Reverse supply chain management in dairy production

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Abstract

Reverse logistics, a fairly new concept in logistics, has gained increasing importance as a profitable and sustainable business strategy. Reverse logistics is becoming also an important aspect of supply chain management in a company. Reverse logistics can be described as a process of planning, implementation and monitoring of effectiveness, efficiency, cost flow of raw materials, processes involving the accumulation of stocks of finished products and links information from the consumption of starting and ending point of departure in order to recover the value or proper.

This article describes a holistic view of reverse logistics and also the stages and principles for successful implementation of reverse logistics from the existing literature. The strategic factors consist of environmental concerns, legislative concerns, strategic costs, overall quality, customer service. The operational factors consist of cost-benefit analysis, warehousing, transportation, supply chain management, remanufacturing and recycling, and also packaging.

The case study is focused on consumer goods industry and retail. It shows the company's perspective on the practical application of reverse logistics in supply chain management.

Key words : *reverse logistics, logistics, supply chain management, waste management, warehousing, transportation, packaging, recycling.*

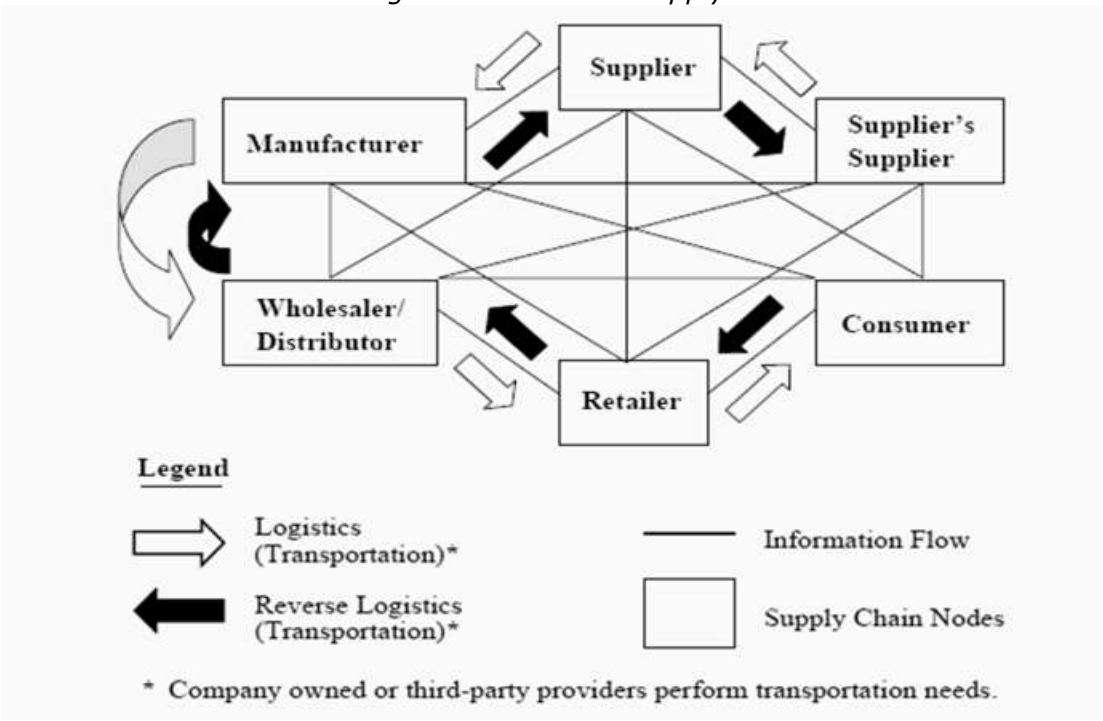
1. Reverse logistics – definitions and significance

Logistics involves the movement of physical goods from one location to another and third-party transportation companies (*Hunt, 2008*) provide a substantial portion of this service. Some of the earliest documentation of the use of logistics can be traced to the military. Simpson and Weiner referenced an article written in 1898 describing logistics as a strategy for handling troops during war, including the moving and quartering of troops. The military has since defined logistics as encompassing all activities and methods connected with supplying the military, including storage requirements, transport and distribution (*Simpson et al., 1989)*.

Several business groups have recently defined logistics for the private sector. American Production and Inventory Control Society (APICS) defines logistics: "In an industrial context, the art and science of obtaining, producing, and distributing material and product in the proper place and in proper quantities" *(Cox III JF, 1998).* The Council of Logistics Management (CLM) defines logistics as "The process of planning, implementing, and controlling the eficient, cost efective flow of raw materials, in-process, inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements" *(Council of Logistics Management - CLM).*

Reverse logistics can be defined as the reverse process of logistics *(Luttwak, 1971).* Traditionally, reverse logistics has been viewed primarily as the process of recycling products. Today, definitions vary depending on what company or segment of industry is attempting to define it.

Figure 1. Consumer supply chain



Source: Lummus, 2003

A comprehensive review of reverse logistics practices was conducted through literature review, WEB searches and survey methodologies. The purpose was to determine the needs of third-party logistics company customers in reverse logistics as well as current strategies of their competitors and the needs of the competitor's customers.

Each stage has a set of people or organizations involved with the reverse logistics process, each having their own special interests. Each stage will be discussed in detail.

