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**ENVIRONMENTAL PERFORMANCE EVALUATION
OF SUPPLIERS: A CASE STUDY ON WHITE GOODS
INDUSTRY**

Hande OĞUZ

Supervisor

Assoc. Prof. Dr. Banu DEMİREL

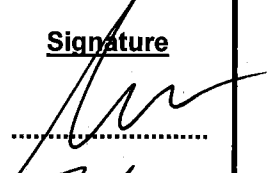
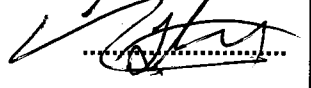
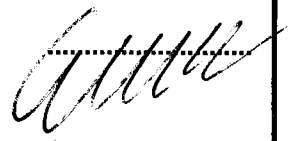
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APPROVAL PAGE

University : Dokuz Eylül University
Graduate School : Graduate School of Social Sciences
Name and Surname : HANDE OĞUZ
Title of Thesis : Environmental Performance Eulation of Suppliers: A Case Study on White Goods Industry

Defence Date : 25/07/2019
Supervisor : Assoc.Prof.Dr. Banu DEMİREL

EXAMINING COMMITTE MEMBERS

<u>Title, Name and Surname</u>	<u>University</u>	<u>Signature</u>
Assoc.Prof.Dr. Banu DEMİREL	-Dokuz Eylül University	
Assoc.Prof.Dr. Aşkın ÖZDAĞOĞLU	-Dokuz Eylül University	
Prof.Dr. Emre GÜLER	- İzmir Katip Çelebi University	

Unanimity (X)

Majority of votes ()

The thesis titled as "Environmental Performance Eulation of Suppliers: A Case Study on White Goods Industry" prepared and presented by HANDE OĞUZ is accepted and approved.

Prof. Dr. Metin ARIKAN
Director

DECLARATION

I hereby declare that this master's thesis titled as "Environmental Performance Evaluation of Suppliers: A Case Study on White Goods Industry" has been written by myself in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honour.

Date

../../....

Hande OĞUZ

Signature

ABSTRACT

Master Thesis

Environmental Performance Evaluation of Suppliers: A Case Study on White Goods Industry

Hande OĞUZ

Dokuz Eylül University

Graduate School of Social Sciences

Department of Business Administration (English)

Business Administration (English) Program

In 21st century, people are much more aware about the importance of the environment than the previous centuries. There are several reasons behind but at the end, in business perspective, procurement functions have big responsibility such as buying the service or products with the low cost, higher quality level but also having some responsibilities about environment.

In the literature, to the best of the author's knowledge, there are limited studies which provides a holistic model on green supplier selection and evaluation. Mostly, the studies are based on the traditional ways of supplier selection and evaluation models. However, the challenging issues of sustainability and the climate change enforces companies not only to pursue pro-environmental practices but also to manage their supply chain in a more environmentally responsible way. This necessity also requires the integration of purchasing function in the supply chain and the sense of environmental responsibility as well as the other functions. Companies should embrace an approach that accepts purchasing function as a strategic function by integrating environmental issues in their decision making process. Hence, the overall objective of this study is to provide a framework which aims to integrate environmental factors into the supplier selection and evaluation process. This framework is believed to serve as a decision support tool for companies in their green supply chain efforts in terms of their purchasing function.

Application section, a framework of the supplier selection and evaluation process which incorporates environmental performance is developed by using AHP method. Manufacturers of related industries can use our proposed model, or tailor the model to meet their own needs, to evaluate their green suppliers or to select the best green supplier for cooperation.

Keywords: Supply Chain Management, Green Supply Chain Management, Environment, Environment Management System, ISO 14001, Analytical Hierarchy Process



ÖZET

Yüksek Lisans Tezi

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Hande OĞUZ

Dokuz Eylül Üniversitesi

Sosyal Bilimler Enstitüsü

İngilizce İşletme Anabilim Dalı

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21. yüzyılda, insanlar çevrenin önemi hakkında önceki yüzyıllardan daha fazla farkındalığa sahipler. Bunun arkasında bir çok sebep vardır, ancak nihayetinde iş perspektifinden bakıldığında, satınalma işlevlerinin düşük maliyetli, yüksek kalite seviyesine sahip ancak aynı zamanda çevre konusunda bazı sorumlulukları olan hizmet veya ürünleri satınalma gibi büyük sorumlulukları bulunmaktadır.

Literatürde, yazarın bilgisinin yararına, yeşil tedarikçi seçimi ve değerlendirmesinde bütünsel bir model sağlayan sınırlı sayıda çalışma bulunmaktadır. Çoğunlukla, çalışmalar geleneksel tedarikçi seçimi ve değerlendirme modellerine dayanmaktadır. Bununla birlikte, zorlu sürdürülebilirlik ve iklim değişikliği sorunları, şirketleri yalnızca çevre yanlı uygulamaların sürdürülmesini değil aynı zamanda tedarik zincirlerini daha çevreci bir şekilde yönetmelerini de zorlamaktadır. Bu gereklilik aynı zamanda satınalma fonksiyonunun tedarik zincirine entegrasyonunu ve diğer fonksiyonların yanı sıra çevresel sorumluluk duygusunu da gerektirir. Şirketler, çevresel sorunları karar alma süreçlerine dahil ederek satın alma işlevini stratejik bir işlev olarak kabul eden bir yaklaşımı benimsemelidir. Dolayısıyla, bu çalışmanın genel amacı, çevresel faktörleri tedarikçi seçimi ve değerlendirme

sürecine entegre etmeyi amaçlayan bir çerçeve sağlamaktır. Bu çerçevenin, yeşil tedarik zinciri çalışmalarında şirketlerin satınalma fonksiyonları açısından karar destek aracı olarak kullanıldığına inanılmaktadır.

Uygulama bölümünde, AHP metodu kullanılarak, çevresel performansı içeren tedarikçi seçim ve değerlendirme sürecinin bir çerçevesi geliştirilmiştir. İlgili endüstrilerin üreticileri önerilen modelimizi kullanabilir veya modeli kendi tedarikçilerini değerlendirmek, yeşil tedarikçilerini değerlendirmek veya işbirliği için en iyi yeşil tedarikçiyi seçmek için uyarlayabilir.

Anahtar Kelimeler: Tedarik Zinciri Yönetimi, Yeşil Tedarik Zinciri Yönetimi, Çevre, Çevre Yönetim Sistemi, ISO 14001, Analitik Hiyerarşi Süreci

**ENVIRONMENTAL PERFORMANCE EVALUATION OF SUPPLIERS: A
CASE STUDY ON WHITE GOODS INDUSTRY**

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ABBREVIATIONS

AHP – Analytical Hierarchy Process

AQAP – Allied Quality Assurance Publications

BS – British Standard

EMAS – Environmental Management System

EMP – Environmental Management System

EMS – Environment Management System

IEC – International Electrotechnic Commission

ISO – International Organization for Standardization

NATO – North Atlantic Treaty Organization

RC – Responsible Care

RCMS – Responsible Care Management System

SAGE – Strategic Environment Consultancy Group

SC – Supply Chain

SCM – Supply Chain Management

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INTRODUCTION

Faster than the rate of renewal of natural resources in the last century environmental crises have emerged as a result of their consumption and these crises have become a threat to the lives and future of both human beings and other living things. A large number of actors, households, governments and non-governmental organizations, etc., have had an impact on crises. However, organizations are known to play a key role in sustaining sustainability as they use a large part of society's resources and have a large and profound impact on society. It is possible to measure the contributions of organizations to sustainability and the damages they cause to the natural environment and to evaluate the performance of organizations in this context.

The objective of this study is to provide a framework which aims to integrate environmental factors into the supplier selection and evaluation process. This framework is believed to serve as a decision support tool for companies in their green supply chain efforts in terms of their purchasing function. This study consists of three chapters. In the first chapter, general overview of Supply Chain and Supply Chain Management is given to understand the mechanism and the concept of the system. Sustainability, and its dimensions are also discussed in this chapter. Besides, the place and the importance of environment in the system is identified. Then, the information provided about the role and function of purchasing, which is one of the most important units related to environmental perspective.

In chapter two, general overview of environment is made. In order to examine the environment management system concepts, first definitions of environment, environmental degradation, causes, effects and solutions are examined. After that, the environment management and audit system determined in details. Key benefits, implementation and importance are examined. Then the other tools while evaluating the Environmental performance is defined. The chapter finishes with the definition, concept and the details of the most used environmental performance evaluation tool, ISO 14001.

In chapter three, the methodology and the findings are presented. Case study method is selected for this study to assist company to prioritize the environmental

strategies and related initiatives and in-depth interview are applied for data collection. Based on the model, as a decision support tool, Analytical Hierarchy Process (AHP) used to evaluate the relative importance of various environmental traits and to assess the relative performance of several suppliers along the traits. Finally, the conclusion of the study is introduced.



CHAPTER ONE

SUPPLY CHAIN MANAGEMENT AND SUSTAINABILITY

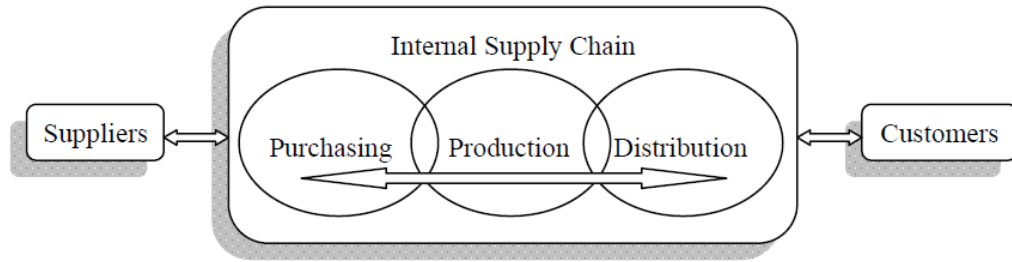
1.1. SUPPLY CHAIN AND SUPPLY CHAIN MANAGEMENT

1.1.1. Defining the Supply Chain

Procurement is to determine the most suitable suppliers that can provide these resources by searching for the resources that the enterprise needs and obtaining these resources from the suppliers. Today, the word procurement in enterprises is used as the name of a department that expresses purchasing. The procurement department of a company is the department that plays the most important role in the international relations of that company. The effectiveness of a procurement department depends on the provision of the information flow from the various units and external units of the firm to the procurement department and from the procurement department to the other functions of the firm. Nowadays, with the advancement of technology, this information flow can be transmitted more accurately and faster. The supply chain includes the whole of the activities in the steps of a substance from raw material to the final consumer. These activities include the information systems required for raw material and material supply, production and assembly, storage and stock tracking, order processing and order management, distribution, delivery to the consumer and follow-up and control of all these activities (Christopher, 1992).

Chen and Paulraj (2004) argued that it is an organization and activities covering the supply of raw materials and converting the raw materials in the production process to the end-consumer, extending from the supplier to the customers.as can be seen in the Figure 1:

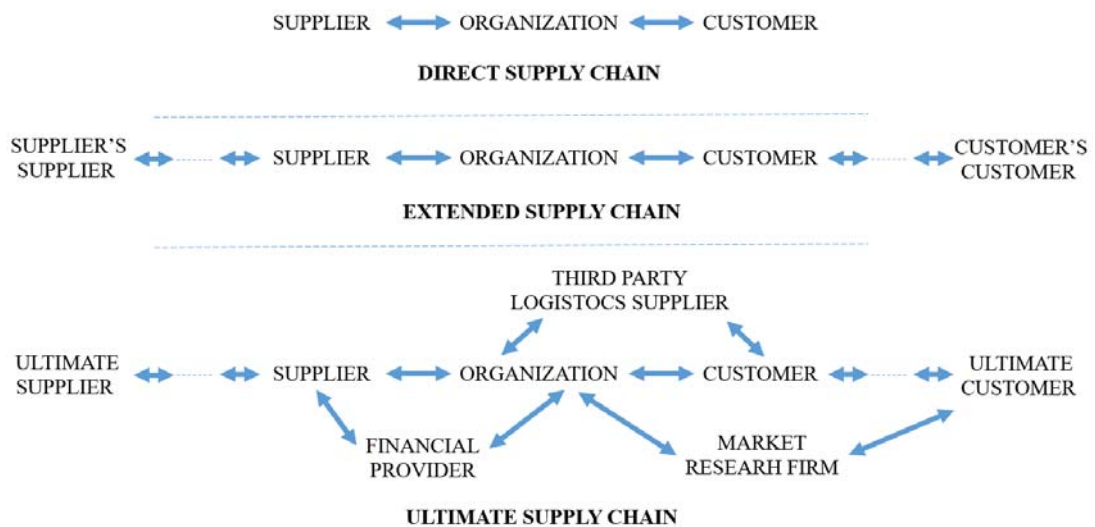
Figure 1 An illustration of a company's supply chain



Source: Chen and Paulraj, 2004

Mentzer et al (2001) stated that the supply chain covers all activities from the raw material to the final consumer, including the continuous flow and conversion of the product as seen in Figure 2.

Figure 2 Direct and extended supply chain



Source: Mentzer et al, 2001

All kinds of resources and components involved in all activities carried out in the Supply Chain process are converted to products and delivered to the customer at the final stage (Mentzer et al, 2001).

According to Mentzer et al (2001), supply chain is the network of all facilities and distribution systems which have the task of purchasing raw materials and converting them to intermediate and final products and delivering the final product to

the customer. In addition, although the structure of the supply chain varies according to industry and firm, it can also be seen in production and service sectors.

1.1.2. Definitions of Supply Chain Management

The extent to which material and information flows in the supply chain are constructed and realized in an efficient and correct manner is an indicator of the success of supply chain management. Structuring, operating, controlling and monitoring all management and planning processes and operational processes among supply chain members and within each member's own body should be handled in this context.

Supply chain management processes and operational excellence are critical to the sustainable success of organizations in today's challenging economic and competitive conditions (Cooper and Ellram, 1993)

The supply chain of suppliers, manufacturers, distributors and retailers is unique systems in today's economy. It can be defined as managerial tasks in which the material and information flow is effectively provided between suppliers, manufacturers, distributors, retailers and customers in this logistics system (Sambrani and Pol, 2016).

