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REVERSE LOGISTICS, ITS RELATION WITH COST AND SUSTAINABILITY, ITS INCLUSION IN CURRICULUM

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Abstract
The effects of globalization developed the technology, competition, product range and supplied the needs of the people while also causing depletion of resources and danger for the environment. Precautions were taken to protect the environment and raise awareness of the consumers to use products of environment conscious companies. These developments have directed the companies to 'reverse logistics'; a process of flowing of previously sold products from consumption point to the point of recovery for the purpose of recondition, reproduce or dispose.

Reverse logistics is in relation with sustainability especially because of recycling the products. Controlling and managing the cost of reverse logistics is a key point to overcome the cost problems.

The aim of this study is to examine 'reverse logistics' concept, its relation with cost and sustainability and its inclusion in undergraduate logistics curriculum, if it's included as a unique course, or a part of another course, or not included.

Keywords: Reverse logistics, Reverse logistics cost, sustainability, logistics education.

INTRODUCTION

The effects of globalization developed the technology, competition, product range and supplied the needs of the people while also causing depletion of resources and danger for the environment. Precautions were taken to protect the environment and raise awareness of the consumers to use products of environment conscious companies; the companies who are addressing waste and sustainability have become more preferable by the consumers and these developments have directed the companies to reverse logistics by which they will have environment friendly image and thereby having good relations with consumers which will lead to protect and continue their market share (Vahabzadeh and Yusuff, 2012: 36; Deran, 2013: 54).

The concept of logistics was first introduced to the business literature in 1984 by the definition suggested by the National Council of Physical Distribution in the United States which was later named the Council of Logistics Management (Akyıldız, 2004). The Council of Logistics Management (CLM), which is established by the purposes of bringing rules to the logistics sector and making definitions by service providers, service takers, academicians, consultants, software industry and equipment manufacturers, defines the logistics management as follows (Sezgin, 2015): "It is to plan, implement, and control the movement and storage of materials, services and information flows in the supply chain

from the start point of the raw material to the end point where the product is consumed, both effectively and efficiently, to meet the needs of the consumers."

According Coyle et al., it is understood by this definition that the logistics process can be seen as a system or structure that allows decisions to be made to carry out the entirety of transport, stock, storage, packaging and other related activities, including cost and service linkage in the supplier's customer flow (İboş, 2015: 17-18).

After the above explanation of the importance of reverse logistics and general information about logistics and logistics system, the aim of this study is to examine 'reverse logistics' concept, its relation with cost, and with sustainability and its inclusion in undergraduate logistics curriculum.

Definition and Scope of Reverse Logistics

The first definition of reverse logistics was made by Lambert and Stock (1981) in the beginning of the 80's stating that it is "going the wrong way down on a one-way street, because the majority of product shipments flow in one direction", because the product shipment was done in a one-way flow. Throughout the 80s, reverse logistics was limited to the definition of the movement of products from manufactures to the consumer, in the opposite direction to the directional flow (Karabulut, 2009: 9).

According to another definition, reverse logistics can be described as "planning, implementation and control activities to enable the flow of product and information from the point of consumption to the point of origin so that the value can be recovered or destroyed in an appropriate manner" (Nakıboğlu, 2007: 183). In addition, James Stock, one of the researchers who contributed greatly to the Reverse Logistics Theory, defines it as "the role of logistics in product returns, resource reduction, recovery, material substitution, material reuse, waste disposal and incineration, repair and production" (Erturgut, 2016: 232).

Apart from these definitions, many researchers have defined reverse logistics in various forms. While Pohlen and Farris (1992) define it as "the movement of the products in the distribution channel from the consumer to the manufacturer", Kroon and Vrijens (1995) point it as "logistics management skills and activities that should be used for the removal, management and disposal of hazardous or non-hazardous wastes from packaging and products by reversing normal distribution activities". Fleischmann, M. et al. (1997) define reverse logistics as "the activities in logistics flow which will be carried out on behalf of the consumers so that the products which are no longer useful can find their place in the market again". Additionally, while Rogers and Tibben-Lembke (1999) define it as "planning, controlling, implementing, and checking the efficiency of the process by taking the goods from the point of consumption to the origin in order to ensure the return or proper destruction of consumed goods and related information", Dowlatshahi (2000) describe it as "the redesign and management of the flow of products to be reproduced, recycled, destroyed or reused effectively integrated with the supply chain of reverse logistics systems".

