

Using Five-R Analysis For Sustainable Supply Chain Management In Clothing Sector

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Abstract

The growing awareness level of consumers and business managers on environmental issues have helped the topic of green supply chain management to become one of the most popular subjects of today. Hence, utilizing of textiles wastes has become increasingly common in the industry. This may stem from two possible reasons: Firstly, cost reduction aim of the companies and also their obligations to comply with the legal regulations of countries, and secondly the desire of the companies to strengthen their corporate image by carrying out environmentally friendly policy in the context of social responsibility. Correspondingly, "Five-R Analysis" is one of the techniques employed to realize these purposes. Five-R analysis developed by Etsy and Winston include the following five concepts: Recycle, reuse, reduce, re-design and re-imagine. Within the scope of this study, the applications of two large-scale clothing companies operated in Turkey are analyzed by using Five-R model concepts and therefore the study aims to reflect the gains of both the companies and their surrounding environment.

Key words: Clothing industry, green supply chain, sustainability, Five-R analysis, Textile industry

1.Introduction

In the new trading scheme where international trade obstacles have been decreasing every day, advantages depending on the labor cost and manufacturing volume slowly losing their importance, while factors such as social and environmental standards compliance have emerged as the new competitive advantages [1]. Therefore, increasing welfare level of communities both in our country and in the other countries around the world has brought the concept of "sustainability" depending on the economic, technological and political developments. For this reason, more companies have started to act while considering the economic, social and environmental impacts of their manufacturing processes, products and services. The concept of sustainability should be understood with its economic (efficiency, growth, etc.), environmental (healthy environment, efficient use of natural resources, etc.) and social aspects (full employment, equality, security, etc.) as a whole. Increasing education and awareness level of consumers and also the intent of companies to move their commercial relations to a more professional and environmentally friendly platform introduced the fact that these activities now are not only expected from the government but also from the companies and their business partners. One of the most important tools of sustainability providing competitive advantage to today's enterprises is the activities performed in the field of supply chain. In the literature the concept of sustainability in the supply chain is defined as managing the environmental, social and economic impacts of products and services throughout their life-cycle. In this context,

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improvements and regulations focusing on cost reduction as well as environmental issues conducted by both within the companies and with partner companies can serve to the concept of sustainability.

"Era of environmental awareness" that began towards the end of 90s emphasizes the need of taking concrete steps and giving importance in respect of protection of the environment as much as efforts of companies for their industrial developments. Accordingly, green supply chain has become one of today's hottest topics owing to the growing awareness level of consumers and also business executives on environmental issues. By adding the "green" concept to supply chain management, acting with the principle of environmental awareness in both materials management and as well as in all logistics operations and configuring the chain in this way has become more important [2].

Textile and clothing industry which has an important place in Turkey's economy and industry has a long and a complex supply chain. Therefore, the supply chain structure is suitable for applications in innovation and acting with the consideration of sustainability. Being able to adapt the sector to changing competition conditions of the world and consumer demands by providing innovative and sustainable activities would be to the benefit of the country's economy, companies' financial structure and consumers' wellbeing.

Waste management is one of the methods used in textile and clothing companies with the purpose of ensuring the sustainability. Some portion of this waste can be reintegrated into production while some cannot be. The reasons for occurrence of such waste depend on various factors. These factors can be listed as the following: raw material variability, work area air conditions variability, variability of order amount (the amount of waste increases while order size decreases and order type increases), insufficient and inadequate work schedules and controls [3]. These wastes are classified under three main groups in the literature in general. Firstly, the wastes from spinning mills, secondly, textile manufacturing wastes and thirdly, apparel wastes of the consumers [4]. Textile wastes can be sent to recycling in order to obtain the raw materials. On the other hand, apparel products are collected by the companies, these collected clothes can be turned into raw material to a level by recycling processes or the repairment of these products enables the re-usage.

Utilizing of wastes in the textile sector has become increasingly common as mentioned afore. This is thought to be of two reasons. First reason may originate from the legal regulations of the state to be complied with in addition to the purpose of reducing costs; and the latter is the desire to strengthen the corporate image through eco-friendly policies in the context of social responsibility.