Stage 1—Retrieval

Retrieval can best be described as the process of collecting and removing goods from a customer. This stage is afected by the type of product picked up and who does the retrieval from the customer. There are several diferent operations of the retrieval process. These operations include:

(a) Store level returns retrievals—Store level returns are those returns that are retrieved from any type of store/outlet. This type of return is made up of product recalls, inventory returns, warranty returns, core returns, reusable containers, damaged goods, seasonal items, hazardous materials (HAZMAT) and stock adjustments.

(b) Consumer returns retrievals—Consumer returns are collected from the ultimate consumer. These returns include product recalls, warranty returns and damaged goods.

(c) Collection center retrievals—These retrievals involve product recalls, warranty returns, inventory returns, core returns, reusable container returns, damaged goods, seasonal items and hazardous materials.

Stage 2—Transportation

The transportation stage of the reverse logistics process is considered to be the actual movement of goods from one location back to another location. The transportation stage is extensively involved in all aspects of reverse logistics, since manufacturers are often unwilling to be the final destination of their returned goods. Instead, they prefer to have an outside source or third-party logistics company dispose of these goods. As a result, transportation companies are often left holding the goods waiting for disposition information. These companies are

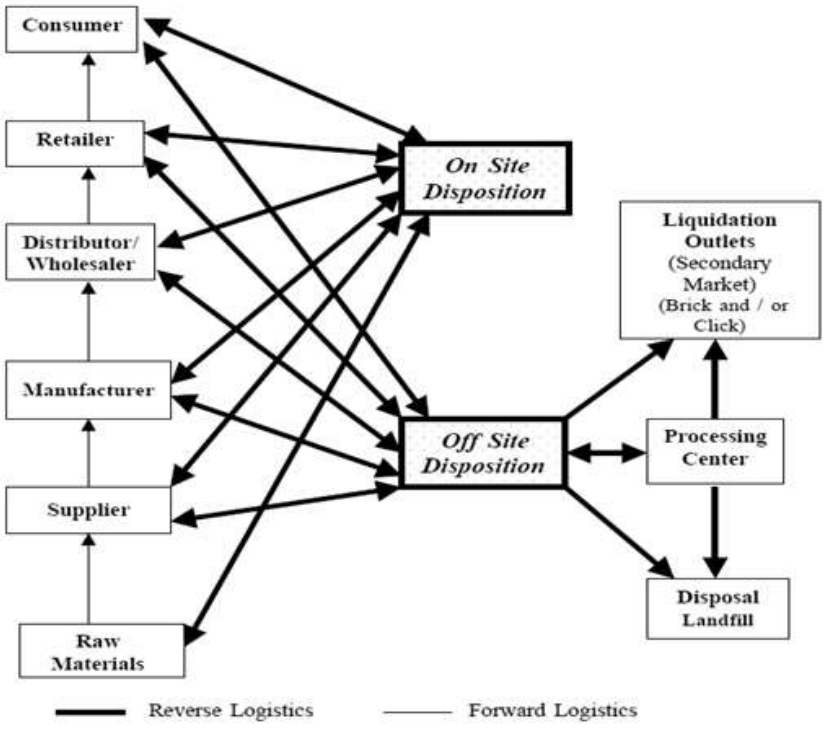
recognizing the pro0table situation of handling otherwise unwanted returned goods.

Stage 3—Disposition

The disposition process involves decisions and actions associated with the fate of a product once a customer demonstrates

product dissatisfaction. There are two types of disposition, on-site and of-site. On-site disposition involves activities that take place at the customer's facility to handle issues related to product concerns. The product may be repaired or replaced on-site. of-site disposition involves shipping the defective product to a diferent facility for repair, replacement, or disposal. A basic flow of the disposition process can be seen in Fig. 2. This figure illustrates the forward movement of goods, or forward logistics, in the supply chain by the use of narrow arrows. Bold arrows illustrate possible reverse logistics flow at all nodes in a product's forward logistics path. At every node, there is potential need for on-site or of-site disposition.