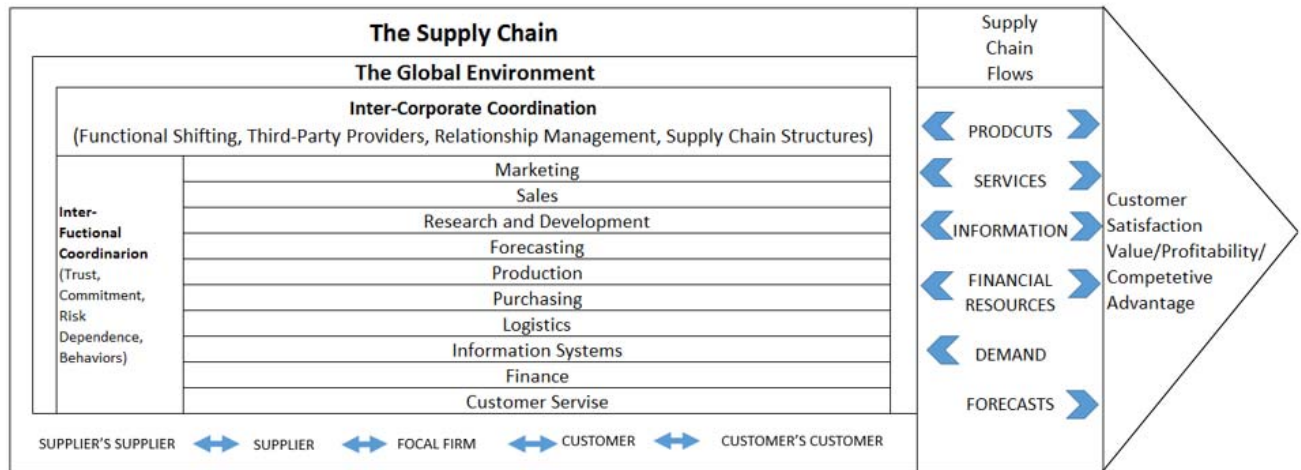
Chopra and Meindl (2007) define supply chain management “*supply chain is not a network of mutual relations between companies, it is a business and relations network that covers the relations of many companies and organizations.*”.

It is the process of discovering and managing a product with all its components from raw material to finished products or services. Today, companies want to market more products and to minimize the costs of their products due to increasing competition conditions. For this reason, enterprises are required to produce and deliver products in the amount requested by their customers. Based on these requirements, the Supply Chain Management philosophy has been formed.

As can be seen from the figure above, applications such as demand forecasting, procurement, needs and production planning are material management in the 1980s. Applications such as distribution planning, order processes and transportation were called physical distribution. Material management and physical

distribution were handled together with storage and packaging in the 1990s and accepted as logistics. When information technologies, marketing and strategic planning were added to logistics applications, this comprehensive application was accepted as Supply Chain Management since the early 2000s.

Figure 3: A Model of Supply Chain Management



Source: Mentzer et al, 2001

1.1.3. Historical Development of SCM

In the literature, there are many different perspectives on the historical development of SCM but many researchers agree that the main progress is related with the changes on logistic management. While some academicians deal with the development of the SCM in terms of production and operations management, some of them deal strategically, while others have explained with physical distribution management, logistics and integrated logistics (Paksoy, 2003).

The first emphasis on the physical distribution stage, which is considered the first stage of supply chain management, was made by Bowersox in 1960s (Bowersox and Closs, 1996).

In the 1970s, Material Requirements Planning (MRP) system, which gives information about what parts of the products, the amount of time and when the product is needed, opens up the use of computer and information systems in the

production sector (Paksoy, 2003). As a result, businesses understand that the system approach is necessary, instead of process approach, to reduce the cost and to optimize the processes.

In a very general sense, it refers to the universe of an enterprise's activities of producing a product or service that resembles a closed network in a circular structure. Thanks to the aforementioned global developments, after the 1990s, it has reached incredible levels of scope and application. Previously, it took 15-30 days for an enterprise to deliver a product that was stored to the consumer as a product, and this period could be longer in certain periods. In this process, manual or computer support was used. But things didn't always go as planned. Either there were no goods in stock, either missing or incorrect orders or production orders were ordered, or the product was shipped to the wrong address (Houlihan, 1988).

After the mid-1990s, managers realized that goods and services from suppliers had an important impact on the ability of the enterprise to meet the needs of their customers. Executives also realize that producing quality goods is not enough by itself. New success method for delivering products to the customer when, where, how and with the desired amount of cost-effective way. As a result of all these developments, business managers have realized that it is not enough to manage their own businesses. Thus, they understood that the network where all the upstream enterprises supplying inputs to them and also the last customers need to take part in managing the whole network of downstream enterprises that deliver products and provide after-sales services (Handfield and Nicholas, 1999). This period is called the SCM stage in the literature according to Ross (1998) and at the same time, Metz (1998), uses the Integrated Supply Chain Management stage statement.

1.1.4. Aims and Benefits of Supply Chain Management

SCM structure covering more than one business, by acting as a single enterprise, aims to create a synergy through the common use of resources (process, human, technology and performance measurements). The aim here is to increase the production capacity of the enterprise, to improve the sensitivity of the changes in the market and to improve the relations between the consumers and the suppliers of

procurement, and thus to deliver the high quality product or service in the fastest and most reliable way with the lowest cost (Civaroğlu, 2006).

The ultimate goal of SCM is to meet customer demand in the most efficient way (Wang et al., 2004). High level of customer service is the main condition for the development of competition and competitive advantage (Korpela et al., 1998). The development of competitiveness in the supply chain depends mainly on the integration of enterprises, coordination of materials, information and money flows throughout the chain (Bayrakçıl, 2007).

The second objective of SCM is to ensure efficiency and cost-effectiveness within the entire operating system: raw materials and other procurement costs, facility investment costs, transportation costs of purchased goods and final product, direct and indirect production costs, direct and indirect distribution center costs, stock cost of ownership and minimization of transportation and transportation costs (Paksoy, 2003). The main aim is not only to reduce transportation or stock costs, but also to implement the system approach to supply chain management (Şen, 2007). This system approach provides a framework to best respond to business needs. Otherwise, the elements will be in contradiction with each other (Başkol, 2011).

We can summarize the important aims of SCM as following:

- Decrease the defect production,
- Decrease the cycle time,
- Increase the competitiveness,
- Increase the profit,
- Increase the market share,
- Increase the service performance

In order to achieve these objectives, companies that included into the supply chain should be integrated in such a way that they operate as a single enterprise and must cooperate in sharing information throughout the chain.

1.2. SUSTAINABLE SUPPLY CHAIN MANAGEMENT

1.2.1. Sustainability

With the rapid increase in the world population and consumption, the risk of environmental pollution and destruction of natural resources has been faced with advances in technology. Sustainable development has been seen as a concept that begins with the industrial revolution and foresees economic benefits to the process of processing raw materials, but prevents environmental and social developments. Founded in 1968 in Rome, the capital of Italy and published papers on humanity, life, economy and safe future, the Club of Rome, Massachusetts Institute of Technology in a research made by the research, the relationship between the economy, the environment and economic growth revealed and interest has been drawn on environmental issues. In this research, five topics, namely production, nutrition, population raw materials and environmental pollution, were emphasized. It is emphasized that humanity may face the threat of extinction due to the shortage of raw materials and environmental problems that may be experienced if the industrialization process continues under current conditions and conditions.

The first serious step in the development of the concept of sustainable development In June 1972, 113 countries came together in Stockholm, the capital of Sweden, gathered under the name of the Human Environment Conference and the United Nations Environment Program (UNEP) was established. The program addressed environmental issues within the United Nations and it was deemed appropriate to support environmental actions with a financial fund. Sustainability is a highly ethical subject and firms today view sustainability as a critical factor for competitiveness (Ross et al., 2012). In throughout the history, a lot of philosophers and thinkers talked about rules, which have the same logic as sustainability. From all these principles, the fair way is to give chance to the next generations to sustain some resources (Kuş, 2012).

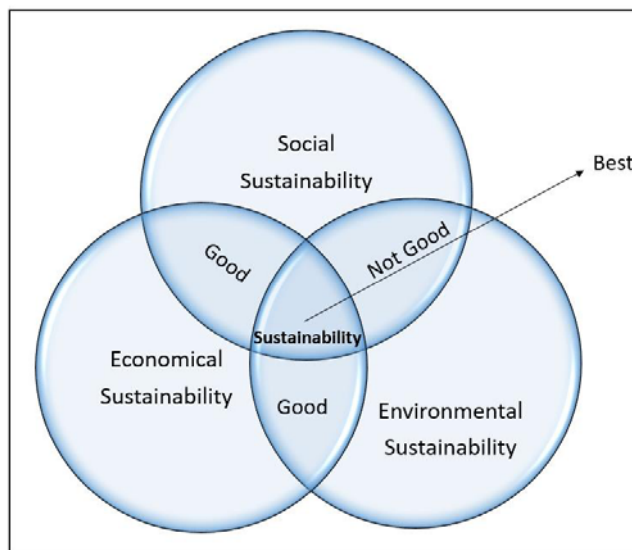
In Soubbotina's report (2004) compiled for the World Bank, it was emphasized that the concept of sustainability is closely related to the concept of equality. The notion of equality here is used to mean that different parties can have the same conditions in terms of their ability to meet their rights and needs. In order to

protect future generations, it is important to first establish equality among today's generations, and to shape sustainability goals in this direction.

Sustainability, in other words, is a World Conservation Strategy which is a more ecological approach that makes a significant contribution to the concept of sustainable development or development. It was published in 1980 by the World Conservation Strategy, the International Union for Natural Resources and Nature Conservation, the World Wildlife Fund and the United Nations Environment Program. However, it is observed that the economic and environmental issues are dealt with from a narrow point of view with the view that every impact will adversely affect the environment in the sustainable development approaches discussed in the World Conservation Strategy. For this reason, the framework of the concept of sustainable development has been redefined in 1984 within the framework of the United Nations Environment Program (Kuş, 2012).

Many problems encountered today have simple solutions. If we want to contribute to sustainability individually; it is possible for us to want and have a more just and sustainable life by using the information that people have learned by living and discovering for thousands of years. There is only one answer to the sustainability situation that must be provided by people. Correct orientation of the choices to be made (Epstein and Yuthas, 2012).

Figure 4: Triple Bottom Line



Source: Carter and Rogers, 2008

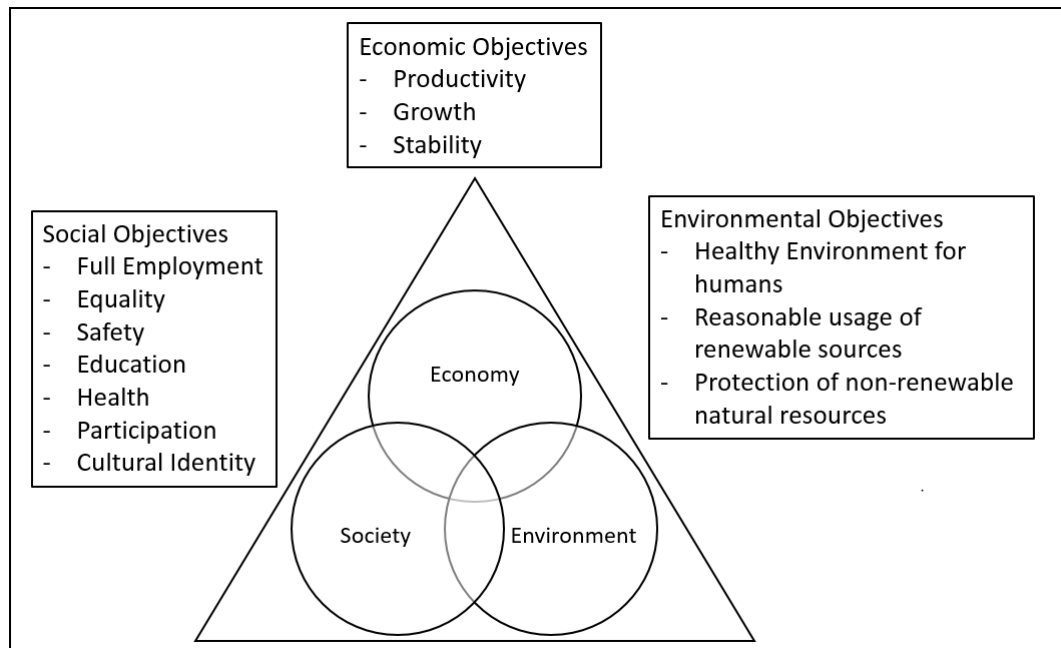
Another development that demonstrates the importance of sustainable development, eco-development thought has been considered as a development that considers the protection and improvement of physical living conditions of the environment and society, uses the resources correctly, and can be exploited from technology and paved the way for the concept of sustainable development (Carter and Rogers, 2008).

As depicted in Figure 4, we can see that sustainability is achieved from the combination of economical, environmental and social dimensions (Carter and Rogers, 2008).

Sustainability ensures continuity in the activities that will be carried out after the completion of the projects with the beginning and the end. It is very important to evaluate the sustainability activities in the area where the study is planned during the preparation process of the project. When applying for grant support for your project, one of the criteria for selecting the project you are applying for is, of course, the sustainability of the project.

Although the environmental dimension is more prevalent, it is basically necessary to read the concept of sustainability as a whole of 'economic, environmental and social' dimensions. When these three dimensions are considered together, it is seen in Figure 5 that conflicting goals can be defined under the same concept. (Soubbotina, 2004; Zink, 2008).

Figure 5: Dimensions of Sustainable Development



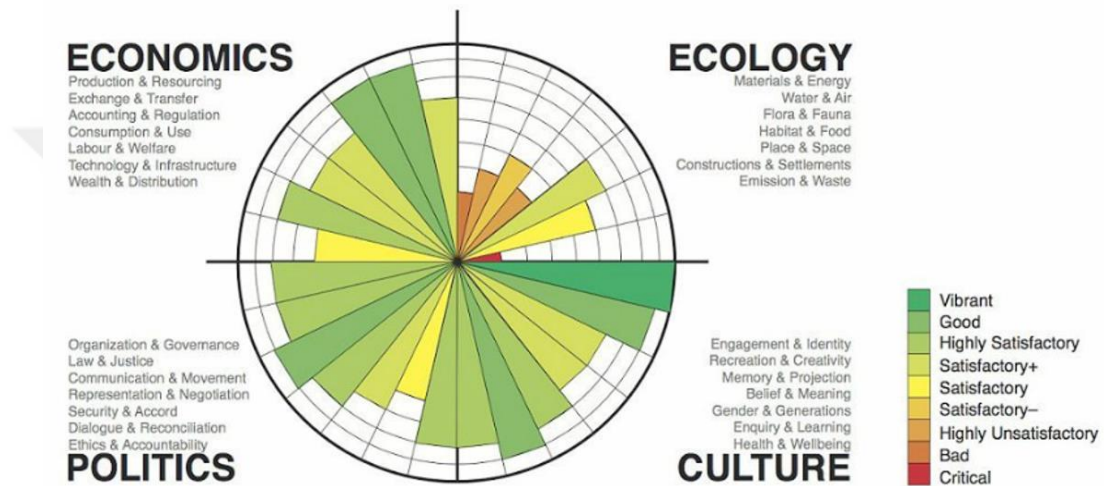
Source: Soubotina, 2004

The aims of economical and environmental sustainability may create some conflicts and the combinations of these two notions are sometimes incompatible for businesses. In a world where growth is only measured by an increase in manufactured goods and services, the necessity to protect the resources that make up inputs necessary for the production of goods and services, creates a contradiction. In order for these two purposes to be realized together, the concept is evaluated integrally with a system thought and it is necessary the professionals belonging to different disciplines who are experts in these three dimensions work together to develop the concept (Zink et al., 2008)

James (2015), have a different approach on sustainability and improves 'Circle of Sustainability' method which is intended to be flexible, modular and systematic. In The approach is based on the argument that we need useful tools for negotiating what kind of world we want to create and re-create. The four domains chosen as primary in the Circles approach – economics, ecology, politics and culture – have been derived as the minimal number of domains that are together useful for

giving a complex sense of the whole of social life, seen in Figure 6. Each the domains are understood as always located in relation both to each other and to nature. James, compared both tripple bottom line and circle of sustainability approaches and believes that Triple Bottom Approach is a kind of blind sustainability reporting in relation.

Figure 6: Circles of Sustainability



Source: James, 2015

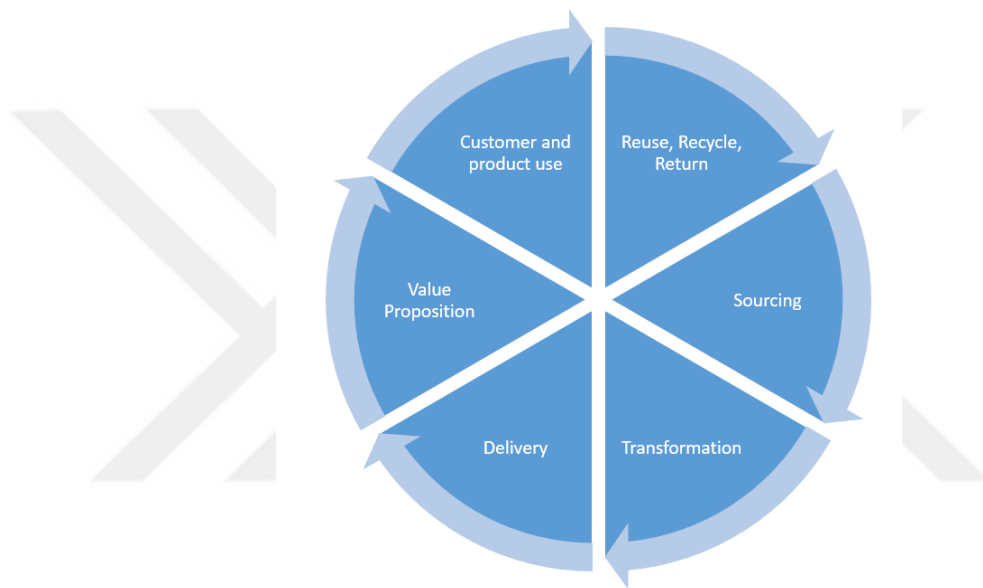
1.2.2. Sustainable Supply Chain Management

Sustainable development has been discussed and discussed more with the Brundtland Report (Our Common Future Report) prepared by the World Environment and Development Commission (Bozlağan, 2005). Sustainable development approach is mostly associated with economic, environmental and social dimensions of sustainable development (Varsei, 2016).

Convergence with the help of globalization and liberalization leads to longer and more complex supply chains. As the opportunity to reach the producer at another end of the world increases, companies no longer only focus on their specific capabilities, but all of their remaining and key skills are transferred to external

resources. This leads to further complexity of supply chains. Companies that want to specialize in the management of complex supply chains need to consider the concept of sustainability from a wider perspective by taking into account the structure of these chains from the first processing of the raw materials to the delivery of the finished product to the final customer and taking into account the information, material and capital flow emerging through this process. (Linton et al., 2007)

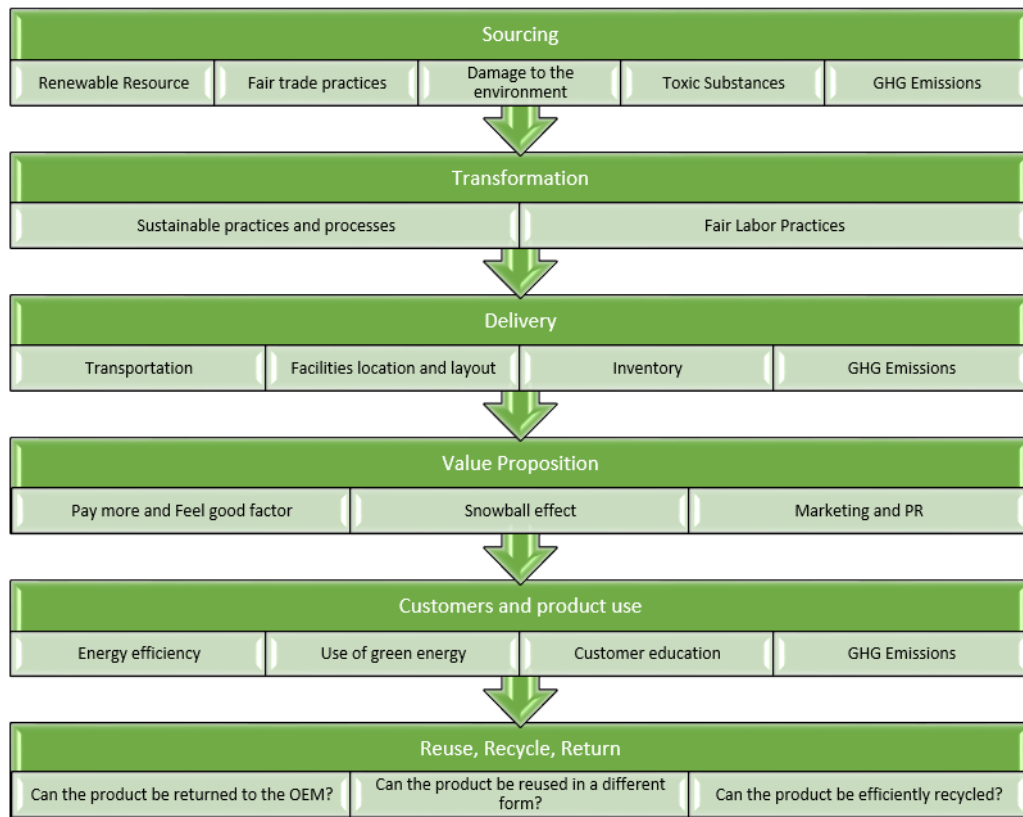
Figure 7 Framework for Sustainable Supply Chains



Source: Hassini et al., 2012

The concept of sustainability was first defined in a transnational dimension. From a global perspective, it can be said that the concept is formed at the level of countries, local governments and institutions, and is adopted and spread at lower levels. States have begun to develop laws that regulate both public production and human life within this boundary with this concept in mind. Corporate sustainability can be defined as the reduction or transfer of the concept of sustainable development to the enterprise level. The generally accepted definition of sustainable development can be adapted to the business life by ensuring that the needs of a firm's direct and indirect stakeholders do not jeopardize the ability to meet the needs of future direct and indirect stakeholders. (Hassini et al., 2012)

Figure 8 Issues for Sustainable Supply Chain Management



Source: Seuring and Müller, 2008a: 1702

Sustainable SCM management is influenced by the fact that the responsibilities of individual organizations now cover not only their own activities, but also the activities of their supply chains. Today, a brand established in a European country is also responsible for all its activities in the Far East, Central Asia and Africa countries where it carries out different stages of its production processes. For this reason, although it has adopted institutional sustainability only in the country where the central organizations are located, by definition of the concept, it has to study all other activities that are outside of it but related to it and work to make it sustainable.. In Figure 8, the detailed Sustainable SCM flow is illustrated (Seuring and Müller, 2008a: 1702).

Sudheer and Omkar (2014) stated that SCM management, while managing materials, information and capital flow throughout a supply chain and the

cooperation of the companies in the chain, is also to set and realize goals - economic, environmental and social - regarding the three different dimensions of sustainable development that come from the expectations of stakeholders and customers. Environmental and social criteria in sustainable supply chains must be met by members in order to maintain their existence in the supply chain. Competitiveness should be strengthened by meeting the economic criteria of sustainability with customer expectations. At this stage, companies are working with suppliers and retailers on issues such as the use of environmentally friendly raw materials and the development of spare parts and waste reduction.

1.2.2.1. Economical Sustainability and SCM

World societies are similar in terms of social, political, cultural and economic aspects and show different characteristics in many respects. When the existing structures of the world societies are evaluated in terms of economy and environment, it is noteworthy that they have more contrasting features. In terms of environmental protection, communities can be divided into two main groups: On the one hand, people who are exposed to natural disasters such as rapidly declining forests, polluted water resources, melting glaciers, deserted soils and people struggling to survive under the threat of these disasters. Moreover, most of them face hunger and poverty problems. On the other hand, despite all these social, economic and environmental problems, there is another group of people trying to maintain their high standards of living. In other words, the societies of the world are in a severe socio-economic decomposition both at national and international level (Ellidott, 2005).

Some of them are as following:

- Growth problem
- Consuming
- Benefit cost analysis
- Homo Economicus
- Competition

One of the most important firsts of today's dominant capitalist economic system is to ensure that the markets are open to competition. It is accepted that higher quality and cheaper products will emerge due to competition and thus the social benefit will increase. However, while many important factors for the market are taken into consideration in creating competitive conditions, the absence of the principle of environmental protection in addition to these conditions or at least ignoring them for a long time is an important problem (Yusuf et al., 2013).

Although the concept of sustainability is multidimensional, it is generally defined through three basic structures: economic, ecological and social. Although each of them has an indispensable place, it is necessary to accept that the problems arising from the obligatory relationship of the economy with nature play a greater role in the emergence of the concept than the others. In fact, sustainability stems from a necessary change and transformation upon understanding that the hegemonic policies established by economic policies on the environment are unsustainable.

Because the survival of the economic system or systems depends on the establishment of the relationship between environment and economy at an acceptable point. Indeed, no matter how dazzling the scientific and technological achievements of human beings, it is clear that nature is an indispensable value for all living life. On the other hand, for the development of the economy, it is not enough for people to use the tools by using their abilities. Natural resources are also needed (Kuş, 2012).

The first work to be carried out in the application of sustainability principles in the field of economy is undoubtedly the principles according to which natural resources will be utilized. Because, because nature has a bearing capacity, a load that cannot bear to nature should not be loaded. To this end, Neumann argues that renewable and non-renewable resources need to be reorganized. The principle of the use of all renewable resources should be just like the processes in which forests maintain their ability to renew themselves or ensure the continuity of resources at sea. Non-renewable resources, such as oil, should be used within the framework of the principles developed in this direction. Renewable resources should be replaced by non-renewable resources (Seuring and Mueller, 2008).

1.2.2.2. Environmental Sustainability and SCM

Environmental sustainability is studied under two subjects; protecting the nature and using green technologies. (Mahler, 2007) During the whole life cycle of the product, using green technologies are very important to implement the environmental benefits. These green technologies are:

- Recycling; separating the recyclable parts and storing rest in a way that do not harm the environment.
- Managing solid wastes (Companies can focus on cost reduction and risk management by tracking where their waste is going. As an example: waste water treatment systems)
- Energy conservation and energy generation (minimizing the usage of energy and be self-sufficient)
- Using renewable resources
- Using electrical vehicles
- Using alternative modes of transportation (railroad, sea etc.) and limiting the resource (fuel) usage and the emissions of these vehicles
- Using solar and wind power

White (2005), stated the environmental dimensions as raw materials, energy, water, biological variety, emulsion, solid wastes, product/service and adaptation. These dimensions separate to subgroups. For example, raw materials grouped by variety, usage and quantity. Energy consumption grouped as direct usage and indirect usage. These metrics may be useful as part of cost reduction in the financial dimension. In Figure 9, 'Intersection of Performance Sizing Dimensions with Environmental Sustainability Indicators' of White is represented. Companies that are considering growing in environmentally sensitive areas are likely to attract customers who are interested in sustainability practices (Ilgin and Gupta, 2010).

Figure 9: Environmental Sustainability Indicators

Indicators of environmental sustainability	Performance Scorecard					
	Financial		Customer		Internal Process	
	Cost Reduction/ Productivity Improvement	Risk Management	Satisfaction, Loyalty	Customer Retention, Acquisition and Profitability	Transactions	After Sales Service
Materials	x	x		x	x	
Energy	x	x		x	x	
Water	x	x		x	x	
Biological Variety				x		
Emission	x	x				
Waste water	x	x				
Waste (solid)	x	x			x	x
Product and Services			x			
Harmony		x				

Source: White, 2005:41

These measures may be useful as part of the cost reduction in the financial dimension of the performance report. Environmental indicators can be also applied to the internal process dimension of the performance card (especially innovation). Companies can reduce emissions by developing new products or processes that emit less greenhouse gases and other ozone-depleting substances. (White, 2005)

Other environmental indicators; Discharging of wastes into water is the loss of important chemicals, oils and fuels. This information is important in terms of cost reduction and risk assessment in the financial dimension of the performance report. In addition, these measures can be useful for internal business processes. Businesses can establish processes aiming to reduce the possibility of discharging. (White, 2005)

1.2.2.3. Social Sustainability and SCM

Social responsibility is to act fairly and impartially. The basis of responsibility is equity. Equity is a high level of moral values such as righteousness, impartiality, fairness and fairness (Mahler, 2007).

The human development approach emphasizes the basic needs and equality issues that have solid foundations in the history of economic theory. Mahler has raised concerns about the predominant acceptance of the view of maximizing prosperity as opposed to the approach of human development in the modern economy they have begun with former economic theorists (Seuring and Müller, 2008).

According to White (2005), organizations capable of economic analysis and policy fail to meet the demands of human development. This approach is to improve the existing rather than to develop a new species. Dealing with human development requires monitoring and competing with other priorities underlying the economy. The economy must be monitored for several centuries to engage in production, wealth and financial success.

Figure 10 Interplay of performance scorecard dimensions with indicators of social sustainability

Indicators of social sustainability	Performance Scorecard								
	Financial		Customer		Internal Process		Learning and Development		
	Cost Reduction/ Productivity Improvement	Risk Management	Satisfaction, Loyalty	Customer Retention, Acquisition and Profitability	Transactions	After Sales Service	Employee Capability	Information System Capabilities	Harmonization and Authorization
Labor Practices and Decent work	x	x			x		x	x	x
Human Rights		x			x			x	
Product Responsibility			x	x		x		x	

Source: White, 2005:42

The concept of sustainable development puts forward whether the current lifestyles are acceptable and whether there is any reason to pass them on to future generations. Since intergenerational equality needs to be passed between generations, the restructuring of the world's income and consumption models can be a prerequisite for the strategies of sustainable development.

1.3. SUPPLIER SELECTION AND EVALUATION

1.3.1. Importance and Benefits of Supplier Selection and Evaluation

Other enterprises that companies use as goods or services are called suppliers. In this concept, the concept of the seller is used in the same sense (Karakış, 2007: 60). Suppliers / sellers are seen as a vital link in the supply chain. Delivery is incomplete, defective etc. doing so will hinder the service delivery of the enterprise, increase inventory costs and negatively affect customer satisfaction. A good supplier or seller is able to establish consistent relationships in the long run. In this context, the factors to be considered for the selection of a good supplier are as follows (Çetinsöz, 2008: 183):

- The supplier should be competent and responsible.
- The supplier must provide timely information on price changes so that it will maintain its competitive price level.
- The supplier should seek and understand how best to meet the needs of the market.
- The supplier must be able to provide products of the right quality and quantity in a consistent manner.
- The supplier must provide continuous information on new and improved products and how to use them.
- The supplier must be professional, should be able to follow up the problems easily and be the solution manufacturer.
- The supplier should be skilled in financial control.