Other than utilizing wastes, the efficient use of water, energy, raw materials, human and time factors are also among the important topics in terms of sustainability because of the nature of textile and clothing industry. Analysis and some of the systems are used to increase the efficiency of production materials and human factor, and while doing so, to reflect the environmental awareness to the work done. One of the methods used for this purpose in the literature is the "Five-R Analysis". Five-R analysis developed by Etsy and Winston include these five concepts:

Recycle, Reuse, Reduce, Re-design and Re-imagine [5]. These five critical topics mentioned are used to analyze clearly the applications of the companies and their gains through these.

Five-R Analysis developed by Etsy and Winston [5] includes the following concepts:

1. **Recycle:** Waste materials are collected and converted into reusable forms. This process can be applied to both industrial and also consumer wastes. Ready-to-wear denim can be given as an example of this process in clothing. Denim fabric forming fibers can be restored to their original fiber length and form by recycling [6]. However, as Shedroff stated, especially it is difficult to convert apparel products into raw materials in an economical manner, because these garments are composed of fiber mixture [7]. For instance, because of the reason that there is not an economical method of recycling sleeve consisting of 80% cotton 20% rayon, such products often cannot be imparted to reproduction.
2. **Reuse:** Reuse is using the material in their original forms. In this way, the life of the material is extended. Packaging materials and accessories (buttons, zippers, etc..) can be re-used in the manufacture of other products in clothing processes.
3. **Reduce:** Reducing the usage of resources and avoidance of waste is the main objective of this segment. Collaborations with local firms for fabric and material purchases may play an important role in reducing carbon dioxide emissions spread into the environment. In addition, establishing demand forecasting systems may prevent the excessive production and, therefore, excessive use of resources.
4. **Re-design:** At this stage, companies must review what and how they are doing. Re-design stage is divided into two categories, namely, product design targeting the re-use of materials and re-design of existing processes to increase the efficiency [6]. Both approaches also possible to adapt to the clothing. Using recyclable and reusable materials in designing of the garments is possible, while some systems may be utilized in the companies to prevent the excessive purchase of materials in large quantities used in clothing manufacturing such as fabrics, accessories and packaging. For instance, cutter cutting system reduces fabric consumption and wastes greatly compared to other cutting methods.
5. **Re-imagine:** Innovation is meant by this step. The aim of re-designing and re-imagining steps is to enable companies to seek new opportunities for creating value in the framework of environmentally sensitive policy. Additionally, including the principles of lean manufacturing and agile manufacturing to the companies' supply chain system, their cycle times can be shortened, high-quality production rates can be increased and also the ratio of waste can be reduced.

2. Material and Method

In the scope of the study, two large-sized companies which are located in Izmir and have textile manufacturing facilities were examined under the headings of Five-R the method described

above. In this context, the applications of the companies and their achievements as a result of these applications are tried to be reflected.

3. General Findings of the Research

EKOTEN, operates in Torbalı, is the first textile company analyzed for the study. The company has a monthly production capacity of 3 million meters of woven fabrics and a working team including 909 staff. At the same time, Ekoten is the largest exporter of knitted fabrics in Turkey. The company is one of the suppliers of the world's leading fashion brands such as M&S, Zara, Mango and Topshop. 10 black belt and 5 green belt employees are taking place in Six Sigma projects to maintain the innovative organizational culture. Furthermore, a full-time engineer and employees are also available in the occupational health and safety committee. EKOTEN carries out research and development activities with its R & D center approved by Industry and Technology Ministry, so that performance improvements of product groups are achieved and also some projects are conducted to increase the efficiency of processes. These efforts are aiming to better the energy and raw material costs, and also to minimize the damage of environment.

The following findings emerge resulting from the analysis of EKOTEN with five-R concept.

Recycle

- Heat energy is used in different ways by the recovery of waste water heat projects.
- Hot water recovery plants are established because of its important role in dyeing processes.
- All kinds of waste resulting in the company are classified, stored and collected separately. Afterwards, they are sent to the recycling companies approved by the Provincial Directorate of Environment.