Figure 2. On-site and off-site Disposition Processes



Source: Krumwiede, 2002

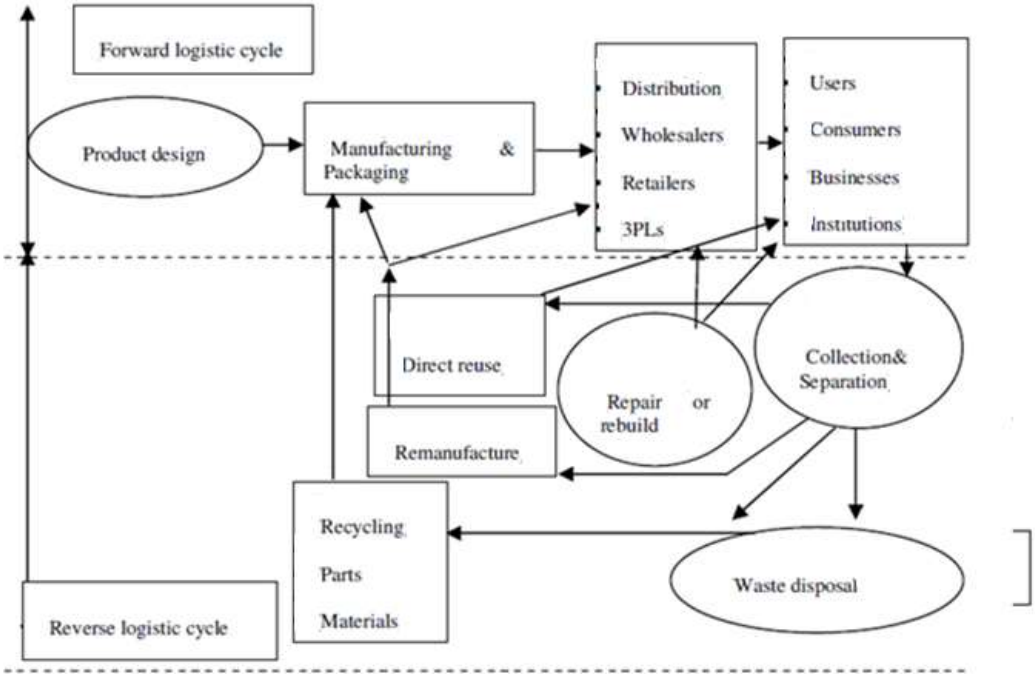
2. Reverse logistics for retailers

Reverse logistics refers to a set of programs or competencies aimed at moving products in the reverse direction in the supply chain (i.e., from consumer to producer). The goal is to maximize value from returned items and insure their proper disposal or both.

Related activities may include handling product returns, recycling, reuse of materials, waste disposal, refurbishing, or remanufacturing.

Operating effective reverse logistics programs is a critical part of retail business, because the programs often represent the firm' s most visible and possibly final effort at recovering value from a service failure. Service failure has been studied at length in marketing publications, and at various times, has been negatively associated with customer satisfaction, customer loyalty, service quality, trust, and behavioral intentions *(Gunasekaran, 2008).*

Figure 3. Forward and reverse logistics cycle



Source: Ray, 2005

A logistics planning system must include reverse logistics, i.e. the return of goods, containers and packaging to the source of supply or distribution. Reusable packaging not only saves time and money, with environmental benefits, it is also required by law. In 1997 the Producer Responsibility Obligations (1997) came into effect (see also University of Westminster, 1998). The aim of the legislation is to place responsibility for packaging recycling on the businesses that either produce or handle packaging. The legislation obligations effect manufacturers, converters, packer / filler, seller, wholesalers and importers. *(Harrison, 2001)*

Standardized and reusable packaging can aid the ergonomic flow of material from inventory storage and on to the production line. Good packaging can help improve warehouse capacity utilization, reduce the need for material handling and can be used as part of the production line ergonomic strategy, including JIT and Kanab systems. Reverse logistics is not the hindrance ; it is most definitely an opportunity to improve logistics systems. *(Harrison, 2001)*

2.1. Reverse logistics management

Reverse logistics management covers all the business functions that allow a retailer to process the merchandise returns generated at the stores, web sites, or warehouses. Reverse flow of merchandise can begin as :

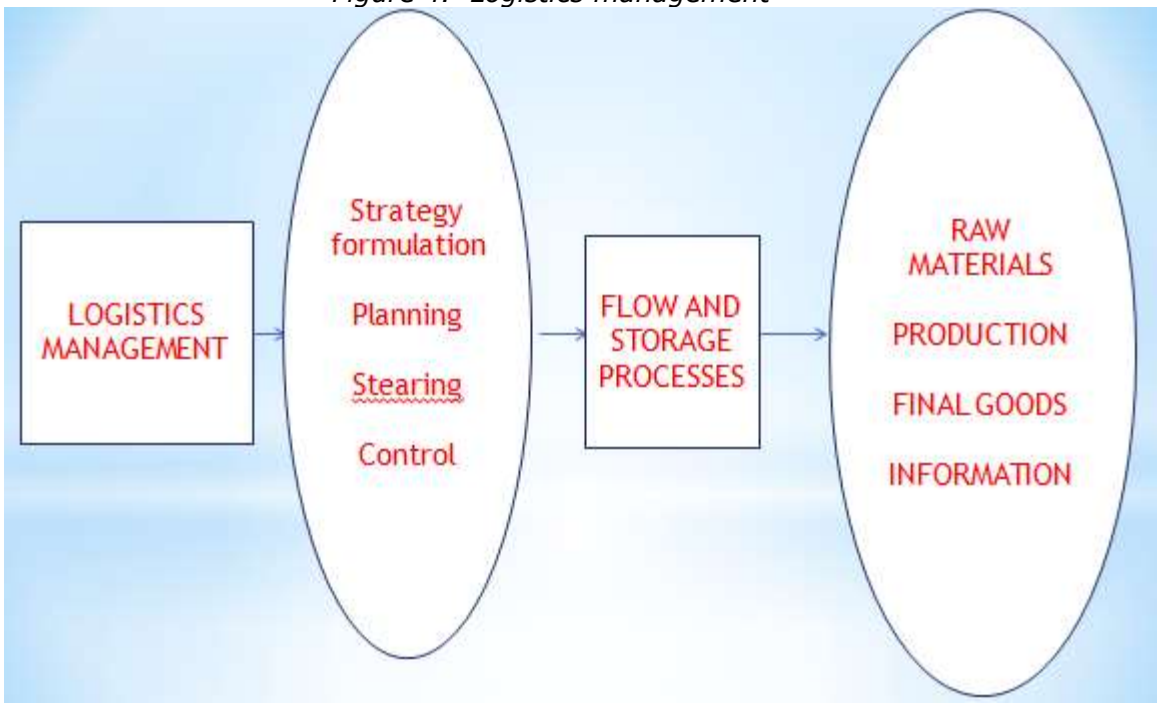
- retail customer returns at a store, and online or catalog returns at a returns facility.
- vendor buybacks, which can be a result of new product introduction by a vendor in a category, or a competitive replacement of another vendor's product. Such buybacks may be triggered by merchants after appropriate negotiations with their suppliers. The buyback information is sent to the stores as part of daily action items to facilitate scheduling and execution of the related tasks.
- retailer-initiated returns due to quality, safety, or compliance concerns. These returns can be triggered by merchants based on customer complaints, vendor request for callback, or a regulatory agency issuing a product callback. *(Supply chain execution, p.147)*