Reverse Logistics and Green Logistics

Reverse logistics as a new research area has been used with different concepts that have mostly similar meanings such as reversed logistics, return logistics, retro logistics and reverse distribution in the literature. However, reverse logistics and waste management are different concepts. While waste management is concerned with how to dispose of worthless waste, reverse logistics deals with the wastes that can create value when they re-enter the logistics supply chain. On the other hand, there are similarities and differences between reverse logistics and green logistics. While green logistics aims to achieve a sustainable perspective on all logistics activities that are from the manufacturer to the consumer, reverse logistics is concerned with all the logistic activities from the consumer towards the manufacturer which is realized in the opposite way of the green logistics flow. (Quoted from Brito and Dekker, 2002 by Bulut and Deran, 2008: 329-328). Green reverse logistics is defined Vahabzadeh and Yusuff, (2012: 37) as "the process of managing returns, including different types of materials, and transportation from the point of consumption to the point of origin to minimize the destructive

effects on environment". Rogers and Tibben-Lembke (2001) classify similarities and differences between reverse logistics and green logistics as seen in Figure 1:

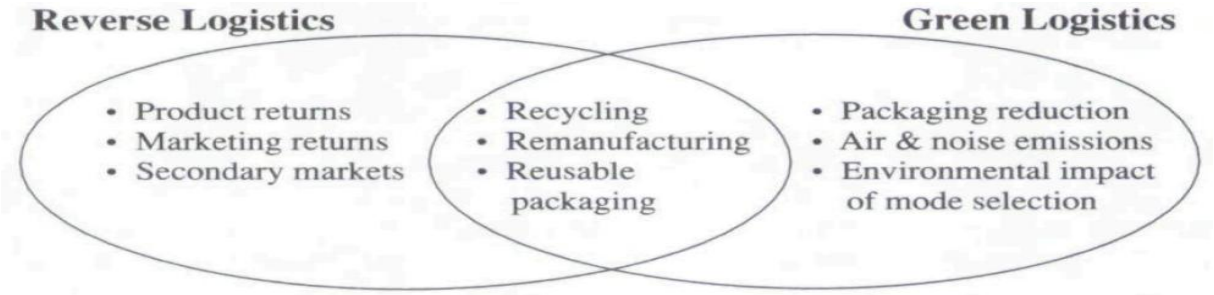

Figure 1: Comparison of Reverse Logistics and Green Logistics
(Source: Rogers and Tibben-Lembke 2001: 131)

The Relation of Reverse Logistics with Sustainability

Enterprises use natural sources when they produce goods and services for the needs of people (Çamlıca and Akar, 2014: 101). The natural sources are limited and the destruction that industrialization caused on natural sources and environment threatens the future generations and this has caused an awareness which has formed the concept of 'sustainability'. As the environmental and social problems like unemployment and poverty which were raised together with population growth became irrecusable, 'sustainable development' concept came up (Yalçınkaya, Durmaz and Adiller, 2011: 3321). World Commission on Environment and Development (WCED) Report (1987: 54), which is also known as Brundtland Report, defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It also mentioned that it is a combination of environmental, economic and social factors which was also defined with regard to triple bottom line as economic prosperity, environmental quality and social justice (Quoted from Elkington, 1997 by Lee and Lam, 2012: 590; WCED Report, 1987).

'Sustainable development' concept is closely related to recovery of products which is one of the parameters of Reverse Logistics (Bulut and Deran, 2008: 342). With regard to sustainability, reverse logistics is defined as "a business strategy that acts as the driving force of putting recovery activities in action effectively in order to increase sustainability" (Ayvaz, Bolat and Aydın, 2015: 391) . Remanufacturing, repairing and recycling are from the recovery alternatives of reverse logistics.