Reuse

- In the companies, the temperature of boilers used for generating steam used to reach to 850°C and a portion of the heat energy was ejected from the flue as waste heat. Established gas liquid heat exchanger enables the re-usage of this heat by increasing the temperature of boiler feed water.
- Waste water is brought into production through treatments.
- Efficiency of heat recovery plant is increased by using waste water.

Reduce

- Through specific studies in order to reduce steam consumption, steam consumed per 1 kg fabric is reduced from 9,5 kg to 4,8 kg.
- Boiler efficiency is increased by 5% through the efforts in order to avoid energy wasting of boilers.
- By changing the water softening system, the total water consumption, specific salt consumption and energy costs are reduced.
- By changing the fabric edge cutting motor, the cut has been thinner and hence rate of waste is

reduced.

- Power consumption is reduced through the use of LED lighting.
- Energy consumption is reduced by reducing the circulation and operation of the fan motor power of the drying machines.
- Water, dye and energy saving has been achieved through the reduction of flote rates.
- Energy and raw materials savings were achieved by altering the dyeing and washing machines.
- Greenhouse gases released into the air is kept under control to ensure sustainability and not to exceed certain limits within the framework of the worldwide accepted standards.
- Waste reduction efforts are carried out as part of the integrated management system. The least waste producing and the best waste classifying departments are rewarded within the repeated reviews in every 6 months.

Re-design

- Specific gravity of compressor area is reduced in order to design the air quality of compressor area within the framework of international standards.
- Ekoten is qualified for ISO 50001 energy management system certificate as being the sixth in the world, second in Turkey and the first in the sector of textile for establishing these standards throughout the firm.
- Ekoten has also been eligible to receive the certification of ISO 14001 environmental management system. In this context, waste management system has been established. In line with the new system, all kinds of waste resulting in the company are classified, stored and collected separately for recycling, and these wastes are sent to the recycling companies. All of these companies are approved by the Provincial Directorate of Environment and they are working within the framework of specific environmental standards.
- Through the establishment of education department, blue and white collar employees are informed about the general responsibilities expected from them and at the same time the department aims to raise awareness about occupational safety and waste management while directing the employees regarding the applications of the company.
- A process team is organized in order to reduce the use of chemical substances without sacrificing quality and the team members are employed only to focus on this area.
- Environmentally-friendly organic fabrics are also involved in the manufacturing processes through receiving the organic production certifications.
- In order to improve the performance of employees and spread the organizational culture, activities such as dinners with the participation of all employees and painting competitions for children are organized.

Re-imagine

- Automation system is established and by doing so instantly detection of errors during production is allowed. Before the establishment of system, the fabric produced was controlled by the quality control department, however, after the new system monitoring can be done simultaneously with the production processes.
- ISO 50001-energy management system is established in a one-year time period starting in

December 2012 and energy management standards are revised within the framework of energy management system.

- 6 Sigma activities have begun in 2005 and today the company is continuing the 6-Sigma projects.
- The newly established department of technical textiles aims to improve product characteristics while taking advantage of the latest technology and working on products with less adverse effects for the environment.
- Children are not employed within the framework of company ethics and ILO standards and also health and safety of employees are regarded to keep ethical values at the forefront.
- Ekoten also gives importance to social responsibility projects. Libraries are provided to schools that do not have sufficient financial possibilities, aid of clothes and toys to students at these schools is provided. Company also delivers the second-hand items of the employees and as well as the produced clothes of business-partner firms to less fortunate families. Furthermore, apparel aids are realized for children and young people under governmental care.
- In addition, various social responsibility projects are realized with other organizations. For instance, the company sponsored printing and production of the T-shirts that LÖSEV sells to obtain fund and also fabric support is provided for new productions. In partnership with Rotaract clubs, there is a project including entertainment and clothing aid for children with insufficient financial means during the feast of sacrifice.