Regardless of their starting point, the returns need to be managed so that the associated costs are minimized. Examples of such costs are the cost of handling returns at the store or for a web/mail channel, determining disposition, transportation, disposal-on-site, and financial reconciliation of the returns transactions.

The first step for customer returns may happen in a store in case of physical returns, or at a call-center where online and catalog customers call for getting a return merchandise authorization (RMA). This chapter focuses only on the supply chain aspects of returns management, and ignores the customer interaction part of the process.

Reverse logistics management consists of managing the flow of merchandise from stores and customers back to the supplier. This returned merchandise may pass through a consolidation center. The complete returns transaction can contain a few shipment legs, warehousing, packing, handling, and other warehouse activities. Due to the complexity of managing the reverse flow, many companies simply subcontract the reverse logistics to a third-party logistics provider. These contracts may be limited to transportation and warehousing, or may include all services, such as disposition determination, disposal, and supplier credit reconciliation.

Figure 4. Logistics management



Source: Patyk, 2012

2.2. Returns Disposition Determination

The returns disposition process helps determine the best way to dispose of the returned merchandise. The disposition can take many forms :

- the returned merchandise can be returned to the sales floor. It may need testing, reconditioning, repackaging, and restocking. It may or may not be marked down for clearance. This disposition action can result in store activities or shipping to a reconditioning facility, and tracking the merchandise back through to the sales floor. The markdown pricing decision may be derived from a corporate policy, or simply may be a store manager's privilege;
- it can generate a return to vendor (RTV) transaction. Such a disposition can then generate many

supply chain activities, such as shipping back to a returns consolidation center or directly to the vendor. The process will also mean integration with accounting to adjust supplier accounts based on the terms of the returned merchandise;

- it can result in a decision to dispose of the returned merchandise. The disposal can be onsite or offsite. Onsite disposal may simply trash the merchandise in accordance with local regulations. Offsite disposal may be done by a third-party company that clears the disposed-of items on a regular basis from the stores.
- it can result in a decision to destroy the merchandise, onsite or offsite. This is generally a result of regulations in place for certain classes of merchandise.
- it can result in disposal with special handling instructions, such as for merchandise that is considered hazardous. Such merchandise needs to be tracked until it is safety disposed of, and records maintained for state and federal regulatory agencies.

2.3. Inputs and Outputs of the Returns Disposition Process

The main inputs to this process are :

- *merchandise classification and regulations for disposal*. For example, all merchandise that is classified as hazmat or biohazard has special regulations governing its handling, storage, and disposal on return. Other merchandise may have disposition regulations as well. It is important that all disposition decisions comply with these regulations and sufficient records are maintained for verification by the regulatory agencies.
- *supplier contracts and terms of merchandise returns* .These terms govern whether the merchandise can be returned to a vendor. Sometimes, the logistics costs of returns may be higher than simply disposing of merchandise locally and reconciling the accounts. If the merchandise is returned to the vendor, these terms will determine who bears the cost of transportation, insurance, warehousing, and handling. Suppliers may also agree to provide cost rebates, if the number of such returns is unacceptably high or crosses a pre-negotiated level.

The output of the process is the disposition method for the returned merchandise.

2.4. Logistics Planning and Execution for Returns

The supply chain for returns flows in reverse to the main flow of goods. While most companies manage their main supply chain logistics with great care, the reverse flows do not get as much attention.

The destination of merchandise in the reverse supply chain depends on the disposition. Based on the disposition, this merchandise may need to be returned to suppliers for credit/rebates, reconditioned and sent back to the stores, or disposed of.

The reverse supply chain can use a *returns consolidation center*, which is a warehouse specifically for managing reverse flows. The returns consolidation center receives all returns from warehouses and stores. It determines the disposition of the merchandise and plans for the tasks required to complete the execution of the selected disposition method. Physically, this might or might not be a separate facility from the main warehouses.

The majority of customer and store returns to the facility can be parcel or LTL. The store returns can take advantage of the backhaul trucks going to the warehouse. Returns from other warehouse to the returns facility can be optimally planned using the logistics planning systems in most cases.

Once the merchandise reaches the returns consolidation facility, it will be tracked until its final disposal. The next part of the returns logistics chain will take some of the merchandise to the supplier's warehouse . Such returns from the retailer 's returns consolidation facility to the supplier's warehouse can also be optimized using the transportation planning systems.

The inputs to the logistics planning and execution process for

reverse logistics are the same as for the main supply chain processes.

