) vehicles requires automakers by 2006, to reuse or recycle 85% of an EOL automobile's weight and 95% by 2015 (Toffel, 2003). Every year, Black and Decker, a renowned consumer electronics company generates revenue of $1 million from their remanufactured products (Alvarez, Berrone, Husillos, & Lado, 2007). For this company, the organizational slack has a positive effect on reverse logistics to meet the demand of both internal and external pressures. The third motivation for implementing RL is for commercial reasons which actually means that the business contacts dictate the terms for returning products, as in the case of unsold or defective products, or those requiring service. Trust and commitment from both sides is essential in this case. But no matter what factors are considered for the successful implementation of reverse logistics, the choices made by top management and individual attitude (proactive or conservative) are the

☆ This manuscript was processed by Area Editor Mohamad Y. Jaber.
* Corresponding author. Tel: +1 519 253 3000x2608; fax: +1 519 973 7062.
E-mail addresses: serge.lambert@uqtr.ca (S. Lambert), diane.riopel@polymtl.ca (D. Riopel), kader@uwindsor.ca (W. Abdul-Kader).
[1] Tel.: +1 819 376 5011x3907; fax: +1 819 376 5070.
[2] Tel.: +1 514 340 4711x4982; fax: +1 514 340 4173.

0360-8352/$ - see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cie.2011.04.012

two most critical determinants in the decision-making process (Alvarez et al., 2007).

The importance of RL is difficult to evaluate because it is often embedded within other processes in a company's logistics infrastructure. Stock (2001) estimates RL to be about 4% of the total logistics cost. To put this figure in perspective, the total transportation costs in the United States in 2004 reached $636 billion according to Wilson (2005), meaning that approximately $25 billion were spent on RL transportation costs. After adding obsolescence and revenue loss, this figure greatly increases. In the United Kingdom, about 40% of RL costs are attributable to inefficient processes as reported in Tulip (2004). In 2005, the cost of RL in North America was estimated at about $46 billion (Blumberg, 2005). Total transportation costs were up 14.1% and total inventory carrying costs increased by 17% (Wilson, 2006). With increasing fuel costs, logistics costs will continue to rise.

The absence of a complete RL decisions conceptual framework could explain these astonishing figures (Pimor, 2003) as RL literature is indeed very limited on the subject. Stock (1998) explains that a company that wishes to engage in RL must first map its business processes and put in place an activity-based costing system, but does not present a generic roadmap to successfully implement RL. Later, for controlling the returned products, a process map is generated (Stock, 2004). Carter and Ellram (1998) explain the different actors affecting reverse logistics, namely suppliers, governments, buyers and competitors. They also propose a hierarchy of reverse logistics ranging from resource reduction to disposal in landfill. By establishing appropriate strategies and programs, the problems related to the returned products can be eliminated significantly (Stock, Speh, & Shear, 2006). Reverse logistics represents one of the largest and most overlooked opportunities to facilitate return profits to a company. Currently, very few companies are doing a good job in addressing this issue. Most companies are overlooking their reverse logistics supply chain and are missing opportunities to improve customer satisfaction and loyalty (Vitasek, Manrodt, & Murphy, 2005). Chopra and Meindl (2007) propose a framework for designing a supply chain in four phases without any reference to reverse logistics. In light of the lack of the state-of-art literature on successful implementation or comprehensive undertaking of RL, this paper proposes a decisions conceptual framework that includes the generic business process, the decisions, the economic aspects, and the performance specific to RL activities. Through an extensive review of the literature, the paper identifies the most important and relevant elements to address RL activities in a comprehensive manner. In addition and based on a qualitative approach, the proposed decisions framework is divided into hierarchical levels: strategic, tactical, and operational. This segmentation is helpful in assigning different responsibilities to the proper levels of management.

The remainder of the paper is organized as follows: Section 2 begins with a literature review. Section 3 presents the methodology used to develop the framework. Section 4 elaborates and discusses the structure of this proposed framework. Section 5 presents an application of the framework to real-world industries where three case studies are addressed. Finally, conclusion and recommendations for future research are presented in Section 6.

2. Literature review

Fleischmann, Bloemhof-Ruwaard, Dekker, Van Nunen, and Van Wassenhove (1997) subdivide reverse logistics into three main areas; these are: distribution planning, inventory control, and production planning. They present a survey addressing the logistics of industrial reuse of products and materials from an Operational Research perspective. More recently, Meade, Sarkis, and Presley (2007) categorize the reverse logistics literature from 1998 to 2006 into four research categories: empirical, theoretical, conceptual and mathematical. They also present an interesting representation of the relations between the functions, activities, inputs, outputs, mechanisms and overall system perspective. Rubio and Corominas (2008) present a review of reverse logistics and closed-loop supply chain articles published in the period of 1995–2005. They characterize the research topics in recovery/distribution management, production and inventory management and supply chain management, while the approach involved in their researches is divided into case study, literature review, mathematical modeling, and survey. The authors show also the presence of a trend followed by researchers. For example, production and inventory issues are dealt with mostly by quantitative models while articles on recovery and distribution management use both quantitative and qualitative methodologies. The research conducted on supply chain management issues tends to employ qualitative methodologies such as case study, literature review, and conceptual descriptions.

In order to adequately cover the various aspects of RL, we present five sub-sections where the first sub-section gives an overview of the steps involved in RL and the second sub-section discusses support systems integral to RL. The remaining three sub-sections review the decisions, economic aspects and the performance measures required to support RL.

2.1. Reverse logistics steps

In the literature, most of the authors, including Giuntini and Andel (1995b), Rogers and Tibben-Lembke (1998), Stock (2004), Schwartz (2000), and Marcoux, Riopel, and Langevin (2001), propose an RL system with four main steps: gatekeeping (entry), collection, sorting, and disposal. The communication among different parties plays a major role in the successful implementation of these steps (Stock et al., 2006). These four steps are discussed below.

The first step is the entry to the reverse logistics system or the recognition of a product return. Rogers and Tibben-Lembke (1998) define it as deciding which products are allowed to enter the system. Moreover, they mention that this first step is essential in order to succeed in managing the system and controlling costs. The second step involves the preliminary grouping of the collected products based on the subsequent operations, for example the remanufacturing or recycling process. The collection step permits the retrieval of products from internal or external customers. Detailed sorting (or the third step) decides the fate of each returned item. At that moment, the company may decide what to do with the product, be it subject to inspection, tests, or other manipulations. The last step involves the choice of disposal, i.e., the destination of the product. Giuntini and Andel (1995a) give two possible destinations: either renewal or removal from the process such as return to vendor, resale or disposing into landfill. Light (2000) mentions the following options as the principal activities of RL: relocation of stocks, donation to charity, remanufacturing, reselling, or selling to discount outlets. De Brito and Dekker (2004) report that industry differentiates between the terms repair and remanufacturing. They suggest that if only a part of the product deteriorates, then recovery options like repair or part replacement are considered. While King, Burgess, Ijomah, and McMahon (2006) define the term repair as the correction of specified faults in a product; and state that the quality of repaired products is inferior to those of remanufactured and reconditioned. Through an extensive survey of published works, Gungor and Gupta (1999) describe the steps that should be taken to ensure environmentally friendly production. They discuss the scope of environmentally conscious design and manufacturing as well as the issues in the recovery of products and materials. Issues involved in all major steps of

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات