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The myth of the closed loop re-cycling system – towards a broader perspective on re-cycling

Monica Macquet
PhD Student
E-mail: dma@hhs.se

Susanne Sweet
PhD, Assistant Professor
E-mail: susanne.sweet@hhs.se

Marketing Department
Stockholm School of Economics
PO BOX 6501
113 83 Stockholm
Sweden
Phone: +46-8-736 9000
Fax: +46-8-33 43 22

This paper will discuss different models of re-cycling and how they relate to practice of re-cycling. First we will give a background to the issues involved and then make a review of supply chain, distribution and logistics literature that discusses re-cycling. Then we will present and analyze four different re-cycling systems that have been implemented in Sweden since the mid-1990s. We will conclude with some thoughts on the need for development of alternative models for re-cycling that take into consideration the differences existing in both the material as well as the social systems that re-cycling activities are embedded in.

Background

Traditional literature on supply chain management has incorporated models of re-cycling during the last decade. The majority of these models imply ideas of “the closed loop system” where re-cycled products and materials cycle-back via the same distribution channel to points where these products and materials originated (see for example Beamon, 1999; van Hoek, 1999; Wu and Dunn, 1995). Hence, ideally the manufacturer of a product will take back waste from its sold products and the re-cycled material will be re-used in the same production chain. This ideal model do not only has a strong presence in literature. Different governmental regulations on re-cycling also point to the manufacturer in setting responsibility for waste re-cycling which also implies and attempts to solidify the closed loop idea. Re-use of the same components or re-cycling of the material in the same usage is considered to be the ideal model (Carter and Ellram, 1998). Early, entire re-cycling systems have been built on this ideal model. For example re-cycling of daily papers goes back over 20 years in Sweden. The papers were collected outside peoples' homes, transported to a papermill, re-processed and

distributed back to the publishers. However, when more complex products and materials are included in re-cycling systems the model of closed loop does not always work to describe or explain patterns of organization of re-cycling activities. Our studies of four different re-cycling systems in Sweden shows a process of prolonging of re-cycling chains rather than closing them. Difficulties in separating materials from each other, contaminated materials, functional demands, as well as regulations and norms, on some products impedes the use of re-cycled materials and components for the same use. The studies also show that the growth of new products and markets of recycled material are dependent upon entrance of new industrial actors as well as the market acceptance of products made of recycled materials. Our paper argues for a broader model adapted to different contexts and products in the area of re-cycling.

Literature Review – closed loop systems as an ideal model

In the logistics and supply-chain literature some attention has been paid to environmental problems. Most literature in this area has focused on recycling, which is considered to extend the activities of the supply-chain to include also the activities that are necessary in order to take care of the products at the end of their lifecycle.

The majority of the models include the idea of the closed loop system where re-cycled products and materials cycle-back via the same distribution channel to points where these products and materials originated. The majority of the models do not necessarily address it in terms of closed loop systems but it is almost always implied. As our paper will show, this might be true for a few products, but for the majority of products this picture is far too simplistic, and that it would be better to address re-cycling systems as an extended network. One problem using the idea of the closed loop system is that it might lead to an over-focus on the single producing firm and how it solves its' take-back of products. Studies of re-cycling often emphasize a firm's take-back of single products, or part of a product, which put focus on the product rather than materials and on one re-cycling loop rather than a material stream (e.g. Clendenin, 1997; McIntyre et. al., 1998). The focus on the closed loop system is probably the reason to the case studies made in the field of reversed logistics and recycling in supply-chain management, which in turn support the idea of the closed loop system. This could lead to that the recycling of most products would never be examined.

In this literature review we will take a look at how different authors, both explicitly and implicitly, use the closed loop model for how recycling is handled as well as more normative, how recycling should be handled.

An example from mid 90th is Wu and Dunn (1994). Referring to Porters value-chain concept (1985) they show that the environmental impact is present in all activities performed by a company, from raw materials acquisition to after-sales services. When they talk about recycling they are referring to the frequently used term, "reversed logistics". They point out that source reduction and substitution is emphasized in reverse logistics rather than recycling. Recycling is referred to as giving discarded materials a new life after some chemical or physical processes. The recycling activities are supposed to take place in the very same supply-chain. The idea that materials go back in the same supply-chain can be found also in the authors' concept of reusing. The implications are that employers competence to take care of returns and tracking systems need to be built up, and that problems can be solved with co-operation between channel members. Even if the authors admit that a "full-scale collection network" is needed, the idea is that this should be handled by the same supply-chain as the one where the products and materials came from. Once again, this is the very idea of "the closed system".