2.5. Financial Reconciliation of Returns

Returned merchandise not only creates a reverse flow of goods, but may also generate a reverse flow of financial transactions. This starts with the credit for customer returns at the store or call center, and continues through the credit and/or rebates from the suppliers to the retailer to compensate for the returned merchandise.

Based on the contract terms with the suppliers, returned merchandise can be reconciled in several ways :

- it may simply be written off as loss;
- the transaction may result in a credit note from the supplier to the retailer. The value of credit note depends on the contractual terms;
- it may result in a rebate or discounts on future purchases from the supplier.

Finally, the credits and rebates may need to be reconciled to calculate the new cost of goods sold (COGS). The financial reconciliation process for returns needs to address all the above situations. Many companies may insist on uniform treatment of returns with all their suppliers to simplify the financial aspects of returns.

2.6. Inputs and Outputs of the Returns Financial Reconciliation Process

The primary inputs to the financial reconciliation for returns are the supplier contracts, return transactions, and their values. The outputs of the process are the journal transactions registering write-offs, or debit and credit notes to accurately reflect the cost of returned merchandise in the financial journals.

3. The Waste Controller system

3.1. System details

Waste Controller takes barcode and scanning logistics technology widely used in many sectors and applies it to the accountancy, control and reporting of waste consignments. It is a modular system, tailored to the individual needs of the business, recording critical information at four stages in the waste management chain:

1 Pre-acceptance of waste material.
2 Acceptance and transportation to site.
3 Storage and processing.
4 Consignment and billing.

Following the issue of a tracking reference, the system builds up an individual waste record that is held in a database and accessed with handheld laser scanners. The system records a wide range of information including all critical regulatory details:

☐ waste producer name;
☐ waste description, composition and List of Waste (LOW) code;
☐ consignment Note Number;
☐ collection date and time (proof of collection and delivery);
☐ on site storage location and treatment date; and
☐ off site shipping and disposal including where, when and how.

The implementation of the Waste Controller system at Robert Hopkins was managed by Bartec Systems, with on site support in setting up the database and provision of on site training in use of the system and equipment over a four week period. The system is supported by a materials and equipment annual service contract and off site data handling facilities that ensure reliable, safe and secure storage of critical regulatory data and immediate access on demand 24 hours a day, 365 days a year.

3.2. Benefits

The most significant benefit of the system for Robert Hopkins has been improved logistics through increased control of movements and removing the requirement for time-consuming recording and reporting of waste consignments on site. Waste

Controller has freed up operational site staff to spend a greater proportion of time on processing waste rather than recording information. The value of this is approximately 1 man-year.

It has simplified the waste logistics with the ability to track split consignments on a single barcode, which historically would have taken many hours of paperwork to accurately record. The system makes it easier to split mixed consignments up quickly and to bulk materials for treatment or recovery with greater efficiency. As data is built up over time it should be possible to use this to inform waste transport planning and the strategic selection of outlets for recovery.

Once a waste consignment arrives on site, within 24 hours, it is tagged with a sticker and stored ready for treatment. The aim is to treat and ship all wastes out from the site within seven days. The barcode system makes the process of tracking waste movement less time-consuming, resulting in a higher rate of success in processing wastes within this target period.

Other benefits of the system were highlighted:

☐ Being modular in nature, there is flexibility to integrate the Waste Controller components at different stages, allowing sufficient time for the business and staff to adapt to the new system.

☐ Positive feedback on the report outputs from the regulatory inspectors and a higher degree of confidence in waste accountancy.

☐ Simplifying consignment record storage – a single repository of information allows compliance with the Hazardous Waste regulations to be automated and paper-free.

3.3. THE LOGISTICS WASTES

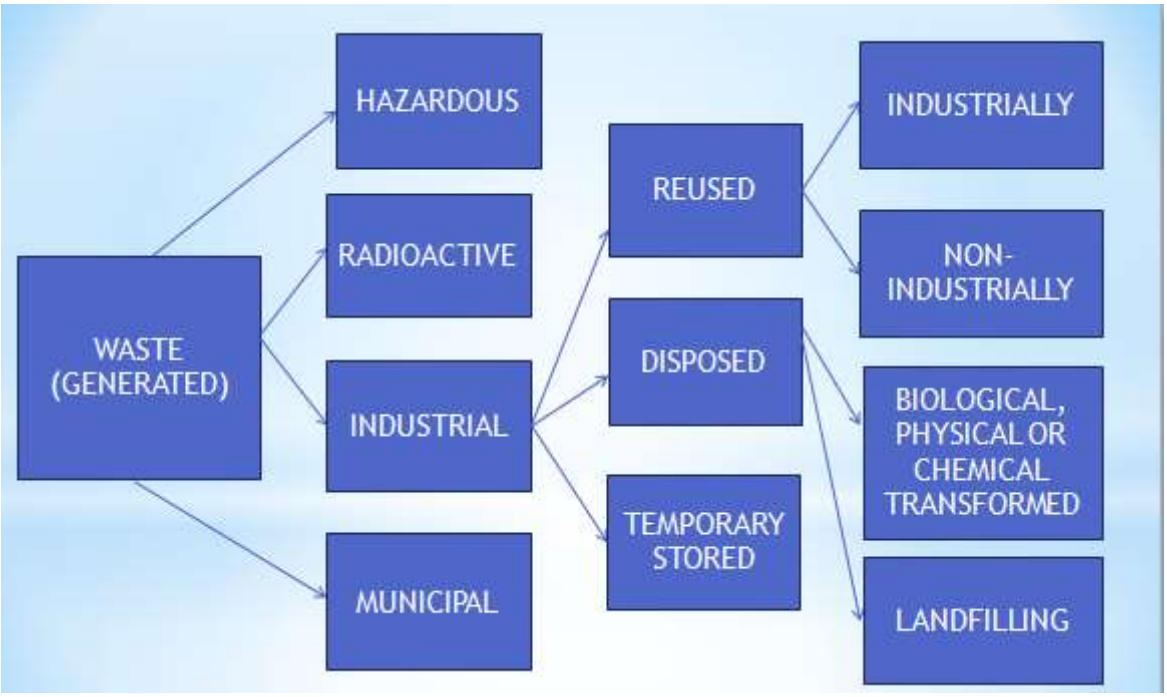
We have all heard the phrase "You can't make something out of nothing." Resources are necessary to accomplish anything great or small, but problems arise from using resources unproductively, applying the wrong resources, failing to tap into necessary resources, or directing resources toward the wrong outputs. In each of these instances, waste is created. Costs are incurred, people's time is consumed, opportunities for value creation and growth are lost, and customers are left less than satisfied.

