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BASIC CONCEPTS IN REVERSE LOGISTICS NETWORK

SUMMARY

In recent years, many companies have begun to pay attention to used products and materials, because of legislative, economic and commercial factors. Reduction of waste has become a major concern for all industrial. In addition to growing disposal costs, governmental legislation requires producers to take charge of their products throughout their life cycle.

There are many reasons why products are returned, either by consumers or by the companies involved in the distribution chain. Retailers may return products because of damage in transit, expired date code, the model being discontinued or replaced, seasonality, excessive retailer inventories, retailer going out of business, etc. Reverse logistics is concerned with the return flows of products or equipment back from the costumer to the logistics network for reuse, recovery or recycling for enviromental, economic or customer service reasons.

The return reasons are listed according the usual supply chain hierarchy, starting with manufacturing, next the wholesaler/retailers and finally the customers/consumers which in principle are going to use the products. Accordingly we differentiate manufacturing returns, distribution returns and customer/user returns.

Key words: distribution, reverse logistics, reduction of waste

SAŽETAK

Proteklih godina mnoga su poduzeća počela obraćati pažnju na korištene proizvode i materijale zbog zakonskih obveza, te ekonomskih i komercijalnih čimbenika. Smanjenje otpada je postala velika briga za sve industrijske zemlje. Zbog povećanja troškova otpada, zakonska ograničenja zahtjevaju od proizvođača da se brinu o svojim proizvodima tijekom njihovog „cijeloživotnog" ciklusa.

Postoji više razloga zbog kojih se proizvodi vraćaju, neovisno o tome da li dolaze od strane potrošača, trgovaca ili proizvođača u opskrbnom lancu. Trgovci na malo mogu vratiti proizvode zbog oštećenja u prijevozu, isteka roka valjanosti, sezonske potražnje, povećanih zaliha, zatvaranja tgovina itd. Pod pojmom povratne logistike podrazumijevaju se povratni tokovi proizvoda ili opreme nazad od potrošača u opskrbni lanac (distribucijsku mrežu) zbog reuporabe, dorade ili recikliranja tj. iz ekološkoh, ekonomskih ili servisnih razloga.

Razlozi povrata proizvoda su navedeni redom kroz hijerarhiju opskrbnog lanca, počevši sa proizvodnjom, pa trgovci na veliko, trgovci na malo i na kraju potrošači koji u

principu i koriste te proizvode. Prema tome razlikuju se povrati u proizvodnji, distribuciji te povrati potrošača.

Ključne riječi: *distribucija, povratna logistika, smanjenje otpada*

1. INTRODUCTION

There are many reasons why products are returned, either by consumers or by the companies involved in the distribution chain. Retailers may return products because of damage in transit, expired date code, the model being discontinued or replaced, seasonality, excessive retailer inventories, retailer going out of business, etc. On the other hand, consumers can return products for such reasons as quality problems, failure to meet the consumer's needs, for remanufacturing, or for proper disposal.

Also, once products have reached the end of their useful life, they may be able to be remanufactured, refurbished or repaired; thus extending their life. These options can provide significant benefits in some instances, especially for products that have modular components (e.g. electronic equipment, computers) that can be replaced, upgraded and/or refurbished. The value of items that are remanufactured will typically be less than the same items produced for the first time. However, their value will be substantially higher than items being sold for scrap, salvage or recycling.

Reverse logistics is concerned with the return flows of products or equipment back from the costumer to the logistics network for reuse, recovery or recycling for enviromental, economic or customer service reasons. The importance of reverse logistics has increased in the recent years. There are no worldwide estimates of the economic scope of reuse activities, but the number of companys engaged in this sector is growing rapidly in response to the opportunities to create additional wealth, and in response to the growth in extended producer responsibility legislation in several countries.

2. BASIC CONCEPTS ABOUT REVERSE LOGISTICS

In recent years, many companies have begun to pay attention to used products and materials, because of legislative, economic and commercial factors. Reduction of waste has become a major concern for most of industrial countries. In addition to growing disposal costs, governmental legislation requires producers to take charge of their products throughout their life cycle. Environmentally concerned customers now expect "green companies" to reduce the quantity of waste generated and to recycle resources encompassed within used products. Recovery programs have also demonstrated an economic interest for industry: a reduction in the cost of raw materials due to recycling, a reduction in the cost of manufacturing packages by reutilization, a de-crease in disposal costs because of reduced quantities.