Due to the increase in competition, the companies spend more efforts to increase their share in the market than to increase their share in the market. The demands and needs of the customers are changing due to technological

developments, improvement of economic conditions, increase of quality scientist and other internal and external factors. In recent years, as a result of the shortening of the product life cycle, the enterprises are more oriented to the supply chain. While product variety is increasing, the introduction of new products to the market as soon as possible becomes an important factor (Mirmahmutoğulları, 2007: 14).

Supplier evaluation is a critical process that requires many facts to be taken into account for the effective management of the supply chain. While traditional supplier evaluation methods use only the financial criteria in the decision-making process, the methods developed in the following years, the price criterion for the supplier evaluation and selection process are not enough alone, but also the other criteria should be taken into consideration. Researches on supplier evaluation date back to the 1960s.

The first study in this area was carried out by Dickson (1966). Dickson found that cost, quality and delivery performance are the three most important criteria for supplier selection as a result of the experimental data from 170 procurement managers. While the summer studies in the 1980s focused on cost (Huang and Keskar, 2007), the time to fulfill this order and the response time to the customer were added to this criterion in the 1990s (Huang and Keskar, 2007).

Weber et al. (1991) in their study by comparing the criteria of supplier evaluation, quality is the highest with the highest ranked, quality of delivery performance and cost have been followed by quality. Fawcet et al. (1997) used cost, quality, delivery, flexibility and innovation criteria as the main criteria for supplier performance. In the study of Ghodsypour and O veBrien (1998), the criteria to be considered for supplier selection are considered as cost, quality and service. In this context, price, quality, service and distribution criteria of the most important criteria taken into consideration in the evaluation of suppliers have been demonstrated in the literature (Pişkin, 4). These four criteria can be explained as follows (Pişkin, 2010: 8):

- Delivery: the supplier is required to deliver the goods required by the desired time and quality. Therefore, performance is seen as an indispensable criterion in the evaluation.

- Quality: It is essential that the product or semi-finished product is delivered to the customer with a quality beyond the expectation.
- Price: businesses want to obtain the materials they use to increase their profitability at the minimum price possible. Therefore, businesses need to find a low-cost source of supply where they can minimize the costs associated with the production of products.
- Service: In addition to the service offered by the supplier, the support given to the sales and after sales company can be defined as the ability to mobilize with all the opportunities in case of a problem arising from the supplier, that is, the ability of the supplier to solve the problems when needed.

Weele (2002: 284) evaluates suppliers at four different levels. These are;

- Product Based: It is aimed to determine the quality of the product and to increase the quality of the supplier in this level.
- Process Based: This evaluation is based on the idea that product quality is related to the supplier's production processes. If the production processes are under control, the product produced will have the features to show the expected quality level.
- On the basis of Quality Assurance Systems: Here, the whole organization structure of the supplier enterprise is examined by quality by the customer.
- On the Basis of Business: In this evaluation, the business is examined financially. In addition, it is aimed to have information about the management quality of the supplier enterprise.

The long-term knowledge, skills and skills of the suppliers in their work, the fact that their personnel are experts in this field, follow the technological innovations and the enterprises perform their work at a lower cost than the costs they will incur a new investment requires the evaluation of alternative suppliers and supplier characteristics. Therefore, supplier valuation is an issue that businesses should take into consideration (Mirmahmutoğulları, 2007: 26).

1.3.2. Strategic Purchasing Function in Supplier Selection and Evaluation

In Ellram and Carr's (1994) articles named three basic streams of strategic purchasing research:

- Strategies that purchasing function may practice with the question of “What are the key strategic issues and options that confront the purchasing function?”

In the past, supply market stagnation has been seen by businesses as a cost-reducing rather than a profit-making function, due to the slow changing technology and the presence of a small number of competing businesses. This point of view has resulted in the inadequacy of the talent, interest and knowledge of the personnel working in the purchasing department. The increasing competition with the globalization and the development of the supply market environment necessitated the senior management to redefine the nature and characteristics of the purchasing function.

Strategic management have some parts. These are:

- Environmental analysis
- Determination of objectives
- Analysis of strategic options
- Choosing between strategic options
- Implementation of strategies
- Control and evaluation

Procurement is the procurement of the necessary services and materials to achieve organizational objectives. Purchasing in the narrow sense is a shopping process. In the broadest sense, purchasing involves the selection of suppliers, finding the appropriate price, determining the conditions, signing the order or contract, and receiving the product. Purchasing is a former business activity as it is a support function. In the 1960s and 1970s, procurement was more of a non-strategic, paper-based, tactical activity. However, due to the oil crisis of the 1970s, procurement was not seen as a managerial function until the competitive pressure, which requires

careful management of inputs to protect the cost structure in both the private and public sectors. In the 1980s, procurement was seen as a managerial function.

Significant parts of a business have a perception and perception about the role of the purchasing function in the organization. In this perception, it is clear that the importance and the role that top management attaches to the purchasing function is decisive. A purchase in which the senior management has traditionally assumed roles will be perceived by other departments of the enterprise as a department with less decision-making power, more office functions and unfriendly relations with suppliers. The senior management, structuring an advanced procurement department within the organizational structure, will ensure that this function is perceived as a department that encourages innovative and collaborative decision making, is actively involved in material and supplier performance issues, is actively involved with other department managers and participates directly in the strategic decision making process. With this in mind, the purchasing department educates other department managers on organizational objectives and strategic inputs, strengthens relationships between departments and suppliers, is considered a link to a worldwide supply base, an important input for strategic management, and a vital part of business success (Carr and Smmeltzer, 1997).

Determining the number of suppliers, evaluating, developing and preparing the plans together are among the tasks of the modern purchasing department. In contrast to the traditional purchasing function, suppliers are viewed as counterparties and, in contrast to unfriendly relationships, the advanced purchasing department enables cooperative family relationships between the enterprise and the supplier. The idea and understanding of mutual needs are developed with a small number of suppliers, and a relationship is established that benefits both parties and affects each other. Suppliers are trusted and information is exchanged for new and improved products. Meetings are held at least once a year, including what is expected of suppliers, long-term cooperation and promises within the framework of newly established business strategies and policies. Close relationships with a small number of suppliers are based on the long-term success of both parties. In order to realize effective strategies and policies, procurement, which has become a strategic supply management function with this understanding, must be able to manage supplier

companies effectively and training programs are organized for this purpose. Basically, the value of the relationship and cooperation, the redirection of tactics on the internal efficiency of strategic network development, the interest and desire of the partners in the network are the research topics.

Strategic purchasing has become a vital function for businesses today. The most important reason for this is that the direct and indirect effects of the strategic acquisition have an effect on the firm's profitability and competitive advantage. Purchasing has a key role in the long-term growth and success of the enterprise (Ferguson et al., 1996). Harmonization of the acquisition with the strategic plan allows the company to move faster and more flexibly against any internal and external changes that may arise (Chen et al., 2004).

It is based on the understanding of developing close relations with a limited number of suppliers in strategic procurement. This allows the company's supplier base to be used more effectively and efficiently (Cousins et al., 2006). Trust, reliability, cooperation and mutual commitment among supply chain partners are strategic value-generating elements. In other words, a relationship-based approach in the supply chain is more effective in achieving long-term goals than a transaction-based approach. The close relationship between supply chain members means sharing risks and earnings as well as information (Cooper and Ellram, 1993).

It is possible to explain this change and development in the approaches to purchasing function with the change. When the development of it in enterprises is examined, it is seen that this administrative function has been increased from a tactical activity to a strategic level (Chen et al., 2004).

In addition, strategic procurement contributes to the competitive advantage of the enterprise as it is a pro-active approach (Cousins et al., 2006). Again, effective management of suppliers and the development of relationships with suppliers are one of the competitive advantages for businesses (McIvor et al., 1997).

1.4. ENVIRONMENTAL PERSPECTIVE IN SUPPLIER EVALUATION AND SELECTION

1.4.1. Product Life Cycle & Relation with Strategic Green Supply Chain

“The Product Life Circle (PLC)” system, which stands for product life cycle management in Turkish, is becoming increasingly important in the industry. On the one hand, PLC transmits the relationship and information flow between customers and suppliers on the internet. In this way, relevant persons or institutions can access this information from anywhere. It also provides an environment for cooperation between engineering disciplines (Birdoğan, 2003).

PLC is a product development platform. With respect to product development, Turkey has started more new fitting a new standard in this regard compared to other countries. In our country in the 90s, engineers from different disciplines started to share the same physical environment and started to standardize for product development. This method is still in use and cannot be said to be very healthy. When you move away from the physical environment, access to information will not be possible, but at the same time speed is inefficient. For these reasons, the foundations of the PLM platform have started to be laid. All engineering, production, service, quality control and documentation stages of the product being worked on PLC platform are kept on the internet. In this platform, the requesting unit receives the required information and makes the necessary revisions. After the change, he puts it back to the same platform and presents it to all units. Thus, in a common place, everyone can quickly access the file that works for him / herself and use the most up-to-date version, eliminating the confusion, delay and the like. In other words, PLC is the management of all the processes that a product goes from idea to production (Biner, 2014).

As technology evolves, systematic communication between customers and suppliers has become difficult. For this reason, companies have started to use PLC activities in order to be more organized and meet the demands of customers. In this way, they present all processes from idea to production. Technological advances, especially in the fields of automation, meant the growth of the supply department, the reduction of labor and the increase in productivity. However, the increase in foreign trade volume today forced the companies to use a system to manage these processes.

The efficiency of PLC software and techniques increased with PLC activities. With this platform, the launch time of the product was considerably reduced and brought about advantages such as energy saving and efficient resource usage (Alagöz; Yılmaz, 2004).

Advantages of Product Life Circle (Alagöz and Yılmaz, 2004):

- PLC controls the life cycle of companies' existing products. It also enables the determination of the strategies to be followed when creating new products.
- PLC provides a collaborative environment. Collaboration between retailers, brands, manufacturers and suppliers provides information on the direction of the product. It also contributes to compliance with regulations, green production, product acceptance. Without a solid and transparent cooperation environment in the workplace, competitiveness decreases. For this reason, it is extremely important to use such a platform in order to remove the product more quickly and in a more regular way. At this stage, the PLC provides an environment for recording, maintaining and communicating standards throughout the product life cycle.
- PLC also makes a significant contribution to the traceability of the product. Traceability in the entire production process increases management's awareness of the entire process and accelerates the procurement process. In this sense, PLC systems can be integrated with all other systems to provide holistic traceability.
- PLC is a platform that also deals with library management. It not only organizes artistic features, but also organizes 2D and 3D CAD data for other initiatives such as quality, fit and cycle time reduction and image archive management. Library management provides easy access to historical data and provides valuable statistical traceability on development costs and sample expenditures.
- The PLC reduces cost and reduces the time it takes to remove the product. A company's competitive advantage stems from innovation and increased speed of delivering value to its customers. It is inevitable to respond to rapidly developing currents and customer demands. Accordingly, harmonized data

management among all partners is emerging as a new and indispensable business requirement.

Güngör and Gupta (1999) emphasize the need to evaluate the effects of green production on the environment at every stage of the product life cycle.

Green production may include activities such as reuse, reproduction and recycling. There is a difference between reproduction, reuse and recycling activities. For example, remanufacturing involves the replacement and reassembly of some parts, whereas reuse does not change the physical properties of the product. In recycling, the product undergoes complete chemical and physical changes. Green production includes these activities in line with environmental targets. Reducing the total amount of materials used is one of the characteristics of green production (Korkankorkmaz, 2012).

1.4.2. Environmentally Conscious Purchasing

There is increasing interest in environmental problems. With the increasing interest in these problems, consumers have become conscious about this issue. The awareness of consumers, like the rings of the chain, pushes businesses to pay attention to this issue. Because consumers' needs and needs are concentrated on environmentally sensitive products, businesses that want to please the enterprises are motivated to produce environmentally sensitive products. The formation of this level of consciousness, called green marketing, has produced a consumption approach that considers the sensitivities about the environmental problems after the production of environmentally sensitive products (Karna, 2003).

Green Marketing refers to an understanding that considers environmental issues in marketing activities, aims to be sensitive to these issues, to prevent the excessive use of natural resources and to target social benefits in all marketing decisions. Green marketing also involves not polluting, protecting the natural environment and producing and consuming environmentally sensitive products. This situation is considered as an important social responsibility of enterprises (Ay and Ecevit, 2005).

Consumers have responsibility for environmental issues as well as businesses. For this reason, today's consumers show great sensitivity to environmental problems

and show significant consumption behavior in order to realize their responsibilities from enterprises and not implement practices that pollute nature. For businesses that are aware of these behaviors of consumers, knowing the tendencies of consumers regarding environmentally sensitive products and their level of interest in such products will provide advantages to enterprises in marketing decisions (Demirbaş, 1999).

In an environment where environmental pollution is increasing day by day, the fact that consumers act with environmental concerns and start to identify themselves as more and more environmentalists (Ottman, 1998) necessitates businesses to behave in the same direction and perform activities that will protect the environment better. A survey conducted in 16 countries in 1992 is an indication that more than half of consumers are becoming sensitive to environmental pollution (Demirbaş, 1999). This has facilitated the emergence of green marketing activities that take environmental sensitivity into account.

One of the most fundamental problems of our day is the destruction of the natural environment and the destruction of the environment. Therefore, with the increase in social and political pressures, businesses have turned to producing green products to combat environmental problems, applying production technologies and methods that will eliminate these problems, making packaging and designs that consume less resources and providing activities for recycling (Ay and Ecevit, 2005).

1.4.3. Purchasing Function in Supplier Selection and Evaluation

Purchasing management is the process of obtaining the right product at the right time, at the right price and from the right supplier. Purchasing management not only provides a significant cost advantage to the enterprises, but also contributes to the quality of the goods and services to be provided, timely delivery and inventory control. Purchasing is a newly understood activity of importance today. Purchasing, which is an ordinary function according to the traditional understanding, is not included in the competitive strategies of the institution. Purchasing strategy and policy is defined from a narrow point of view and treated as ordinary business policies and strategies (Pooler et al., 2004).