Reverse logistics can be considered together with the dimensions (economic, environmental, social) of sustainability. Tangible and intangible economic and business factors, the standard cost/benefit analyses of payback, return on investment and also organization's customer service dimension should be considered in evaluating reverse logistics decisions (Presley, Meade and Sarkis, 2007: 4606-4608). The increase of the awareness of consumers to environmentally friendly products necessitates the implementation of effective reverse logistics which supports recycling, remanufacturing and reclamation practices from environmental perspective. The influence of reverse logistics on social dimensions may be sometimes company or industry specific, such as predisposition towards more or less socially useful practices of reverse logistics, For instance, safety issues for employees may be influenced by product type. There are many social issues of reverse logistics that need to be included in sustainability evaluation process.

Lee and Lam (2012: 590) examined the studies related to the practices leading to sustainable outcomes and stated that some studies focused on "remanufacturing as an effective way to maintain products in a closed-loop, reducing both environmental impacts and costs of the manufacturing processes and sustainability strategies in remanufacturing require proper planning, efficiency and effectiveness in the process"; they also stated that another strategy for sustainable development is recycling where the main point is on product recovery management.

With sustainable green policies, it is created more efficient working opportunities that use resources properly by in-company training and sustainability also facilitates adapting to technology (Musiad Research Report, 2015: 127). Besides, it causes the company to be differentiated as having high social responsibility in the eye of conscious society.

Reverse Logistics Activities

Rogers and Tibben-Lembke (2001) list the reverse logistics activities as "reproduction, repair, recycling, waste burial, repackaging, return and recovery". Brito and Dekker (2002), on the other hand, classify them in 4 groups of collection, control/selection/classification, direct recycling (reuse, resale and redistribution), and reprocessing (repair, maintenance, reproduction, recovery and recycling).

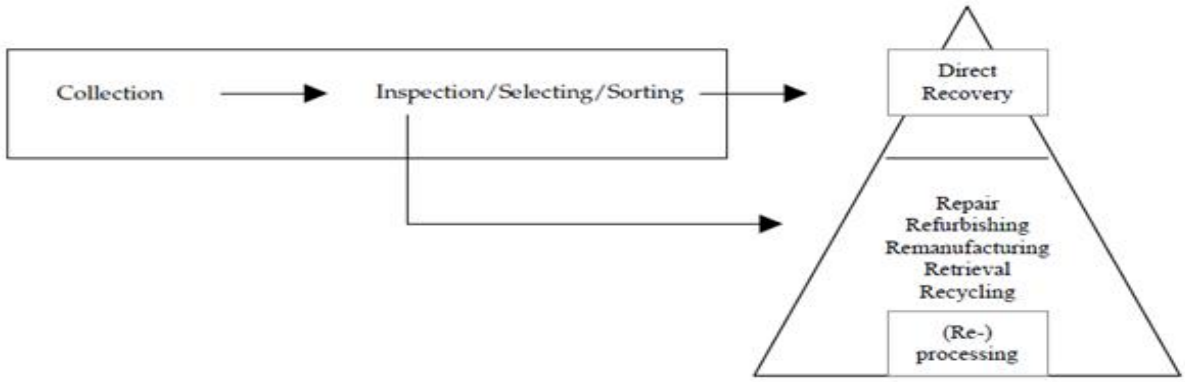

Figure 2: Reverse Logistics Processes
(Source: Brito ve Dekker 2002: 14)

Reverse logistics activities include collection, reprocessing and redistribution of products. These processes are common to reverse activities, but the step that makes the difference is the reprocessing step. When the recovery processes are examined (Quoted from Thierry et al., 1995: 117-125 by Bulut and Deran, 2008: 333-334), the following steps are involved.

A. Repair: In this step, it is ensured that the returned product becomes operational again by means of repairing and replacement of defective parts. A relative reduction can be seen in the quality of the repaired product relative to its original.

B. Refurbishment: In order to achieve a standard quality level of the consumed product, the product is refurbished by upgrading or renewing the critical parts after the product is separated. This is a step that increases the quality of the product. The process of refurbishing aircraft used for military or commercial purposes is an example of this step.

C. Remanufacturing: The returned product is made to conform to the quality standards of newly produced products. In this step, change, repair, control and assemble are made and various improvements can be made in the product.