Several definitions of reverse logistics have been proposed by various authors, so in order to emphasize the links between traditional forward flows and reverse flows in an integrated logistics system, we propose the following definition: "Reverse Logistics can be viewed as an evolution of traditional forward logistics in an environmentally-conscious industry or due to other commercial drives; it encompasses ali the logistics activities and management functions necessary for reintroducing valued-objects, which have finished or are not suitable to perform their primary function any more, into certain recovery systems for either recapturing their value or proper disposal" (Lu, 2003).

At this point, it is important to emphasize the global nature of the reverse logistics concepts and their differences from concepts such as:

- waste management, because for these products there is no new use or no recovery value,

- green logistics, which considers environmental aspects of forward logistics,
- transportation of empty materials such as containers or movements of empty vehicles, transport activities being complementary to logistics activities.
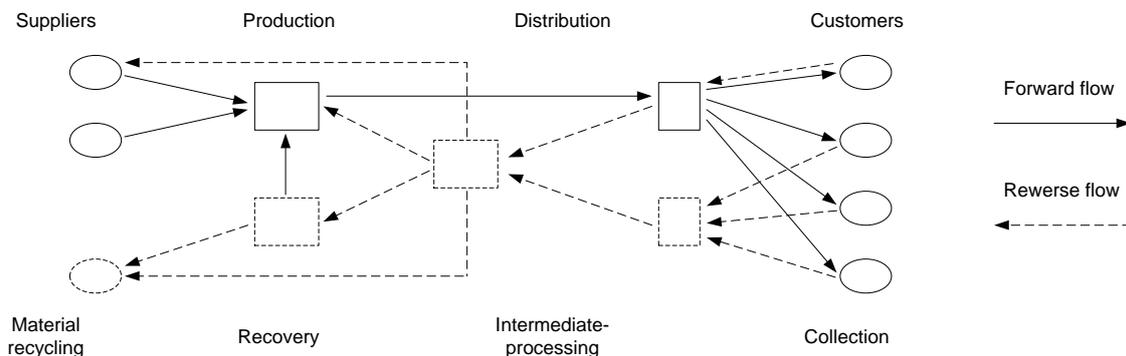

Figure 1. Framework of an integrated logistics system with forward and reverse flows

A reverse logistics system consists of a series of activities such as: collection, cleaning, disassembly, testing and sorting, storage, transport and recovery operations. An integrated logistics system with forward and reverse flows can be represented as shown in Figure 1.

The nodes of the network represent forward or reverse activities; solid arrows represent forward flows whereas dashed arrows represent reverse nows betvveen nodes.

The design and management of such an integrated network is more complex than that of traditional logistics networks limited to direct fiows. Two factors cause these dificulties:
- the simultaneous existence and mutual impact of the two types of flow: the possible coordination/integration and interfering constraints between forward and reverse flows must be considered;
- the existence of numerous uncertainties about the return flows: choice of recovery options, quality of return objects, quantity, reprocessing time.

3. ACTIVITIES INVOLVED IN REVERSE LOGISTICS

There are four main reverse logistic processes.
- collection,
- combined inspection / selection / sorting process,
- re-processing or direct recovery,
- redistribution.

Collection refers to bringing the products from the customer to a point of recovery. At this point the products are inspected, i.e. their quality is assessed and a decision is made on the type of recovery. Direct recovery embraces re-use, re-sale and re-distribution. Re processing includes the following options: repair, refurbishing, remanufacturing, retrieval, recycling and incineration. Finally, redistribution is the process of bringig the recovered goods to new users.

In the inspection/selection and sorting phase products are being sorted according to the planned recovery option and within each option, products are sorted according to their quality state and recovery route. As a last phase in the recovery products undergo some kind of processing. This can consist of dismantling and/or grinding, again a sorting, a testing and possibly a (re)manufacturing. In dismantling the product is split up into parts or components, which may undergo a separate recovery. In grinding the product structure is destroyed and its

materials may be recycled after sorting. These actions may be combined, e.g. one may first remove batteries from a monitor and then grind it.