While much has been said and written about the wastes found in a manufacturing environment, relatively little is mentioned about the wastes in logistics.

The wastes in logistics are just as prevalent as in any other functional area of a firm, although they are not always as visible given the scope of logistics activity. In fact, it has been suggested that more than 80 percent of the work of logistics takes place outside the view of supervision, suggesting all the more that precise yet robust processes must be developed for logistics. The next section illustrates the potential wastes found in logistics. The sources of waste in logistics include *(Ross, 2010):*

- Inventory
- Transportation
- Space and facilities
- Time
- Packaging
- Administration
- Knowledge

Figure 5. Types of waste



Source: Patyk, 2012

3.4. The business case for Waste Controller

The traceability of waste consignments is a fundamental aspect of waste logistics. It is of prime importance to both waste producers and waste managers (Hopkins, 2010).

The information generated during the waste lifecycle (consignment, processing, recovery or disposal) is used as the basis for regulatory reporting, for optimising logistics, for managing waste processing on site and ultimately as proof of disposal in an environmentally responsible manner.

Historically, Robert Hopkins had relied on the accurate collection of waste information by its on site chemists. The process of tracking waste consignments from collection to disposal was intensive and resulted in the generation of large volumes of paperwork. Waste Controller has changed this, integrating a new electronic waste information system to streamline logistics.

4. Green supply chain management

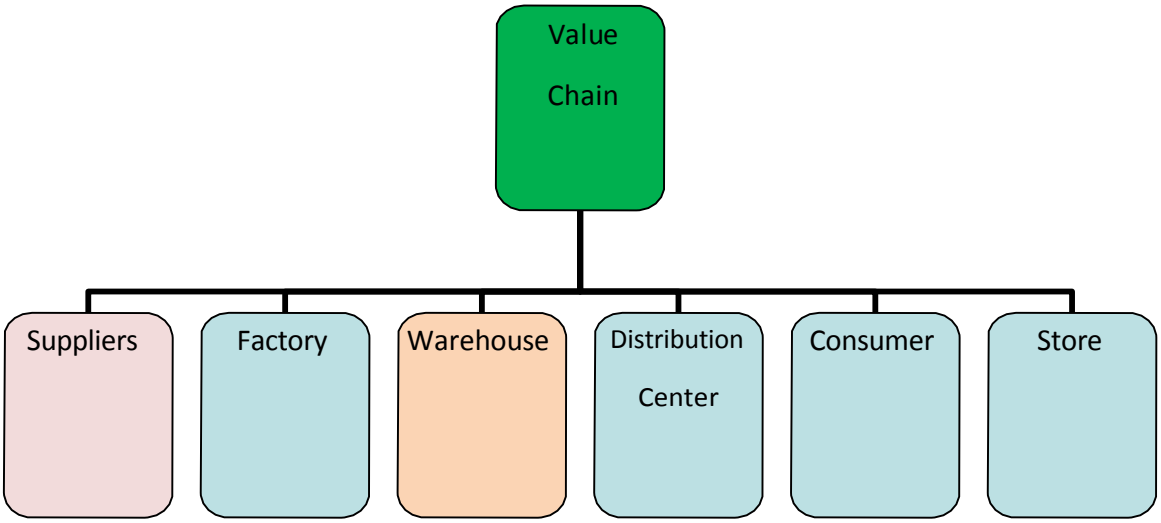
Environmental awareness is increasing day by day. Supply chain has now become such an important function that embedding environmental issues in day to day supply chain issues has become inevitable for sustainable development. This has led to the interest in Green Supply Chain Management.

The concept of supply chain includes the low of materials from the source to the point of use. Organisations are investing in managing the supply chain efectively. The focus is now on productivity – how can we maximize the output with the given input resources *(Mohanty, 1997).* Supply chain is also called as a value chain (Extended enterprise). This is a loosely connected network of companies that work together to provide goods or services to a market.