D. Product Cannibalization: This step means that when a company offers two products with the same quality, one is cheaper while the other is expensive, there happens an affect in the market regarding the better sales of cheaper product than the expensive one as market share. In this step, unlike other steps, only a small part of the product is reused. These parts are used in repair, refurbishment and reproduction.

E. Recycle: In the above-mentioned steps, the main purpose is to protect the functions and qualities of the product. However in this recycle step, these functions become dysfunctional, and the main goal here is to recycle these materials. For instance, in many developed countries such as the

USA, Germany and England, metal parts, which account for 75% of the weight of used cars, are recycled.

The Relationship Between Reverse Logistics and Costs

The activities including transportation, warehousing, inventory management, handling, order processing, packaging, procurement and information management in the logistics flow process are expressed as logistic costs. In this regard, logistics costs can also be expressed as costs caused by procurement, production, sales, and distribution. According to a broader definition provided by Keskin (2006), logistics costs are composed of cost elements starting with material procurement process and continuing with sales, distribution and after-sales services including transportation, insurance, customs clearance, interim transport, storage, deterioration, damage, loss, late delivery, penalties, mistakes costs, information systems, information communication, personnel, non-optimal order quantity costs, stockpile and idle capacity costs in transportation vehicles. The management and control of logistics costs firstly require the determination of these costs (Tokay, Deran, and Arslan, 2011).

As the returned, recalled, or unprofitable products in the reverse logistics activities are cost elements, they have a key importance in terms of the perceptions of the manufacturers, and therefore managing this process is of vital significance. How to obtain products to be recycled from customers, management of semi products, raw materials or useless wastes emerging as a result of classification, disassembling and disposal of recalled products in a controlled manner or repairing are among the important elements of how to effectively deal with reverse logistics costs (Dirik, 2012: ii).

In addition to specifying the recall of products by the concept of reverse distribution, Chandran and Lancioni (1981) show schematically the distribution channel of the recalls and how recalls can increase which cost items in the companies. They also categorized these cost items into four sections including communication costs (mail, telephone etc.), renewal costs (production, labeling, packaging, storage, etc.), documentation costs (renewing invoices of recalled products, repairs, etc.), and refurbishment costs (parts placement, stocking, repair, renewal, etc.).

Because finding the share of reverse logistics on the total costs can only be possible by determining the certain shares belonging to the reverse logistics within each logistics process, it is a challenging process to deal with. On the other hand, the concern of a majority of studies in reverse logistics is being unable to have logistics performance to minimize costs by while having profit maximization by integrating reverse logistics to all other logistics processes. Stock (2001) estimates that the share of reverse logistics on total logistics cost is about 4% (Lambert et al., 2011: 562; Yu, 2016: 2694). According to Hill (2004), it is estimated that 20% of all products sold are returned and 5% of companies' logistics costs are spent for reverse logistics (Nakıboğlu, 2007: 186).

Recovery and recycle of products, which are the parameters of reverse logistics, have an important place on operating costs. Such returns reduce direct business profitability. The presence of obsolete products in each logistics flow further increases the cost burden of the companies. On the other hand, it is necessary for the analysis of the products to be renewed to be done correctly and for the cost advantage of the analysis to be carried out by the experts. Any mistakes that can be made in this process can bring additional costs to the companies. Moreover, the return of unacceptable products causes additional costs and damages to the image of the manufacturer. All these are the direct or indirect costs that the manufacturers have to deal with to have a long place in the market (Çetik and Batuk, 2013: 371).

It is difficult for companies to predict how many products they will take back under the circumstances of reverse logistics activities. Thanks to a well-managed reverse flow process, recycling of recalled products in the manufacturing process both helps saving of raw material and poses an environmentalist approach. In addition to this, recycling of the product in the re-production flow can provide added value and they can be offered to second hand markets. All of this shows that reverse

logistics is advantageous in terms of cost. For this reason, the importance of reverse logistics activities is increasing (Quoted from Coşkun, 2011: 42 by Dirik, 2012: 76).

Reverse logistics can provide both direct and indirect benefits to companies in economic terms. The materials and the processes that create added value are transformed directly into economic gains by providing cost advantages. Besides, the positive environmentalist image created by the reverse processes attracts more customers to the business and the market share is preserved (Quoted from Fleischmann, 2001 by İlgün, 2010: 24).