The condition of returned products may be derived from the return reason. They determine very much whether the product can be re-used or remanufactured. If that is not the case then only recycling or disposal are left over as recovery options. For example, supply chain returns normally refers to products in good condition (unless damaged in transport and or if they are recalls). They can often be re-used, but not always be sold as new. Yet they may be sold at a discount or at a secondary market. Warranty returns may often be repaired, but sometimes the needed effort for testing and repair does not pay (economically) off. End-of-use returns are often deteriorated, but they may contain valuable components that can be re-used. This is e.g. the case with photocopiers.

4. DEFINING RETURN REASONS IN REVERSE LOGISTICS NETWORK

In the previous section we considered the basic concepts and activities involved in reverse logistics from a receiver perspective. In this second part, we reflect at a lower level through the returner/initiator perspective. Roughly speaking products are returned or discarded because they either do not function properly or because they or their function are no longer needed. We will elaborate these reasons and categorize them under three main headings according to the supply chain stage in which they occur. This is justified because all these streams have Reverse Logistics aspects. The return reasons are listed according the usual supply chain hierarchy, starting with manufacturing, next the wholesaler/retailers and finally the customers/consumers which in principle are going to use the products. Accordingly we differentiate manufacturing returns, distribution returns and customer/user returns. One should keep in mind however that manufacturers are as well part of the supply chain. With „manufacturing returns" we consider returns during the production process, while returns involving the manufacturer as a chain actor are included in distribution returns. Yet, a precise demarcation between these stages is not straightforward as final production may be done in the distribution chain.

Manufacturing Returns

We define manufacturing returns as all those cases where components or products have to be recovered in the production phase. This occurs for a variety of reasons. Raw materials may be left over, intermediate or final products may fail quality checks and have to be reworked and products may be left over during production. The first and the last represent the product not-needed category, the latter the "faulty" category. In sum, manufacturing returns include:

- raw material surplus;
- quality-control returns;
- production leftovers;

Distribution Returns

Distribution returns refers to all those returns that are initiated by a supply chain actor during distribution after the product has been made (including the manufacturer). It refers to product recalls, commercial returns, stock adjustments and functional returns. Product recalls are products recollected because of safety or health problems with the products, and the manufacturer or a supplier usually initiates them. Commercial returns are all those returns where a buyer has a contractual option to return products to the seller. This can refer to wrong/damaged deliveries, or to unsold products that retailers or distributors return to e.g. the

wholesaler or manufacturer. The latter include outdated products, i.e.those products whose shelf life has been too long (e.g. pharmaceuticals and food) and may no longer be sold. Stock adjustments go on when an actor in the chain re-distributes stocks, for instance among warehouses or shops. Finally, functional returns concern all the products that its inherent function makes them going back and forward in the chain. An obvious example is the one of distribution carriers as pallets: their function is to carry other products and they can serve this purpose several times. Summarizing, distribution returns comprehend:

- product recalls;
- commercial returns (e.g. unsold products, wrong/damaged deliveries);
- stock adjustments;
- functional returns;

Customer/User Returns

The third group consists of customer returns, those returns initiated by a customer or user and/or as a result of consumption/use, in the large extent). Again there is a variety of reasons to return the products. Customer returns comprehend:

- reimbursement guarantees
- warranty returns;
- service returns (repairs and spare-parts);
- end-of-use;
- end-of-life;

The reasons have been listed more or less according to the lifecycle of a product. Reimbursement guarantees give customers the opportunity to change their minds about purchasing (commonly shortly after having received/acquired the product) when their needs or expectations are not met. The list of motives is long, e.g. with respect to clothes dissatisfaction may be due to size, colour, fabric's properties and so forth. Independent of the motive, when a customer returns a new product benefiting from a money-back-guarantee or an equivalent, we are in the presence of reimbursement guarantees returns. The next two reasons refer to an incorrect, functioning of the product (in a broad sense) during use. We like to remark that the word "use" should be interpreted broadly, e.g. an untouched spare part has served a function (potential back-up) while being there.