Realizing the potential contribution that acquisition would make to profit through cost reduction, managers began to pay more attention to it. The major savings in this area were driven by large expenditures. For many businesses, large expenditures are made by personnel. Thanks to advances in technology, labor costs have been significantly reduced. Again, many companies think that it is cheaper to outsource raw materials and components to experienced suppliers (Pooler et al., 2004). Purchasing process, equipment, parts, etc. from the enterprise, suppliers. starts with the purchase request and ends with the notification of receipt of the products and services by the purchasing department. The main stages of the purchasing process are as follows (Aktepe, 2007):

- The purchasing department receives the purchase request. This request includes the description of the requested material, the quantity and quality required, the requested delivery dates, the place of delivery and the name of the requester.
- The procurement department should identify the suppliers who can supply the requested goods. Supplier evaluation ranking is effective in supplier selection.
- The purchasing department orders the supplier. Bargaining with the supplier is done at this stage.
- The purchasing department keeps track of the orders. Possible delays are forwarded to the relevant department. If there are any changes related to the order, quantity, etc., the supplier is notified.
- The products received from suppliers are checked in terms of quality and quantity and then delivered from suppliers. If the goods do not meet the requirements, they are returned to the supplier or subjected to detailed inspection. In any case, the information is processed in the supplier evaluation files.
- Afterwards, value analysis is performed by testing the functions of purchased materials and parts in order to reduce their costs and increase their performance.

CHAPTER TWO

OVERVIEW OF ENVIRONMENTAL PERFORMANCE EVALUATION OF SUPPLIERS

2.1. THE PERSPECTIVE

In this part of thesis, there will be general to detailed look and summaries about environment, EMS standards and performance evaluation tools. The chapter has the aim of giving information and examples about how important the environment is and related matters.

2.2. ENVIRONMENT

2.2.1. Definition of Environment

The environmental financial and human values as a whole are expressed as all of the social, biological, chemical and physical qualities that affect all actions and attitudes of living beings (Vision and Foresight Report, 2003: 11). The Environment Law explains the environment as follows: It is a natural habitat where all individuals living in nature benefit from air, water, soil, plants and historical richness (Environmental Law No. 2872).

Another definition of the environment: Human activities and living entities over a certain period of time or wait for them to affect them directly or indirectly biological, physical and chemical factors are expressed as the sum of time over time (Keleş, 2002: 21). In order to sustain the existence of the creatures in the nature, the sources found in connection with them are also called the environment. The definition of a comprehensive environment is the whole of the structural elements of humans and living things in nature, and therefore of all beings (Bulca, 2000: 332). Unfortunately, although people are a part of the environment, they are the ones who suffer the most from the environment they are part of.

Science, which examines the interaction of the assets between themselves and the environment, is called environmental science. As science or ecology, science is actually one of the sub-branches of biology (Kışlalıoğlu and Berkes, 2003: 16).

The effect or power that natural entities have not yet intervened or interfered with by any human being is yet to be changed is called the natural environment (Özdemir, 1988: 10). In short, the natural environment that preserves its natural power and where all natural assets that do not change itself despite the effects of people can be called natural environment. In other words, the environment in which the individuals fail to destroy the environment and maintain their sustainability is called the natural environment. Due to the rapid growth of the population and the depletion of natural resources through technological developments and the lack of production continuity, the natural environment is gradually disappearing. An artificial environment can be mentioned next to the natural environment. Artificial environment: From the past to the present day by people from both the social and economic point created by the human hand created by the environment is called. In other words, the natural environment can be said to be degraded. Another definition of the artificial environment is the environment that is deteriorated or degraded by the interventions of the individuals living in the society (Kırlioğlu and Can, 1998: 3-4).

2.2.2. Environmental Degradation

Types of environmental degradation are generally classified as air pollution, water pollution, soil pollution, noise pollution and image pollution. Environmental pollution causes harm to all living organisms directly or indirectly causing harm to nature. Nowadays, visual pollution and light pollution are also seen as environmental pollution and these environmental pollution is created by people and causes harm to human beings and other living things. Pollution of the environment disrupts the balance of the ecosystem and causes climatic changes (Zelenika and Pearce, 2013)

In contrast to American environmental sociology, which attempts to explain the causes of environmental degradation, the theory of ecological modernization has emerged as a result of social research, environmental movements, and ecological research into non-utopian practical environmental improvement. This theory was developed in the early 1980s by German sociologist Joseph Huber (Hajer, 1995). This theory examines the ways in which today's industrialized societies address the

environmental crisis (Mol and Sonnenfeld, 2000: 5-6). One of the most important arguments at the center of this theory is that although ecological interests and criteria are slow in designing global production and consumption, they catch the economic criteria. Therefore, in recent industrialized societies, free market dynamics and economic agents are the carriers of ecological regulation and restructuring (Mol and Sonnenfeld, 2000: 6).

Dunlap and Catton (1978) use the Durkheimian paradigm to explain environmental degradation and change. Among institutional organizations that create environmental destruction, the authors argue that cultural institutions play an important role. The environmental sociology of Dunlap and Catton (Catton, 1976, 1980, 1994; Catton and Dunlap 1978a) is gathered around a number of related ideas. The environmental problems and the inability of traditional sociology to address these problems arise from the dominant western worldview that exists in society and the exceptional paradigm of human beings in sociology.

2.2.2.2 Causes

In primitive society, human being is totally vulnerable to nature and natural phenomena, and while its survival depends on its bending to nature and adapting to its environment, nomadic human being is influencing his environment to a certain extent, but he is far from shaping the nature for his own benefit and understanding the essence of natural events and therefore controlling his environment. The transition of mankind to settled agrarian society, especially the emergence of cities at the end of the Neolithic era, has also made it clear that man controls and shapes his environment. Thus, starting from this period, the knowledge and technical knowledge of the human being has increased rapidly, and in parallel with this development, human being has paved the way for further processing of nature and affecting the environment more and more. It is known that environmental problems have become more on the world agenda especially since 1970s and studies on this subject have gained momentum. Environmental problems have no boundaries and environmental problems at the local and regional level have been merged and become global. Local and regional environmental problems are also issues that need to be handled as carefully as global environmental problems (Bulut, 2011).

The environment can be defined in general terms as the sum of physical, chemical, biological and social factors that can have an immediate or direct impact on human activities and living beings at any given time or over a period of time. When the pollution of the environmental elements constituting a living environment reached a visible and dangerous level, it became impossible to distinguish between environmental problems. It is not possible to isolate environmental problems from each other and evaluate them individually. Environmental problems include water pollution, air pollution, soil pollution, noise pollution, radioactive pollution, wastes. Pollution as well as global environmental problems such as warming and climate change, destruction of natural vegetation, extinction of animal species and species, depletion of water resources on the earth, depletion of natural resources, erosion and desertification, acid rains, depletion of ozone layer, and destruction of rain forests. at the beginning. However, it is emphasized that global environmental problems can be expressed as a sum of the environmental problems that arise individually. It is added that problems identified as local or regional cause global damages, such as the depletion of the ozone layer or the change of world climate. While environmental problems such as ozone depletion or global warming are considered as environmental problems at global level, air and water pollution from environmental pollution emerges as regional and wastes as local problems (Selçuk and Yılmaz, 2017: 1151).

The environmental problems did not emerge suddenly, and they accumulated over time and announced their existence. Environmental problems have increased with urbanization, industrialization, population growth and technology. Industrialization and urbanization are factors that accelerate the emergence of environmental problems. Perhaps environmental problems existed before, but both industrialization, urbanization and rapidly developing technology undertook the function of transforming the pressures, deteriorations and losses suffered by the environment into a problem. Environmental problems are an issue that needs to be evaluated by considering the ecological, economic, political, legal, scientific and technological dimensions (Bulut, 2011).

It is stated that the first place should be given to pollution in environmental problems. This problem, which shows the pollution of three basic environmental elements (air, water and soil), has emerged especially in the form of air pollution, in the countries that have experienced the industrial revolution and in the leading Britain in this context, and has been accepted as a problem even at that time. In addition to rapidly increasing the pollution in the industrial production areas, the industrialized Western world has also polluted all the spaces it uses to process the resources that it uses to meet the resource requirement and which are scattered throughout many parts of the world. In addition to industrialization, urbanization has also increased the environmental impact of activities aimed at meeting urban services and urbanization has been an important process that pollutes the receiving environment. However, no pollution problem has made it easier to comprehend the state of the planet as much as the ozone layer begins to disappear and threats from global warming emerge. In this context, pollution is gradually increasing and accumulating deteriorates the characteristics of living environments. A general definition of contamination is the presence of undesirable amounts of substances such as chemical, radioactive elements, solid or biological waste, including heat energy, light and sound (Büyükgüngör, 2006).

2.2.2.3 Effects

Environmental pollution (physical, chemical and biological) is generally called environmental pollution, which causes harmful effects on living and inanimate beings (Çokgezen, 2007).

Environmental pollution is present to this side as the world is established in terms of some of its elements. However, due to the existing balance in the creation of nature, the environment cleans itself. However, in the last century, as a result of intense developments that disrupt the natural balance in the negative direction in terms of contamination rate and exceed or destroy the capacity of the natural cleaning tools, the environmental pollution problem makes itself felt worldwide with its heavy weight (Çokgezen, 2007).

The environment is a mediocre in which the organism is involved, influenced and affected, and with its biological and physicochemical status, causes positive or negative changes in the organism. In order for living beings to survive, the genetic (hereditary) structure and their associated capabilities and environmental conditions must be in an appropriate order. Specific environment for every living thing conditions. Some physiological changes can be expected in living things as we move out of the optimal living conditions, that is, as we approach the limits (extreme conditions). If we go beyond these limits, the living can no longer survive (Çelebi and Gök, 2018).

When the microorganisms living in a certain nutrient environment pollute this environment with the residual substances they remove during their physiological activities, the chemical composition of the environment changes and new environmental conditions emerge. As a result, this environment becomes harmful and uninhabitable for them. Although our world is a limited environment, it has a delicate balance of power that will reinstate harmful substances that occur as a result of the vital activities of living things through very complicated analysis or synthesis. This fidelity time depends on the composition of the harmful substances. If it takes a long time for the harmful substances to remain in the same state, the damage is also comparable. Mankind's vital activities caused changes in the chemical composition of its environment and the accumulation of toxic substances that could remain intact for a long time (Çelebi and Gök, 2018).

Environmental pollutants: Combustion products; human excrement; inhaled air; dusts, pathogenic microbes; vapors; gases; industrial solvents, extreme (extremely high or low) temperatures; agricultural fertilizers, infrared (infrared), ultraviolet (ultraviolet) and even visible light; ionizing radiation; radioisotopes; noise; extreme high frequency sound and some microwave electromagnetic radiation (Çelebi and Gök, 2018).

Water and coastal pollution: Water pollution is used to make the use of water unsuitable. In this case, water is not used for drinking. Other drawbacks arise in use and irrigation water. In the rivers, lakes and seas, the fish die and other creatures decrease in species and number. The air starts to get dirty. The value of tourist, recreation, swimming and watching is lost. The ingredients inside will

corrode. Reduces transportation. Foam is formed on the surface. The color, smell and taste of fresh waters change. Algae first multiply. Then he dies, increasing the contamination (Erhan, 2012).

Air pollution: This pollution is caused by fuel use, increased industrialization and excessive population swelling in cities. Contaminants are in the form of gas, liquid droplets (particles) or mixtures thereof. These substances; either emits directly from a source or emits by reacting the substances emitted in the atmosphere among themselves or with atmospheric components and whether there is a photochemical activity (Erhan, 2012).

Industrial pollutants: Gases from factory and building chimneys and car exhausts are harmful to humans, animals and plants. This situation, which concerns especially the industrialized countries, also concerns the backward countries due to atmospheric movements (Erhan, 2012).

Every person uses 14,000 liters of air per day. So the very low proportion of poisons that people will get with the air can approach the lethal dose in a short time. The difference between the accumulation of poisons in the body and the poisons taken and discarded is important for humans. If the excretion of poison from the body is slow and accumulation in the body is observed, poisoning will soon show the cat (Erhan, 2012).

Soil pollution: Soil is one of the most important natural resources of people. In our time, the soil is also exposed to danger due to the pollution of the environment and is made harmful. This contamination of the soil comes from drugs used for protection in agriculture, fertilizers, industrial residues, radioactive isotopes and pollutants such as concrete, asphalt, tin, iron, lead, aluminum, polyethylene, petroleum and other solid and liquid residues (Büyükuşoğlu, 2010).

Biological pollutants: Microorganisms (microbes, bacteria), human, animal and plant diseases (pathogens), a part of the environment, continuously finds suitable conditions in the environment increases its activity. If these conditions disappear, activity slows down or stops. If it contaminates the environment, epidemics occur. During the outbreak, the environment is now polluted by that effect. Epidemics also disappear when microbes are reduced, that is, to a level that cannot survive, or when protective measures are taken, or, in some circumstances, immunity is produced. As

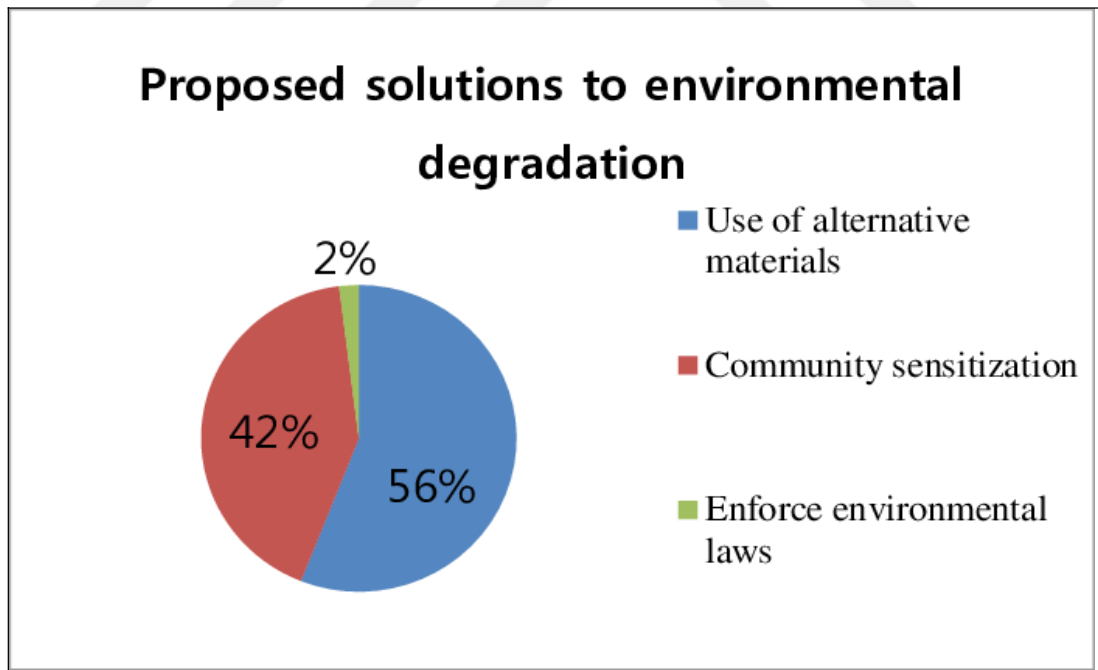
a result, the disease microbial proliferation decreases and equilibrium is restored (Büyükuşoğlu, 2010).

2.2.2.4 Solutions

Environmental degradation can take hundreds of years to repair. For the sustainability of the ecosystem, at least it should not be eliminated. According to the term ecology, toxic substances can be stored. Plants can be used for this. Soil and water with metal pollution can be purified from waste. On the other hand, projects carried out by non-governmental organizations and governments can protect endangered animals, and can be taken for environmental regulation and cleaning (Göbenez, 2001).