Creating an effective reverse logistics network that is cost-effective and sustainable can be more difficult than designing advanced logistics networks. Returned product quantities, return timings, how favorable the recovery of the returned product is have an impact on cost analysis in reverse processes. In addition, a good information flow system needs to be set up in order to calculate the costs of the reverse processes (İlgün, 2010: 26-27).

During the recovery of the products, many technical processes are applied. Especially since the reprocessing requires a significant amount of investment, reverse processes should be regulated accordingly, taking into account the costs of recalling the products and performing the reflows.

If reverse operations are implemented effectively and efficiently, they can provide an advantage over the competition with other companies in the same market by providing a cost-reducing effect on logistics processes such as transportation and storage related to return activities as well as reducing the cost of obtaining raw materials and materials (İlgün, 2010: 60).

METHOD

The aim of the research part is to examine the inclusion of the 'Reverse Logistics' concept in undergraduate logistics curriculum in Turkey. Undergraduate programs are chosen from the "Student Selection and Placement System Guide for Undergraduate Programs 2017" which has "logistics" name. Undergraduate programs in Cyprus aren't included in the study.

The number of logistics programs are listed according to the name and the number of the schools of faculties that contain these programs are listed under the name of each program.

Curriculums are examined if they contain a unique course of 'reverse logistics'; or this concept is contained as a part in another course, or not included in any of the courses. Curriculums which contain 'Reverse Logistics' as a separate course are analyzed according to the credit-hour basis; it is also mentioned whether the course is compulsory or elective. The results are shown in tables.

FINDINGS

There are 64 Logistics undergraduate programs in 60 Universities in Turkey. 4 universities have 2 different logistics program. Curriculum of one of the programs couldn't be reached, so, curriculums of the 63 programs are analysed. In 6 programs, curriculums could be reached but course contents couldn't be reached. In 2 programs course contents were not adequate. 3rd and 4th year's curriculum couldn't be reached in 1 program and 4th year's curriculum couldn't be reached in 2 program.

The number of each logistics program and the school and faculties that they are contained are shown in Table 1 and Table 2. The programs are.

Table 1: Number of each Undergraduate Logistics Programs

Logistics Programs	Number
International Trade and Logistics	31
International Logistics and Transportation	9
Logistics Management	6
International Trade and Logistics Management	5
International Logistics Management	4
Logistics	3
International Logistics	3
Transportation and Logistics	1
Logistics and Transportation	1
Transportation and Logistics Management	1

As it is seen in Table 1, International Trade and Logistics, International Logistics and Transportation and Logistics Management programs constitute more than two thirds of the whole undergraduate logistics programs.

Table 2: Classification of the Schools /Faculties under each Logistics Program They Contain

Logistics Programs	Number
International Trade and Logistics	**31**
Faculty of Economics and Administrative Sciences	11
School of Applied Sciences	7
Faculty of Applied Sciences	4
School of Applied Technology and Management	2
Faculty of Economics, Administrative and Social Sciences	3
Faculty of Management	2
Faculty of Humanities and Social Sciences	2
International Logistics and Transportation	**9**
School of Applied Sciences	3
Faculty of Economics and Administrative Sciences	2
Faculty of Economics, Administrative and Social Sciences	1
Faculty of Business Administration and Management Sciences	1
Faculty of Business Administration	1
Faculty of Commerce	1
Logistics Management	**6**
Faculty of Business and Administrative Sciences	2
Faculty of Business	2
Faculty of Economics, Administrative and Social Sciences	1
Maritime Faculty	1
International Trade and Logistics Management	**5**
Faculty of Economics and Administrative Sciences	2
Faculty of Business Administration	1
Faculty of Business and Management Sciences	1
School of Applied Technology and Management	1
International Logistics Management	**4**
Faculty of Business Administration	2
Faculty of Business Administration and Management Sciences	1
Faculty of Economics and Administrative Sciences	1
Logistics	**3**

School of Applied Sciences	3
International Logistics	**3**
Faculty of Business Administration	1
Faculty of Business and Administrative Sciences	1
School of Applied Sciences	1
Transportation and Logistics	**1**
Faculty of Transportation and Logistics	1
Logistics and Transportation	**1**
School of Applied Sciences	1
Transportation and Logistics Management	**1**
Faculty of Applied Sciences	1

Table 2 shows the logistics programs and the classification of Schools and Faculties that they are contained. Faculty of Economics and Administrative Sciences, School of Applied Sciences and Faculty of Business Administration mostly contain different logistics programs.