Initially, customers benefiting from a warranty can return products that do not (seem to) meet the promised quality standards. Sometimes these returns can be repaired and a customer gets a new product or his / her money back upon which the returned product needs recovery. After the warranty period has expired, customers can still benefit from maintenance or repair services, but they have no longer a right to get a substitute product. Products can be repaired at customer's site or sent back for repair. In the former case, returns do occur in the form of spare-parts since in advance it is hard to know precisely which components are going to be needed for the repair.
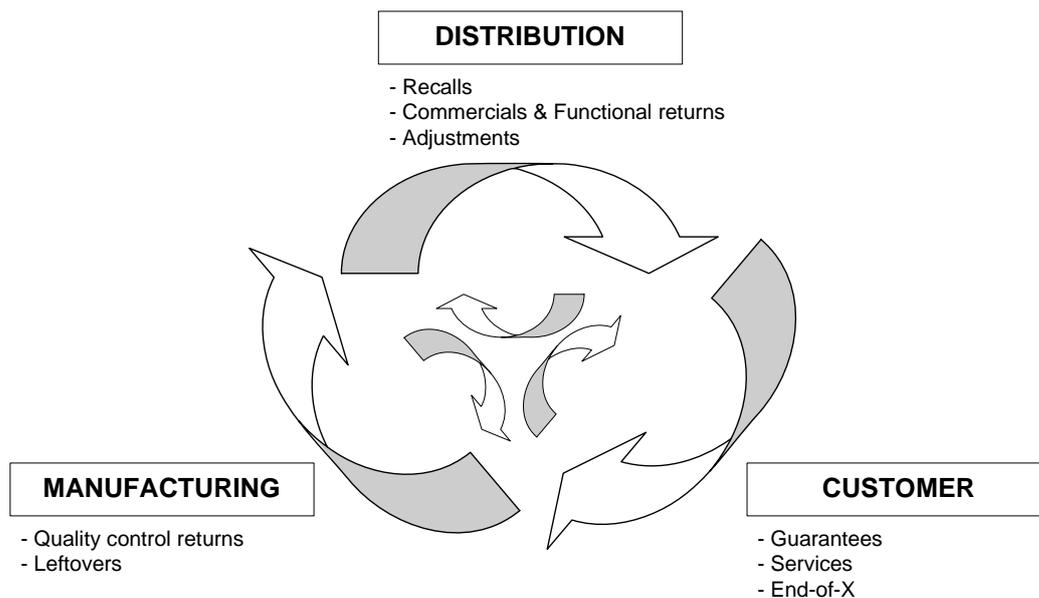
Figure 2. Return reasons for Reverse Logistics

Figure 2 summarizes the reasons for Reverse Logistics in three stages of a Supply Chain Loop: manufacturing, distribution and customer/user.

End-of-use returns refer to those situations where the user has a return opportunity at a certain life stage of the product. This refers to leasing cases and returnable containers like bottles, or returns to second-hand markets. Although end-of-use products are not really new, they are often in a good or reasonable state.

Finally, end-of-life returns refer to those returns where the products are at the end of their economic or physical life. They are either returned to the OEM (Original equipment manufacturer) because of legal product-take-back obligations or "returned" to another company for value-added recovery. Customers can be more or less active concerning the returns, as illustrated respectively by returning bottles to the supermarket, by sending back toner cartridges, or by having refrigerators collected at home. Deposit fees and charity's contributions are some of the incentives used by companies to stimulate (their own or other) customers to bring/send back the goods they would like to recover. From a broad perspective, a customer might not even be involved with the "return" of products ("return" in the sense of climbing the supply chain hierarchy - with respect to customer). This occurs for instance in the case of recycling of construction waste. However, those are cases in the boundary between Reverse Logistics and Waste Management.

5. CONCLUSION

Returning goods into the supply chain is equally important as moving goods to market, so assigning key executives to centralize, manage and improve the asset-recovery program is fundamental to achieving profitable results. As managers communicate objectives and introduce new projects, the company needs to recognize the value of its operations and define metrics for success. Increasingly, reverse logistics must be considered part of a successful growth strategy. Today, having a solid disposition logic is an essential aspect of an asset-recovery strategy. Returns, repairs, and used items can also have branding implications. For some companies, brand protection is paramount, and they want to ensure their goods are not sold in secondary markets and do not end up being sold in discount stores.

In this paper we listed return reasons according the usual supply chain hierarchy, starting with manufacturing, next the wholesaler/retailers and finally the customers/consumers which in principle are going to use the products. Accordingly we differentiate manufacturing returns, distribution returns and customer/user returns. Each point represents a step in one of many configurations of reverse logistics programs. It is important that each company defines how an effective reverse logistics program will affect customer experience and original equipment demand while contributing to revenue. Each step requires more detailed characteristics to be defined.

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