MAYTEKS established in Manisa is the other company interviewed for the study. The company serves customers by over 500 employees on a 40.000m² closed production area. 950 tons of knitted, 750 tons of paint & finishing and 200 tons of printed fabric are produced per month. Company, that operates dyeing, printing and finishing processes in Manisa, export 70% of products abroad. The company also carries out joint projects for research and development activities with universities and other institutions.

The following findings emerge when we evaluate applications of MAYTEKS in the scope of Five-R analysis.

Recycle

- Through heat recovery of waste water projects, heat energy is utilized in different ways.
- All kinds of waste emerge in the company are classified, stored and collected separately and these wastes are sent to the recycling companies approved by the Provincial Directorate of Environment.

Reuse

- Soft water is heated by utilizing the heat energy of the waste hot water and, accordingly, the temperature of the soft water reaches from 25°C to 45°C.
- 50 tons of water per day is again been brought into production by using waste water of tube opening for blanket cleaning of printing machines.
- Water used in the regeneration of resin for water softening process is not drained to the water

waste line. Instead, to use this water again, conductivity of the water is controlled instantaneously by an electrode and water that is under a certain level of conductivity is sent to the pool of raw water. Thereby, 150 tons of water per day is imparted to reproduction.

Reduce

- The pH of waste water is adjusted by using sulfuric acid which is a waste product of the coal boiler. In this way, new and other chemicals are not used for this purpose which means less damage to the environment.
- 10% saving in the use of chemicals and dyes are provided thanks to auto paint and chemical dosing system. The system also ensures repeatability in production and reduction of error rates and wastage.
- Numbers of washing baths are reduced through the reduction of flotte rates. For example, the flotte rate is reduced from 1:8 to 1:6 for cotton dyeing with these experiments. Water, energy and production lead time reduction is achieved resulting from these efforts.

Re-design

- The company expands and redesigns the product scale in line with customer expectations and demands by producing "Organic" and "Better Cotton" products, and company also has been eligible to receive internationally recognized environmental certificates.
- All kinds of waste resulting in the company are classified, stored and collected separately for recycling, and these wastes are sent to the recycling companies. All of these companies are approved by the Provincial Directorate of Environment and they are working within the framework of specific environmental standards.

Re-imagine

- One of the overall objectives of finishing businesses is to minimize the use of water, chemicals and time. To accomplish this goal, the company has made continuous experiments and improvements according to their statements. For example, the flotte rate is reduced from 1:8 to 1:6 for cotton dyeing with these experiments. Water, energy and production lead time reduction is achieved resulting from these efforts.
- In the long term, on-going new dyeing projects of the company aim both to reduce the bath numbers and also to decrease dyeing temperature. Thus, reduction of water, energy and production lead time is attempted.

4. Results and General Evaluation

Textile and clothing industry is one of the sectors that contain intense competition both in our country and in the world. Because of increasing consumer awareness, new legislations and sanctions of the governments, the advantages ensured by the international certification and standards, becoming a requirement in today's professional business world, companies have started to re-design their supply chain more "green" day by day. This situation brings about sustainability and directs companies towards being more innovative. Textile and clothing

industry in our country with a significant production potential and high rate of employment has a competitive position in the international arena. Innovative and sustainability-oriented investments and practices in such a sector will be able to make significant contributions to the economy of both the country and business, while contributing as well as to the environment and consumers with the efficient use of natural resources.

Effective use of resources and waste reduction in textile and clothing industry, as in all sectors, enable environmental and cost advantages while playing an important role in reducing the risk of harming the environment. To accomplish these goals, companies are required to analyze their production and supply chain structures primarily within this perspective. One of the methods developed for this purpose is Five-R analysis. As discussed above, firms can revise their practices in the framework of five titles, namely Recycle, Reuse, Reduce, Re-design and Re-imagine.

Five-R analysis offers companies the chance of reviewing their applications and realizing how effective they use a specific amount of resources such as raw materials and energy. In this way, firms can take important steps in coping with high costs, and as well as resulting from sustainable implementations our surrounding environment will likely to be less damaged and therefore consumers also may live in a healthier world.

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