4.1. Strategies for a Green Supply Chain

So, having understood what green supply chain management is and why we need one, we now look at the various strategies for institutionalizing green supply chains within an organization. *(Mohanty, 1997).*

Figure 6. The Supply Chain or extended enterprise



Source: Mohanty, 1997

5. Barriers to Reverse Logistics

Even if the company makes the decision to implement reverse logistics processes into its activity, usually it is not possible to expect immediate success by reverse logistics executing, while there are a lot of very real and difficult to avoid internal and external barriers. The literature presents various numbers of them, for example Rogers and Tibben-Lembke described 8 main barriers to reverse logistics *(Srivastava, 2008),* then, on this base, Ravi and Shankar added 3 next to discussed 11 barriers in their article *(Rogers, Tibben-Lembke, 1998),* and finally Jindal and Sangwan considered **16 reverse** logistics barriers *(New, 1997).* In this paper we are following the last approach, because its number of barriers was created on the yearly-widest literature review. Additionally, it is possible to divide all barriers into 4 main groups: **economical, organizational**, related **to market** and related **to government**.

Economical barriers

This group of barriers mainly refers to the reverse logistics costs and also to financial benefits that might be expected after successful reverse logistics processes implementation into practice. In this group there are distinguished the following barriers:

1. lack of economic benefits, which is causing that many companies hesitate to reverse logistics implementation because its processes and their organization (designing, testing, recycling, waste management, etc.) are very expensive at the beginning so they aware of possibility that the costs might be higher than future benefits *(Jindal, Sangwan, 2011; Xiaoming, Olorunniwo, 2008);*

2. *high set-up and operating cost* the most connected with transportation and remanufacturing issues, which in case of reverse logistics are strongly supported by specific and expensive information systems to truck and trace the returns and to lead the proper products recovery *(Pokharel, Mutha,, 2009; Ravi, Shankar, 2005);*

3. *lack of economy of scale* caused by lower than expected volume of returns and resulting in inability to obtain the value from them *(Hansen, 2002; Pokharel, Mutha, 2009)*. These three economical barriers are playing the crucial role, because at the first stage of reverse logistics implementation into practice there are always necessary the financial means to cover all expenses associated with supporting infrastructure, manpower, efficient information and technological systems, various recovery processes, personnel training, etc., so the good solution here needs to balance these financial constraints.

Organizational barriers

This group of barriers to reverse logistics refers to all organizational aspects which are very specific for reverse logistics processes. These barriers are:

4. *lack of top management commitment* that negates efficient leadership needed to provide the clear vision, value and continuous support to reverse logistics programs, strategic/action plans, and might lead to higher costs, problems and delays *(Baumgarten, Kornak, 1990; Srivastava, 2008);*

5. *lack of strategic planning* means lack of reverse logistics goals identification and specification of long-time plans for managing them, thus the company survival on the global market might be threatened *(Rogers, Tibben-Lembke, 1998);*

6. *company policies* which usually are restrictive and do not highlight the importance of reverse logistics processes what blocks the proper returns handling and hides secondary value from returns recovery *(Srivastava, 2008);*

7. *resistance to change* to reverse logistics states the fundamental barrier caused by lack of knowledge – when only the radical requirements of social and practical changes are seen together with high costs of investments, instead of any reverse logistics benefits *(Rogers, Tibben-Lembke, 1998);*

8. *lack of technology and information systems availability* what prevents: the support for reverse logistics during various stages of the product life cycle, tracking and tracing the product returns, information exchange between supply chain partners, product recovery planning and control, support of inventory management, support for developing linkages to achieve efficient reverse logistics operations *(Rogers, Tibben-Lembke, 1998; Srivastava, 2008);*

9. *lack of training and education* for personnel resources hired at all organization levels mainly in the field of reverse logistics technologies and processes that will be implemented, providing the knowledge about possible to gain values and benefits, and opportunities to improve their integration, environmental issues and performance *(Rogers, Tibben-Lembk., 1998; Srivastava, 2008).* The above mentioned barriers are significant to good reverse logistics practice and to prevent them there are actions necessary to be taken before reverse logistics implementation.

Mainly it is about ensure the good knowledge about reverse logistics processes and prevalence this knowledge through all company to prepare it for upcoming organizational changes.

Barriers related to market

Barriers in this group are the very specific ones and their characteristic comes from reverse logistics processes uniqueness, particularity and susceptibility to the impact of surroundings. The group contains:

10. *stochastic return and demand* that as the complex issue is connected with the high level of returns quality and quantity uncertainty what causes problems with further planning and control of production and inventory *(Guide, van Wassenhove, 2009; Lau, Wang, 2009);*

11. *marketing of remanufactured products* that is very difficult in comparison to marketing of new products, especially when they are both in sale on the same market and the challenge is to encourage customers to buy the remanufactured ones *(Guitini, 1996; Presley, Meade, Sarkis, 2007; Srivastava, 2008; Xiaoming, Olorunniwo, 2008);*

12. *lack in support of supply chain partners* denoting lack of collaboration between them mainly with information exchange what often prevents the products and returns visibility in the reverse flows *(de Brito, 2003; Pokharel, Mutha, 2009);*

13. *lack of appropriate performance metrics* what makes impossible to proper coordination of all reverse logistics processes, to performance management, improvements, documentation, gathering data, etc., according to the expectations *(Rogers, Tibben-Lembke,1998).* This group of barriers to reverse logistics is quite hard to be avoided, because the market is unpredictable. However, by taking actions to improve collaboration along the supply chain partners and conducting market and customer research it is possible to get better results with good reverse logistics practice.