For the sustainability of the environment, large power plant constructions must be stopped as soon as possible and environmentally friendly, renewable energy resources should be preferred.

Figure 11: Proposed solutions to environmental degradation



Source: Michael Kyakula, 2015

Figure 11 shows that 56 % of the participants to the survey, determined the use of alternative materials as a solution to environmental degradation and 42 % determined community sensitization while 2% enforcing environmental laws.

Waste from the fuels we use, such as ash and toxic gas, is released. Acid rains occur as a result of the combination of toxic gases from the chimney and exhausts. Acid rain causes the destruction of the vegetation it comes into contact with and causes skin and lung diseases in humans. To reduce environmental pollution, high-calorie fuels with low ash and toxic gas emissions should be used. (natural gas, hard coal ...) Oil spills into the sea with marine accidents, spread on water. If the oil spilled on the water is not cleaned in a short time, it causes the water to stop contact with sunlight and air. This event adversely affects aquatic organisms.

Climate changes: Although climate change and environmental problems are reflected in some circles as being exaggerated, they are important elements that threaten the future of the planet we live in. The leading names of the art world who want to draw attention to this danger carry out various studies and projects. (Göbenez, 2001). According to a report by the European Environment Agency (EEA) on 25 January 2017, Europe's regions are facing extreme weather conditions, such as more frequent and more severe heat waves, floods, droughts and storms caused by rising sea levels and climate change. The report assesses the latest trends and projections on climate change and its impacts in Europe and emphasizes that better and more flexible adaptation strategies, policies and measures should be taken to mitigate these impacts. Climate change, impacts and vulnerability in Europe According to the 2016 report, the observed climate changes are already having extensive impacts on ecosystems, the economy and human health and well-being in Europe. Global and European temperatures, sea levels and decreasing sea ice masses in the Arctic are breaking new records in succession. The change in the precipitation pattern generally makes the rainy regions of Europe more rainy and arid regions even more arid. Glacier volume and snow cover are decreasing. At the same time, climate-related extremes such as heat waves, heavy rainfall and drought are increasing in many regions in terms of frequency and intensity. In recent years, increasingly developed climate projections provide new evidence that climate-related extremes will increase in many European regions.

Pollution: Environmental pollution is the degradation of the environment by human hands. One of the reasons for such an increase in environmental pollution is the rapidly developing technology and industry, population growth and the unconscious use of natural resources. While nature has a beauty that renews itself and cleans itself, environmental pollution has become inevitable with these reasons. We cannot completely stop these environmental pollution factors, but we can take some measures to minimize their environmental impact (Szasz and Meuser, 1997).

Environmental pollution is the phenomenon of intense mixing of air, water and soil with foreign substances that cause structural damages and deteriorate their properties on inanimate elements, which adversely affect the life activities of the living elements of the environment. The rapidly increasing human population increases the needs and the extent of the harm created by human pollution to nature and the environment increases day by day. Measures that make life more perfect, some improvements aimed at providing a healthier and longer life have become evident that it disrupts natural resources in rural and urban areas, causes water, air, soil pollution, and harms the existence and health of plants and animals (Szasz and Meuser, 1997).

Deforestation: As in many parts of the world, the futures of forest are endangered by the fire. Forests are not alien to forest fires, naturally, lightning and so on fire for many different reasons. Therefore, there will be fire in the forests even if people are not. However, the human factor increases the number of fire. In this case, modern and professional forestry approach should be put in place to prevent fires and to reduce their losses. In other words, the administration needs to take some measures. For the prevention of forest fires; protective measures and preventive measures may be taken (Bridges and Wilhelm, 2008).

Trees and forests are the building blocks of our world. We are obliged to trees that enrich rain and ground water, which are used in industry, prevent air pollution and erosion, and compensate for hot and cold. In addition to this necessity, we must protect them with the awareness that they are living beings. Destruction of forest areas is not only a risk for people, but also for living beings living in forest areas. (Bridges and Wilhelm, 2008):

- Citizens should be made aware of forest needs and forest fires. The curriculum should be handled with precision.
- Those who deliberately burn forests or cause forests to burn must be discouraged.
- The number of fire extinguishing vehicles (aircraft, helicopter, and pumper) should be ensured by the relevant authorities.

Water scarcity: Scarce water resources pose a risk for everyone. With the increasing population and growing economies, the number of countries affected by the water crisis will increase. Water scarcity, food security, energy security, fight against poverty, and increase in water related health problems, unsustainable economic development, adaptation to climate change and loss of biodiversity will bring with it. It is not easy to predict the consequences of water scarcity. Water scarcity is caused by the complex interaction of social, economic and ecological factors. It cannot be attributed only to low rainfall. When analysing water risks, it is not enough to consider only the amount of water per capita. Water management is defined as the planned development, distribution and use of water resources. There are risks that are of interest to both the authorities and the business world. The insufficient amount of water to meet the needs of people, the environment and the business world will cause some economic, social, administrative and political problems (Bridges and Wilhelm, 2008).

The global and European Union 2020 targets for stopping and restoring loss of biodiversity are very ambitious. Achieving these objectives requires the implementation of effective policies, inter-sectoral coordination, ecosystem management approaches and a better understanding of the value of biodiversity.

2.3. ENVIRONMENT MANAGEMENT SYSTEM AND PERFORMANCE EVALUATION TOOLS

Nowadays, organizations are facing inescapable requirements for the confrontation with the environmental challenges and the proper environmental management has been turned into the organizations' success factor. Increased attention paid to the environment conservation through the establishment of the national/regional/international rules and regulations and the emerging sustainable development necessity has caused the organizations to take important steps and measures for acquiring an environmental management system (Taç, 2006).

2.3.1. Environmental Management and Audit System (EMAS)

2.3.1.1. What is EMAS?

EMAS started to be developed for the EU countries (EU) or the United States (USA) in 1993 with the EU Eco-Management and Audit Program. The requirements of EMAS are multidisciplinary and include details. Germany is said to have an important share in the development of EMAS. This program is based on the BS 7750 British National Standard. It was reorganized in 2001 and became part of the ISO 14001 International Standard Organization. At the same time, EMAS is a well-established institution, which aims to increase the success of enterprises on the environment. EMAS aims to improve the performance of the environment in general and to develop the reward system (Jones, 2005: 211-219). Since EMAS is a publicly traded standard, it is obligatory to prepare reports through reliability and impartial audit after environmental audit. In this way, their reputation, reputation and reliability is increased (Topuz, 2009: 8).

EMAS regulation is the continuous monitoring of the EMS of the enterprises by an independent audit firm. Companies that fulfill the requirements of this system are entitled to use the EMAS logo and gain prestige by communicating their sensitivity to the protection of the environment (Topuz, 2009).

The EMAS II Regulation does not impose any obligation on a regional or sectoral basis, and is entirely voluntary. Therefore, it can be applied by all enterprises

and institutions that want to improve their environmental performance and adopt an environmentally friendly production policy (Topuz, 2009).

Standard requirements are (Topuz, 2009):

- Credibility
- Transparency
- Continuous improvement process
- Compliance
- Stakeholder agreement
- Performance

2.3.1.2. Key Benefits of EMAS

- Legal Responsibilities (Jones, 2005):

The EMAS Program enables the enterprise to establish a system for detailed investigation and monitoring of its legal responsibilities. Within the scope of the program, it is ensured that the business examines the responsibilities, standards, permits, audits, sanctions in the legislation and adopts the rules to be followed for their sectors and adapt them to their own systems. While taking measures to prevent pollution is systematically ensured, compliance with legislation is ensured through policies aimed at further improving environmental performance and increasingly stringent objectives and objectives.

- Commercial Benefits (Jones, 2005):

The most important benefit that businesses can achieve by applying the EMAS Program is to increase the quality of their products and to become more preferred in purchasing decisions as a result of environmentally sensitive production. In addition to this, as a result of increasing sensitivity in the protection of the environment, customers will prefer environmentally friendly products and enterprises and will increase the number of customers.

Another commercial benefit is the prevention of environmental accidents through emergency management work carried out within the framework of EMAS, thus reducing the costs associated with emergency situations (Jones, 2005).

In addition, since the enterprise provides the effective use of raw materials within the framework of EMAS, it provides a significant benefit by reducing raw material costs. However, waste management costs will be reduced as less waste will be generated as a result of studies to reduce pollution.

- Customer Satisfaction / Increasing Product and Service Quality (Sipahi, 2010):

Preserving the ever-growing environment and the tendency towards the efficient use of natural resources have made it possible for the customers to make the production that is sensitive to the environment. Customers have begun to select producers as priorities in the decisions taken during the procurement process. In this framework, the EMAS logo, which certifies that the enterprise produces environmentally friendly products and doesn't harm the environment, has become one of the characteristics of the customers.

In most of the procurement and tenders made in EU member states, EMAS certification is a condition. The fact that Turkish SMEs can compete in international trade and meet customer demands will be possible through the implementation of the EMAS Program.

- Company Prestige (Sipahi, 2010):

Businesses who successfully establish EMS, and announce it with environmental reports within the scope of EMAS Program, gain prestige among both public institutions and the public. Although they are based on volunteerism, businesses that demonstrate their environmental sensitivity by meeting various costs improve their public image by documenting it.

- Increasing Credibility:

Within the framework of the infrastructure established in the countries where EMAS II Regulation is applied, it is seen that the enterprises implementing the Regulation are priorities in state aids and loan allocations (Biondi et al., 1998).

In Turkey, KOSGEB which the institution responsible for SMEs, the allocation of private credit to businesses engaged in environmental management and other support to prioritize the distribution, in promoting the production of environmentally friendly is thought to play a crucial role.

2.3.1.3. How does it work?

One of the most important objectives of the EMAS Program is that it fulfils the minimum responsibilities given in the legislation and establishes a system for monitoring compliance with the legislation. Within this framework, the enterprise should examine in detail the legislation components, such as applicable laws, regulations, and communiqués, related to their activities. In particular, the tasks and responsibilities in the legislation, standards, permits, licenses, and auditing, sanctions and general implementation principles should be considered separately. In order to minimize the environmental impacts caused by its activities, it should set the threshold values and implementation rules set out in the legislation. Action plans, guidelines and communiqués related to legislation should also be followed in order to achieve sub-regulations and rules in the implementation of the legislation (Us, 1999).

Nonetheless, it is an important step to increase the competitiveness of the companies by producing international standards related to their products and services, not only to the legislation but also to the production of these standards.

Within the framework of EMAS regulations, the entity should establish a system to ensure that the revised and newly issued legislation is followed. In order to monitor the legislation, a list of external sources should be documented and relevant Internet addresses and competent authorities should be determined. Legislative follow-up can be carried out on the internet pages of the relevant competent authorities, as well as from various regulatory registers. In addition, sectorial chambers and associations as well as professional chambers generally follow the

environmental legislation, and sector specific issues or rules can also be accessed from these chambers and associations (Us, 1999).

2.3.1.4. EMAS Certification

European Regulation 1221/2009 The Certificate of Compliance is a voluntary instrument proposed by the European Commission for the Eco-Management and Inspection Program to present information on appropriate environmental management to the community and other interested parties and to improve and evaluate their environmental performance (Kolk and Mauser, 2002).

The entity shall pay the required share of the registration and fill in the registration information form contained in the Regulation and submit it to the national competent authority together with the approved environmental report. The competent authority records the business and sends the registration number and the EMAS logo together with the registration number. The annual EMAS registration list prepared by the competent authority shall be sent to the European Commission and announced by the European Commission every year in the Official Gazette (Kolk and Mauser, 2002).

After receiving the participation certificate and EMAS logo sent by the competent authority, the company is entitled to use the EMAS logo.

2.3.1.5. Importance of EMAS

Thanks to EMAS, relations with environmental legislation were developed in various enterprises within the EU, targets in the market were maximized, investors and insurers were shown evidence about management competence, were responded to expectations and pressure was created for environmental reporting (Kolk and Mauser, 2002).

Service and product quality has been improved, more effective and efficient communication with stakeholders has been achieved, and management has been modernized and verified green demands on products, services and activities have been established.

Environmental innovation has been enriched and access to sustainability of consumption has been accelerated, employees' motivation and participation in environmental protection has been increased, and individual and public health has been improved (Çolak, 2010).

2.3.2. British Standard 7750 (BS7750)

The first published standard on environmental management is the British BS 7750 standard published in 1992. The document, which was published by the British Standards Institute (BSI) in 1992 and revised in 1994, has been prepared as a standard which is envisaged to be implemented in the enterprise and in the field of activity at every scale. It is designed as a standard that focuses on environmental performance and in the following years it has also been the source of EMAS and time series of ISO 14000 standards (Labodova, 2004).

2.3.2.1. Short History of BS 7750

In the early 1990s, developments started to be observed in the field of Environmental Management System (EMS). In 1992, the British Standards Institute (BSI) established the British Standards for BS, BS 7750, and in 1994 it was revised and standardized. BS 7750 Standards have been the starting point for EMAS (Labodova, 2004).

The British Standard BS 7750 is the first published standard for EMS. ISO 14001, which is based on BS 7750, was published in 1996 within the scope of ISO 14000 series and thus BS 7750 was repealed. EMAS (EU Eco-Management and Auditing Program) was developed in 1993 for EU countries and is based on the BS 7750 standard (Labodova, 2004).

2.3.2.2. Requirements of BS 7750

According to Labodova, 2004:

- System integration and interfaces

- User interfaces: systems can be adapted to workflows depending on user requirements.
- Data entry tools
- Reports
- Documentation
- User trainings: businesses often require special trainings for their users.

2.3.3. Responsible Care Management System (RCMS)

2.3.3.1. Definition of RCMS

Responsible Care Management System that guides the establishment and development of a Quality Management System to improve customer satisfaction in organizations. (American Chemistry Council, 2013).

2.3.3.2. Facts about RCMS

In today's conditions, the great developments in the field of information, technology and communication are driving the societies into a rivalry competition and an economic race in which new developments are taking place day by day. The globalization of world trade has expanded the scope and limits of competition and the number of participants has increased. Moreover, the participants of this race are getting more qualified every day. Customers have become more conscious, more informed and customer expectations have reached the highest level. It is no longer sufficient to meet customer expectations, but also to go beyond customer expectations. The pace of change has increased, and developments in the field of technology have made possible unimaginable applications possible. It is very difficult for organizations that cannot keep up with the change and the pace of change. Survival of enterprises can only be realized by providing goods production or service in accordance with customer needs and expectations in all sectors. For this reason, has been a sine qua non in the organizations. It has become the most popular international standards since its publication (1987). The RCMS demonstrates how an

effective management system can be set up, documented and maintained (American Chemistry Council, 2013).