The main point made by van Hoek (1999) is that reversed logistics has to change into green supply chains. In a way it could be used as a critique of Wu and Dunn (1994), since van Hoek argues that the commonly used scheme from raw material acquisition to after-sales, is too narrow since it does not reflect the cross-company dimension. The underlying idea of "the closed loop system" can however be found even here. According to van Hoek returned goods could be returned, not only to the producer, but as well to suppliers and other supply-chain partners, that is in the same chain as from where it came in the first place.

Another even more obvious example of the closed loop system idea can be found in Beamon (1999). In this article, the author argues for a change from the common supply-chain concept to an extended one, that also includes activities performed to take care of the final waste caused by a supply-chain. Those activities are considered to be end-of-life product and packaging recovery, collection, and reuse. Those activities are assumed to take place within the same chain. Beamon even uses the word, a closed loop as a metaphor for this extended supply-chain.

Carter and Ellram (1998) have made a model of drivers and constraints for reverse logistics. They point out that a wider focus is necessary and that source reduction actually is a better option than recycling. Even though their conceptual ideas of the recycling system is fairly open, it is implicitly understood that the idea of the closed loop system is the basic model upon which their discussion is built.

Referring to themselves (1999), Rogers and Tibben-Lembke (2001) define reverse logistics in the following way:

"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 or creating value or proper disposal."

The very concept of the closed loop system is definitely present in this definition, since the scraped products are supposed to go back to, and be treated and recycled by the producer of the product. Rogers and Tibben-Lembke exclude activities such as substitution and source reduction from reverse logistics, referring to that those activities rather belong to the labels "green logistics" and "environmental logistics". However, handling recycling that other actors carry out is not considered a part of reverse logistics. Later in the text though, they point out that most of what is being recycled follow a forward flow to recycling companies, forward in the channel or through a parallel reversed channel.

In contrast to the idea of the closed loop system we have noticed that the flow of returns take different shapes. According to Jones (1998) the return-flow follows a variety of channels. It can return to the manufacturer for reuse or renewal. Components can be dismantled and go back to suppliers. Reusable packaging can be returned to a previous stage of distribution or production for further use. Also non-reusable packaging can be returned for processing and reuse. Those are referred to as close loop systems. The products can be scrapped and materials therefrom can be passed to a processor for conversion to usable forms and thereafter enter a commodity market. The materials from the recycled products are here sold to other actors in different supply-chains. Jones calls this an "open loop system". The last return- flow Jones considers is when customers send a product back because of complaints or regrets.

In the case studies of four different return systems for products, three based on Swedish laws on producer responsibility and one voluntary system, we have found that they all are best described as Jones (1998) open-loop system. We will also argue that most recycling is better described as an extended network rather than a closed loop system or an extended supply-chain.

Re-cycling systems at work

In this section we will describe and analyze four re-cycling systems that have been implemented in Sweden. The studied systems are the re-cycling of cellular telephones, car-tires, plastic packaging, and white goods. In Sweden there are several types of re-cycling systems. Some are regulated and others are voluntary. The regulated studied systems are so in the form of "producer responsibility", i.e. the producer is identified as having the responsibility for its' products after they have been consumed. These regulations do not stipulate how to organize re-cycling or decide what actors should be involved, but merely set up goals for re-cycling quantities and what and where to report these quantities. In the case of electrical and electronic goods (for example cellular telephones and white goods) Sweden has not yet any stipulated goals but await EU regulations.

Concluding Remarks – Extended perspectives on re-cycling systems

In this section we will argue that it is better to talk about recycling as an extended network rather than a closed loop system. This will be done by using both the case studies and with help from the industrial network theory developed mainly in Scandinavia (e.g. Håkansson and Snehota, 1995; Axelsson and Easton, 1992; Johanson och Mattsson, 1994).

We will also point out that even though we criticize the idea of "the closed loop system", many of the principles in the supply-chain literature on recycling can be used as they are.

We will also raise the question, if the laws on producer responsibility based on the idea of the closed loop system is misleading.

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