Barriers related to government

The last group of barriers to reverse logistics mainly occurs in emerging and developing economies, while in highly developed countries these barriers have already been overcome and if they occur, it is only in very limited scope. In this group the barriers are:

14. *lack of awareness about reverse logistics* is mainly lack of awareness about the reverse logistics benefits and low perception of its processes importance *(Jindal, Sangwan, 2011; Pokharel, Mutha, 2009; Presley, Meade, Sarkis, 2007; Rogers, Tibben-Lembke, 2001)*;

15. *lack of law, legislation and supportive economic policies*, thus lack of enforceable acts, directives to motivate companies and also lack of economic support, preferential tax policies and other government incentives for reverse logistics implementations *(Baumgarten, Kornak, 1990; Pokharel, Mutha, 2009);*

16. *not fully regulated waste management* what is the cause of many organizational problems at this field and might show that reverse logistics is not valuable and profitable with waste disposition *(Stock, 2001).* Above barriers are independent of the companies, so it is very hard to force them. The solutions here have to be created mostly by government and appropriate policy to encourage

companies for investments on reverse logistics, and to show them potential economic, social and environmental benefits.

6. Case study: Retail SC NATURA SA (dairy products)

The main activity of the company is the processing and sale of milk and milk products named after the brand Natura, the largest milk processing factory in the county, with a tradition of over fifty years.

The processes are:

-Reception
-Filtration
-Cooling
-Buffering
-Centrifugal separation
-Normalization
-Pasteurization
-Cooling after pasteurization
-Storage
-Packaging
-Storing drinking milk
-Selling

As a non-compliant products can be identified:

- Raw materials and packaging compliant detected after reception
- semifinished found to be non-compliant during product realization
- finished products found compliant control before delivery
- delivered products and customer complained as inappropriate

In order to control young non-compliant products, it is recommended to determine:

- how to identify non-compliant products;
- the marking of non-compliant products to ensure that they can be differentiated from conforming products
- the documentation of nonconformities
- how to assess the nature of nonconformities
- handling of nonconforming product
- how information functions involved

In order to simplify the way of solving non-complying products in the event the organization can establish the way that you browse any level nonconforming product is detected.

Conclusions

Prior to the introduction of Waste Controller barcode technology, Robert Hopkins used labour-intensive manual accountancy of wastes. Having evaluated other solutions such as radio frequency ID, the flexibility of the barcode system together with combined traceability and accountancy benefits made both commercial and financial sense. In discussing the benefits and pitfalls of barcode technologies with other waste management service providers, Robert Hopkins reported the feedback was overwhelmingly positive for Waste Controller.

In evaluating the benefits of Waste Controller for the wider waste management industry and with an emphasis on construction, demolition and excavation wastes, the costs of implementing such a system are offset by a host of benefits. These include:

☐ streamlined logistics and waste accountancy, increasing operational efficiency and simplifying reporting and recordkeeping; particularly with regard to regulatory compliance;

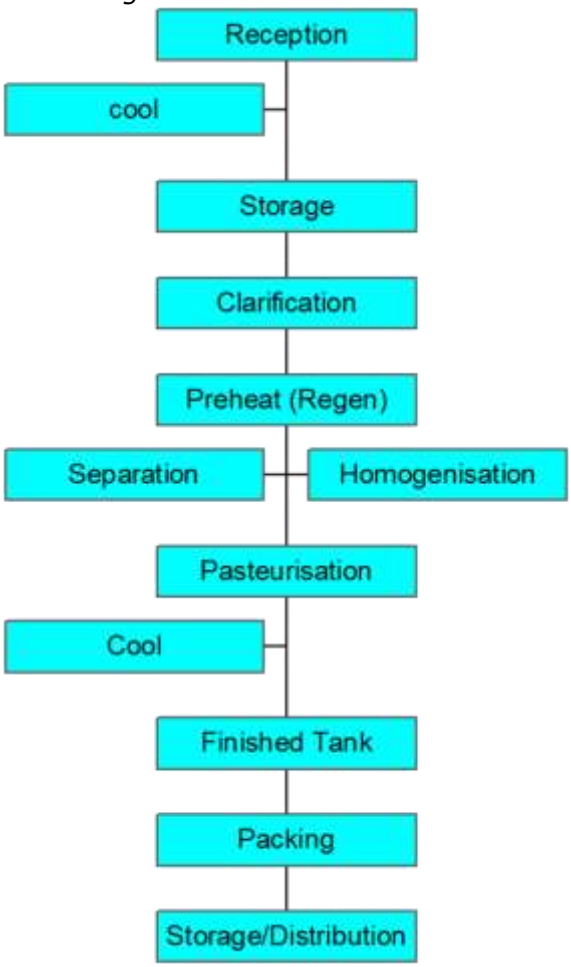
☐ instant access to information on waste movements that can benefit both the client and waste service providers;

☐ the capability to track a range of individual waste skips from single or multiple sites from collection through to the disposal

☐ reduction in human errors relating to skip delivery and collection; both at the client and consignee premises.

In a market where the trust and confidence of the clients and regulators is paramount to a successful business,

Figure 7 : Natura Processes



Source : own elaboration

barcode tracking technology and the traceability it provides is a powerful logistics tool.

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