2.3.3.3. Implementing the RCMS

RCMS is a globally recognized quality management system that envisages increasing customer satisfaction through meeting customer expectations, needs and regulatory requirements. It determines the conditions of Quality Management System in many points from the organizational structure of the organization to the satisfaction level of its customers, from the analysis of the collected data to the effective management of the processes, from internal audits to product design, from purchase to sale. RCMS is essentially a control mechanism. The basic assumption is that if an effective Quality Management System is established and implemented, quality products and services will be produced to meet customer needs. RCMS is not challenging and includes general requirements. It can be applied to any sector regardless of large or small scale. It represents a strong management system when properly understood and applied correctly. RCMS has left completely to the organizations how the Quality Management System will be established.

2.3.3.4. RCMS® and RC14001® Responsible Care

An organization operating with the RC14001 system uses a system and associated procedures to balance and optimize energy consumption. By following this system, it strives for continuous improvement to reduce or keep energy consumption per product. RC14001 training provides the introduction of this standard and informs organizations who want to establish a management system in accordance with the standard about the requirements of the standard (Oskarsson et al., 2005).

It complies with the relevant laws and environmental regulations and takes the necessary measures to evaluate the recyclable wastes, to reduce the use of natural resources, to prevent pollution caused by harmful wastes, to protect the natural assets, not to adversely affect the living life, to pollute the environment and to take

positive measures. establishes the necessary communication channels between the employees and the management in order to take precautions against the risks that may arise in terms of OHS and eliminate these risks and keeps these channels open. Provides prevention of diseases by conducting periodic health checks of employees. Objectives and targets have been determined in order to realize continuous improvement and management programs have been established in line with these goals and targets. Collaborates with employers, government agencies, research institutes and the public to improve environmental efficiency, OHS performance and quality (Oskarsson et al., 2005).

2.3.3.5. Responsible Care Meets ISO

The preparation of the ISO 14000 Environmental Management System standard is based on the decisions taken at the world summit in Rio in June 1992 and the principles contained in the Rio Convention. About a year after the world summit in Rio, in 1993, ISO established a technical committee of representatives from around 50 countries to prepare international environmental management standards. As a result of the work of this committee, the history of ISO 14001 was adopted in September 1996 and the ISO 14001 Environmental Management System standard was published. Although the implementation of ISO 14000 standard is voluntary, it is expected that the standard will become a compulsory application in the near future with the force of the society, international organizations and governments (Whitelaw, 2004).

About a year after the world summit in Rio, in 1993 the ISO established a technical committee of representatives from around 50 countries to prepare international environmental management standards. As a result of the work of this committee, in September 1996, the ISO 14001 Environmental Management System standard was published. Although the implementation of the ISO 14000 standard is still voluntary, it is expected that the system will become compulsory in the future under the coercion of societies, international organizations and governments (Whitelaw, 2004).

The attempt to establish a quality standard was made during the Second World War in America, the country where the expansion and impacts of industry and

technology were felt most. This attempt to establish the standard led to the emergence of MIL-Q-9858, a quality system specification, and MIL-I-45208, which set the inspection system requirements. Following the first attempt to establish a quality standard, these two standards were the basis for a set of standards for use in the North Atlantic Treaty Organization (NATO). These are called Allied Quality Assurance Publications (AQAP), of which AQAP-110 is a quality system specification, manufacturing, design, inspection and testing, AQAP-120 manufacturing and AQAP-130 are inspection system specifications, covering only the final inspection. In 1979, the BS 5750 Standard, based on AQAP standards, was introduced in the UK. This standard consists of three parts. The first section included the quality system specification and the second and third sections included the inspection system specifications. This situation, which was defined for the United Kingdom, began to be applied in a similar way all over the world, and all these developments resulted in essentially the same but different standards of quality and control (Whitelaw, 2004).

2.3.4. ISO 14001: 2015_ EMS

2.3.4.1. Definition of ISO 14001: 2015

Environmental awareness began to emerge after understanding some of the main environmental problems that threaten the world and the consequences of these environmental problems. Therefore, this necessitates the necessity of organizations to be more sensitive to the environment. Increasing environmental awareness has led to the development of international standards for environmental management systems (ISO 14001). ISO 14001 environmental management system includes planning, implementation, control and regulatory methods required by the organization for maintenance. With the increase in population, urbanization and industrialization, the increase in negative environmental impacts has started to force nature. The effects of the scientific technological revolution on the environment in the 1960s revealed the need for rapid protection and improvement for the environment. Taking into consideration the employment needs of the developing population, food needs and the progress of the countries, new solutions were sought for environmental problems

that suppress our lives. Since an ineffective production method is impossible, especially by producing zero waste, methods that enable production / service by providing less polluting environment are investigated (Özüsağlam et al., 2018).

In 1969 the Secretary-General of the United Nations; addressed to all members on the protection of the environment. These problems were brought to the agenda with the report prepared by the Roman Club founded in 1968 on the dilemma of 'conflict or disappearance Roma. In 1972 an environmental conference was held and attracted the attention of many organizations all over the world to environmental problems. In the Stockholm environmental conference in 1972, the development strategy that did not exclude the environment was explained. The goal was to make fair use of natural resources. In the 1970s, the philosophy of sustainable development began to be addressed as a solution to the protection of the environment as well as economic development. This method was included in our Common Future Report. (Özüsağlam et al., 2018).

Sustainable development is to meet today's needs without destroying the ability of future generations to meet their own needs. It is a process of change aimed at meeting the basic needs of everyone and the use of resources. Environmental issues have been increasingly addressed in the last 30 years. Following these discussions, publications such as various regulations, administrative communiqués and standards have increased rapidly. EMAS is a strict discipline in the member states of the European Union. In September 1996, ISO published the ISO 14001 Environmental Management Systems standard on the control and disposal of environmental aspects. ISO 14001 Environmental Management System, whose methods are rapidly spreading and accepted, includes conditions for the control and disposal of environmental dimensions in line with environmental policy, environmental objectives / targets and environmental programs (Özüsağlam et al., 2018).

2.3.4.2. Key Concepts of a Successful ISO 14001: 2015

EMS Scope

The Environmental Management System (EMS) is a holistic strategy and process for identifying, monitoring and managing the environmental impact of the

facility over time. Without a comprehensive plan, it is possible to maximize environmental performance by identifying a long-term strategy that will inform the decision-makers about the environmental management of the facility, while it is possible to make environmental improvements within the facility.

The world has realized the importance of the concept of environmental management system in the way of sustainable development. Developed countries have created environmental management systems by working in this field. According to this new understanding, industrialized countries have implemented different legal requirements and different environmental standards according to national and regional conditions in the field of goods and services. In countries such as the European Community, the United States and Canada, more than ten different programs have been implemented regarding the environmental label and this situation has emerged as a commercial barrier (TSE, 1998; Güler, 1999).

In the face of this concept complexity, the process of developing environmental management system (Environmental Management Systems-EMS) standards has been initiated. The main objective here is to create an environmental management system that can be implemented by any company operating around the world, regardless of country, state, regional and local law.

The International Standardization Organization (ISO) has been assigned to prepare the environmental management system standards which are expected to be used all over the world. Since 1991, the Strategic Environment Consultancy Group (SAGE) has been established with the participation of ISO and IEC (International Electrotechnic Commission) member countries with the encouragement of the diversification and increasing of environmental activities and the successful implementation of ISO 9000 Quality Management System. As a result of SAGE studies, it has established the technical committee of ISO TC 207 to prepare international environmental management standards (Bektaş, 1997).

The Committee has established sub-committees to work on different topics. As a result of the works of these committees, the first standards of the environmental management system series and ISO 14001 / Environmental Management System Standard were published in 1996 (Bektaş, 1997).

Environmental Policy

Environmental Policy refers to the objectives, aims, norms and principles set forth in order to regulate the relationship of the society with the environment and all the measures taken to protect the environment. In other words, environmental policy includes the principles and action plans that form the basis of environmental decisions and activities on the one hand and the determination of the form and content of environmental activities through public institutions and organizations. (Bektaş, 1997).

Planning

Environmental planning is of great importance for the management of natural resources. Environmental management aims at minimizing the negative impact of people on the environment. After environmental problems emerge in environmental planning, studies are carried out to prevent the occurrence of environmental problems rather than taking measures to eliminate their effects. For this purpose, various local and country organizations are established. Because it is possible to solve these problems through planning, organization and supervision. Risks are put forward through local or national organizations. Then the causes of these problems are determined. To prevent them, it is revealed what needs to be done. To this end, the public is made aware and the tasks are shared to prevent the emergence of environmental problems. In order for environmental management to achieve its objectives, citizens are actively involved in the process and change their environmentally damaging behaviour (Richardson and Sharp, 2008).

Environmental Aspects

Due to methodological problems, some countries develop indicators sets that describe selected economic, social and environmental aspects of sustainable development instead of indices, while monitoring changes with them, while others use both indicators and indices together (Richardson and Sharp, 2008).

Legal and Other Requirements

The cross-border effects of environmental problems and their globalization have necessitated multilateral cooperation and international coordination in solving these problems. This global dimension of environmental problems has inevitably left countries and international organizations on an intensive agenda for the preparation of the necessary legal infrastructure on the environment. Within this framework, while preparing bilateral, regional or global conventions, protocols and declarations, international organizations such as United Nations, Council of Europe, OECD, OSCE, World Bank and WTO have established environmental organizations and departments within them and They set common policies towards their solutions, developed rules and principles and implemented action plans in this direction (Richardson and Sharp, 2008).

Objectives and Targets

The organization should determine the environmental goals and objectives for each task and every level within the organization and ensure that these are documented and maintained. (Richardson and Sharp, 2008).

Environmental Management Programs (EMPs)

The organization should organize environmental programs or programs to achieve and maintain its objectives and objectives. This program or programs (Anderson et al., 1999):

- Determination and determination of the responsibility of each appropriate function and management level of the organization to ensure the achievement of the objectives and objectives
- They should contain information on the means necessary for their realization, the date and time of the implementation. If a project is related to a new development, new or modified activity, product and / or service, programs or programs should be changed, if necessary, to ensure that environmental management can also be applied to these projects.

Implementation and Operation

Roles, Authorities and Responsibilities

In order to ensure the effectiveness of environmental management, the duties, responsibilities and authorities should be described, documented and communicated to those concerned. Management should provide the necessary resources for the implementation and control of the EMS. These resources should include special skills, human, technological and financial resources (Anderson et al., 1999).

Training and Competence

The organization should identify the need for training and provide appropriate training to those whose tasks may have significant impacts on the environment (Anderson et al., 1999). The ISO 14001 series of standards brings a worldwide practice in environmental management and sustainable development. At the same time, the standards are developing a voluntary common approach to environmental protection approaches, which enables industries to achieve a more independent and less environmentally responsible structure. In addition, the ISO 14001 series harmonizes international rules and methods for assessing environmental impacts and minimizes barriers to global trade. It is very important for a country to use ISO 14001 standards.

Communication

In terms of organization, environmental dimensions and EMS:

- Ensuring communication between the various levels and the units performing various tasks,
- Establish and maintain procedures for the acceptance, registration and reply of appropriate documents from outside parties.

The organization should review the procedures and procedures necessary for external communications on important environmental aspects and record its decisions on this issue. (Anderson et al., 1999).

EMS Documentation

The organization shall establish and maintain the necessary procedures for the identification, maintenance and management of environmental records. These records should include the results of training, auditing and review procedures. Records of the environment should be legible, identifiable and appropriate for monitoring the activity, product and service. These records should be stored in such a way that they are easily accessible, protected against damage and deterioration and prevent their loss. How long they will be kept should be based on a principle. These records should be kept in accordance with the system and the organization to demonstrate compliance with the requirements of this standard (Anderson et al., 1999).

Document Control

All documents deemed necessary by the TS ISO standard:

- determination of their places,
- they are reviewed within certain periods and, when necessary, this is done properly and their competence is approved by authorized personnel,
- keep the latest copies in all locations where operations are considered important for the efficient operation of the environmental management system,
- the copies that have become invalid, are collected immediately from the places they are sent and used or the unintended use is prevented,
- the proper identification of invalid copies stored for legal reasons or for the purpose of storing information;
- establish and maintain the necessary procedures to ensure

Documents must be legible, carry the effective or review date, be easily identifiable, and be properly stored for a specified period of time. Procedures and responsibilities with regard to the implementation and modification of different documents should be determined and maintained. (Anderson et al., 1999).

Operational Control

In engineering perspective, for sure the operational steps may have an impact on environment and that may affect the companies' results. Operational controls are also included in EMP (Anderson et al., 1999).

Emergency Preparedness and Response

For ISO 14001 certificate prior training and a consultancy service must be obtained. ISO 14001 education is firstly examined with the company providing ISO 14001 environmental standard and then the activities that affect the environment are determined. What is meant by the environment, what is meant by the environment (air, water, soil, plant, living things, etc.) is intended to be studied in the pollution of the environment, noise, aesthetics, factors that change the nature of the environment air pollution, soil pollution, water pollution, etc. are factors such as (Anderson et al., 1999).

Checking and Corrective Action

Monitoring and Measurement

The organization should establish and maintain a documented procedure to properly monitor and measure the main characteristics of operations and activities that may have significant impacts on the environment. This procedure should include the recording of information to monitor the degree of performance and achievement, the relevant transaction controls and their conformity with the objectives and objectives of the organization. The monitoring equipment should be calibrated according to the organization's procedures and records of these operations must be maintained and maintained. The organization shall establish and maintain documented procedures to periodically review the compliance of its activities with applicable environmental legislation (Raines, 2002).

Non-conformance and Corrective and Preventive Action

The organization shall establish and maintain procedures for the identification and responsibility for the investigation and enforcement of non-compliance, to take

action to mitigate harmful effects, and to initiate and conclude corrective and preventive actions.

Records

The organization shall establish and maintain the necessary procedures for the identification, maintenance and management of environmental records. These records should include the results of training, auditing and review procedures. Records of the environment should be legible, identifiable and appropriate for monitoring the activity, product and service. These records should be stored in such a way that they are easily accessible, protected against damage and deterioration and prevent their loss. How long they will be kept should be based on a principle (Raines, 2002).

EMS Internal Audits

The organization should organize an environmental program or programs to achieve and maintain its objectives and objectives. A project; if a new development is related to a new or modified activity, product and / or service, programs or programs should be changed, if necessary, to ensure that environmental management can be applied to these projects as well (Raines, 2002).

Management Review

In order to ensure the effectiveness of environmental management, the duties, responsibilities and authorities should be described, documented and communicated to those concerned. Management should provide the necessary resources for the implementation and control of the EMS. These resources should include special skills, human, technological and financial resources (Raines, 2002).

2.3.4.3. Topics which ISO 14001 Covers

Documentation volume may vary from organization to organization depending on the following issues (Özusağlam et al., 2018):

- Size, type, activities, products or services of the organization,
- Complexity of operations and their interaction,
- Expertise of staff.
- Examples of documents in this section:
- Statements of policies, objectives and objectives,
- Information on important environmental aspects,
- Procedures,
- Information on transactions,
- Organization charts,
- Internal and external standards,
- Emergency plans of the establishment site,
- Records

2.3.4.4. Benefits of Implementing an EMS

An advantages of the environmental management system certificate are as follows (Tan, 2005):

- To increase the compliance of national or international procedures
- To increase the reputation of institutions and organizations in national and international markets.
- According to the type of activity required authorization or authority certificate is more convenient.
- The development of cost planning ensures that costs are minimized and continuity increases.
- More efficient use of natural resources at the production stage reduces the cost.
- During the production, the costs arising from environmental factors are minimized.
- The quality of the institution or organization increases.
- Ownership of the certificate increases the confidence of the guests against the firm.
- It facilitates the institution or organization to step into other markets.