The main analysis of this paper to find out the inclusion of 'Reverse logistics' concept in the 63 curriculums as a separate course or as a part in another course. If it is included as a separate course, it is also analyzed on credit hour basis and whether it is compulsory or elective. 21 programs have 'Reverse Logistics' as a separate course, all on elective basis. Table 3 shows the name, the class and credit hours of the courses.

Table 3: Separate 'Reverse Logistics' Course with its Class and Credit Hour

Name of the Course	Class	Credit hours	Total
Reverse Logistics	4	3	**5**
	3	3	**4**
	4	2	**1**
	3	2	**1**
Reverse Logistics Management	4	3	**1**
Green and Reverse Logistics	4	3	**4**
	3	3	**2**
	4	2	**1**
	3	2	**1**
Reverse and Green Logistics	4	3	**1**

As it is seen in Table 3, 'Reverse logistics' concept is included as a separate course mostly with the same name and as "Green and Reverse Logistics" and mostly in the 4 th class as 3 credit hour basis.

Inclusion of 'Reverse Logistics' as a part of another Course

'Reverse Logistics' is included as a part (as weekly subject) of another course in 14 programs of 16 courses; it is included in 2 courses of 2 programs. It is mostly included in "Logistics Management", "Introduction to Logistics", "Green Logistics" and "Current Issues in Logistics" courses.

Inclusion of 'Sustainability' Concept in Curriculum

8 programs have 10 courses of 'Sustainability' concept as a separate course, all on elective basis. 'Sustainability' is included as a part of another course in 9 programs of 10 courses.

CONCLUSION

The enterprises are realizing that green image and social responsibility may cause to sell their product at a higher price and they reconsider about their market position and business process due to this fact and the increasing concern about environment and energy conservation (Lee and Lam, 2012: 589). Logistics is very important for the continuation of production and consumption functions; if we consider sustainability as a tree regarding to the purpose of enterprises, it is possible to consider environmental approaches and green logistics as branches of sustainability (Musiad Research Report, 2015, 38). Many companies with high international awareness choose their suppliers from the firms who invested in green logistics, so making them also internationally recognized (p. 127).

Environmental issues such as global warming and climate change have serious impacts on daily lives which necessitate sustainability to accomplish environmental, social and economic performances of the organizations (Mavi, Goh and Zarbakhshnia, 2017: 2404). There is a pressure to decrease the destructive ecological and social effects, so businesses are leaded to implement sustainable reverse logistics systems. Many enterprises use reverse logistics activities for reusability of products and because they recognized that it is a competition advantage because of the good results of generating cost saving and revenue (Bulut and Deran, 2008: 339).

As the importance of 'Reverse Logistics' concept is increasing day by day, this paper analyzed its inclusion in curriculum of undergradute logistics programs. There are 64 undergraduate logistics programs in Turkey and only 21 programs have 'Reverse Logistics' as a separate course, all on elective basis. It is one third of whole programs. It is also included as a part of another course in 16 courses of 14 programs. The inclusion of 'Sustainability' concept in curriculum is also examined; it is included in 10 courses of 8 programs as a separate course, all on elective basis and in 10 courses of 9 programs as a part of another course.

As it is mentioned several times in the study, the awareness about reverse logistics is increasing day by day. It is also important to train well equipped students, in other words future specialists, to work in logistics sector who have recognized the importance of reverse logistics and sustainability. The curriculums of logistics programs should be updated for inclusion of reverse logistics as a seperate course. As reverse logistics provides cost advantages, the curriculums should also be supported with adequate accounting lessons to train the future logistics specialist candidates with the ability of calculating the costs.

It is suggested for future studies to examine the relationship between green logistics, reverse logistics and sustainability deeply and also taking opinions of the specialists and academicians about the inclusion of sustainability and reverse logisitcs, or another important topic that they will suggest as seperate courses.

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