- Increases the quality of the organization in the field of operation.
- It increases the motivation of the personnel in the institution and ensures that they remain connected to the institution.
- Since the dangers are known beforehand, they are always ready for emergencies and incidents.
- Losses against emergency situations and cases are minimized.
- Increases compliance with environmental norms.
- Having the certificate increases the effectiveness and quality of the institution.
- The wastes to be released to the environment are minimized.
- Increases the acquisition of new international markets.
- Creates a corporate image sensitive to environmental factors.
- Energy consumption and the use of raw materials are aimed at minimizing.
- It makes the international name of the institution or organization heard and increases its prestige.
- The cases of responsibility are minimized and the cost of liability insurance is minimized.
- It is a certificate that aims to protect the natural standard of the institution or organization.
- For companies in the market, it helps to gain a competitive advantage.
- Ensuring the control of the pollution from the source and ensuring the reduction of the minimum values
- Careful selection of raw materials and sparing use of natural resources are ensured.
- It creates opportunities and creates strategies in new markets.
- Provision of prerequisites for public tenders.
- It ensures the acceptance of a common and common language in the international market.

2.3.4.5. ISO 14001 and EMAS

The aim of these standards is to promote the use of advanced technologies that do not destroy the environment and resources, to achieve sustainable development goals, to make consumers conscious and sensitive in this direction, to eliminate harmful products and raw materials, and to eliminate harmful products by evaluating the environmental effects throughout the life of the product. In parallel with this awareness in our country, the number of organizations that make up the TS-EN-ISO 14000 Environmental Management System is increasing (Tavmergen, 1998).

As of September 10, 1997, the number of companies which are entitled to receive TS-EN-ISO 14001 certificate is 10. In recognition of the fact that the legal regulations alone did not solve the environmental problems, the European Union countries implemented the EMAS (Environmental Management and Audit Scheme) implementation in 1993, which will enable the control of the environmental impacts of products and activities by market forces rather than legal practices (Tavmergen, 1998).

According to this new understanding, the industrialized countries have implemented different legal requirements and different environmental standards according to the national and regional conditions in the purchase of goods and services. In countries such as the European Community, the United States and Canada, more than 10 different programs on the environmental label have been introduced and this situation has started to emerge as a commercial barrier.

The United Nations Conference on Environment and Development, held in Rio de Janeiro on 3-14 June 1992, issued a declaration aimed at realizing a new cooperation between the main sectors of society and the public (Tavmergen, 1998).

In 1993, ISO established its technical committee (TC 207), which will work on Environmental Management. The standards prepared by TC 207 are known as ISO 14000 Environmental Management System standards and have received great support from industry (Tavmergen, 1998).

CHAPTER THREE

A CASE STUDY ON WHITE GOODS INDUSTRY

3. METHODOLOGY AND FINDINGS

This study is an exploratory research that aims to develop a decision support tool which can help companies to evaluate the suppliers environmental performance.

3.1. DESIGN OF STUDY

3.1.1. Objective of the Study

The environment in which we live consists of living and inanimate beings. Air, water, soil, plants and animals make up our environment. Damage to one of these elements threatens our lives. Air pollution causes a number of health problems, particularly respiratory difficulties. Falling of harmful substances in the air with rainfall will damage the soil, water, nutrients and structures. In the same way, pollution of water and soil directly affects our lives. Excessive collection of plants and hunting of animals causes the destruction of some species. Diversification of social life needs leads to excessive consumption of natural resources and damage to the environment. Today, some industrial plants do not take the necessary measures also cause environmental damage. In addition, urbanization and tourism activities are also harmful factors for the environment (Verghese and Lewis, 2007).

Damage to the environment has reached dimensions that threaten human life. This situation and the future anxiety in people brought the environmental problem to the agenda. The protection and sustainable use of the environment has necessitated the development of certain forms of behavior in humans. For this purpose, environmental protection practices have come up. However, when the sensitivity to the environment becomes a behavior, a significant improvement will be achieved in this area. This can be achieved through an educational process that begins in the family and continues in the school and social structure. This is the one of the important functions of purchasing in SCM.

The limited assets in the environment we live in cannot meet our unlimited and ever-increasing needs. Therefore, we have to leave a livable environment for the future. We should not harm the environment not because it is prohibited, but because it is the area where we live. In terms of creating environmental awareness, firstly environmental problems are revealed (Lee et al., 2008). What needs to be done to prevent these problems is determined. In the next stage, task sharing is done. In the division of duties, the obligations of all sectors, from families to educators, from municipalities to country administration, are determined. It is ensured that individuals know their responsibilities individually and in an organized way and act accordingly. The most important and analytical attitude in this regard is to target a livable world in the future.

In the literature, to the best of the author's knowledge, there are limited studies which provides a holistic model on green supplier selection and evaluation. Mostly, the studies are based on the traditional ways of supplier selection and evaluation models. However, the challenging issues of sustainability and the climate change enforces companies not only to pursue pro-environmental practices but also to manage their supply chain in a more environmentally responsible way. This necessity also requires the integration of purchasing function in the supply chain and the sense of environmental responsibility as well as the other functions. Companies should embrace an approach that accepts purchasing function as a strategic function by integrating environmental issues in their decision making process.

Hence, the overall objective of this study is to provide a framework which aims to integrate environmental factors into the supplier selection and evaluation process. This framework is believed to serve as a decision support tool for companies in their green supply chain efforts in terms of their purchasing function. This framework proposes and assesses the use of Analytical Hierarchy Process (AHP) tool to assist managers while structuring the problem of environmental dimensions during supplier evaluation and decision. Besides, the tool can be used to frame the issue clearly and provide a better understanding of what environmental criteria were really important in evaluating and selecting suppliers.

3.2. WHITE GOOD INDUSTRY IN TURKEY

The first production in the white goods sector in Turkey was held in Istanbul in 1955, based on the assembly industry. The first domestic washing machine was produced in 1959, the first refrigerator in 1960 and the first automatic washing machine in 1974. Until the 1980s, the white goods sector, where only a few firms were active, began to develop due to the widespread use of market economy, and the number of firms operating in the sector increased (Pavitt, 1984). The sector, which was negatively affected by factors such as the lack of market economy, the absence of foreign capital, the lack of advanced technology and qualified personnel, and the low purchasing power of the consumer, entered into a rapid development process with the emphasis on market economy applications after 1980, and foreign companies started to invest in the market (Milne, 1991).

In 1989, the durable customs duties and fund payments on made the sale and 1 January 1996 on the goods external competitive pressure as a result of realization of the Customs Union between Turkey and the EU, the increase of development and product diversification of product quality has played a very important role. Both the developments in 1989 and 1996 led various foreign companies to the Turkish market. Some of the domestic companies have established technology relations with these foreign companies. Thus, domestic companies have reached the level of quality and technology that can compete with international companies today (Demir, 2001).

Nowadays, there are around 130 large manufacturers in the Turkish white goods sector, including about 100 small and medium sized producers and around 20 importers. Appealing to a specific group of consumers, sales units in very low yield all companies prefer to import world-renowned brands importers distributors or engages in sales activities and after-sales service in Turkey market through a company founded by the parent company (Demir, 2001).

However, the competitive advantages of the firms operating in the labor-intensive low circles of the value chains have been reduced by the fact that large firms with more flexible labor markets, especially in China and India, show themselves in the international markets. The majority of firms in Turkey in order to compete with these countries, companies, or to increase productivity or run fewer workers also tended to informality. The necessity to compete with China and India

brought about a shift to more technology-intensive sectors such as automotive and white goods from traditional sectors such as textile and apparel, while the Customs Union Agreement signed with the European Union and the restructuring carried out following the 2001 Crisis further integrated the economy with international markets (Ministry of Industry and Trade, 2010). As in the traditional sectors, the introduction of value chains in these sectors and the share of domestic production, which started from contract production and assembly, have increased.

These statistics in production, especially in exports, are the result of Turkish companies, which have to compete with foreign firms as a result of the liberalization policies in the economy, by investing in quality, standardization and R & D, in the value chains and establishing their own value chains. In addition to the rapid growth of the sector in which domestic use was 70% in 2010, the support provided by the suppliers to the main producers, as well as the investment made by the manufacturing companies in technology and quality, as well as the production of advanced and international standards, plays a role. While the resident companies perform 90% of the production, most of the foreign brands are sold in the market through import and export techno markets in recent years (General Directorate of Industry, 2010).

Large companies in the sector have begun to show themselves in Europe and China and Russia markets. However, the high transportation costs prevent the influence of the remote markets on the one hand, while protecting the domestic market from the competitive pressure of the Far East countries, particularly China (Demir, 2001).

Producer firms are strengthening their position not only in the domestic market but also in the foreign market with their strong brands. In the sector, local brands such as Arçelik, Beko, Altus, Aygaz and Vestel, which compete with foreign brands such as Bosch, Siemens (Bosch Profilo) Ariston, Indesit (Indesit), have reached considerable market shares (Esen, 2008).

The strategic cooperation of Turkish firms with foreign firms in the past to close the technology deficits has increased and their scope has changed. As we will see in more detail in the future, strategic alliances are now increasingly being used to increase market share and sales volume. One of the issues that Turkish companies

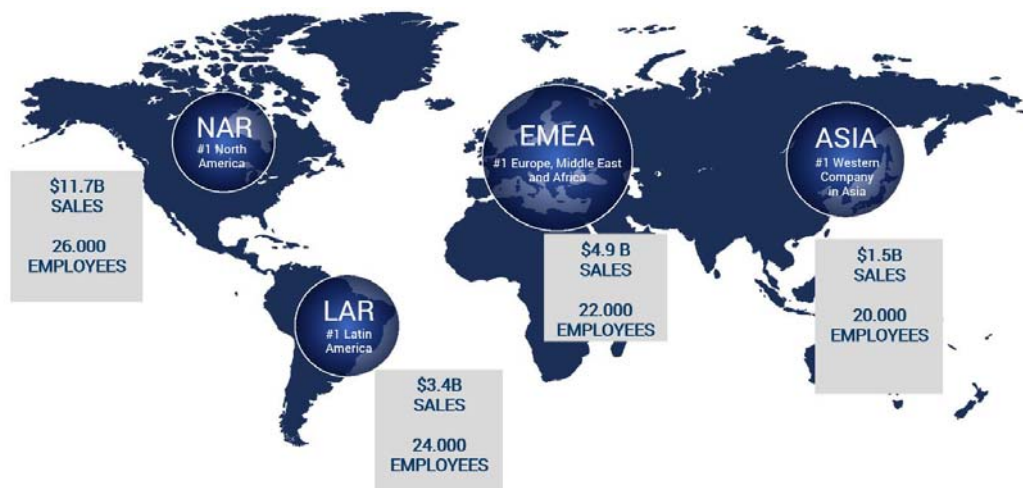
give importance to increase their sales is innovation and new product development. Unlike developments in the world of white goods sector, the number of patent applications is one of the sectors in Turkey. As a result of these developments, the white goods sector, which was the net importer until the end of the 1990s, has become one of the sectors with the highest foreign exchange and the highest competitiveness of Turkish companies in foreign trade (Arçelik, 2009).

30 percent increase in the last 5 years the production of white goods in Turkey reached 28.4 million units. Exports in the sector increased by 13.6 percent to 20 million 240 thousand 904 units rose. Meanwhile, the revenue generated from white goods exports increased by 5.7 percent to \$ 3.3 billion (The Ministry of Industry and Trade, 2010).

3.3. WHIRLPOOL COOPERATION COMPANY PROFILE

To give information about Whirlpool Corporation, the company where this study is generated; the world's leading, major home appliance manufacturer in the world. Globally, they have 92.000 employees, 21\$ billion sales (2017), 70 manufacturing and R&D centers all over the world. Approximately 72 million products sell in more than 170 countries in the world yearly.

Figure 12: Whirlpool Company Location and Information

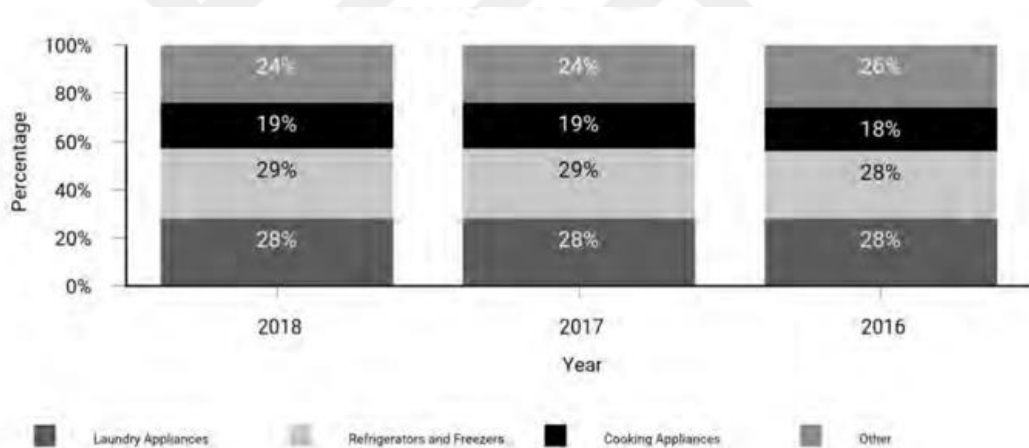


Source: Whirlpool Annual Report, 2018

As shown in the Figure 12, Whirlpool have many manufacturing areas in North America, Latin America, Europe, Middle East, Africa and Asia. Under the name of Whirlpool, there are different brands are produced currently in a different regions of the world. These brands are Kitchenaid, Maytag, Consul, Bauknecht, Brastemp, Amana, Jennair, Acros, Indesit, Diqua, Hotpoint, Gladiator, Affresh, Swash.

Whirlpool manufactures and markets a full line of major home appliances and related products. The principal products are laundry appliances, refrigerators and freezers, cooking appliances, dishwashers, mixers and other small domestic appliances. They also produce hermetic compressors for refrigeration systems. The Figure 13 provides the percentage of net sales for each of product categories which accounted for 10% or more of consolidated net sales over the last three years.

Figure 13: Product Categories as % per Net Sales



Source: Whirlpool Annual Report, 2018

The vision of the company is to be 'The best branded consumer products in every home around the world'. The vision sets the direction for the next 10-20 years, provides context to help them understand where they are going as a company. It provides a north star for the decisions that their company takes and helps them make short-term steps in line with their long-term aspirations. The important point for Whirlpool that the vision should be aspirational and practical, not mean to know how to get there, but it does mean it is achievable.

The mission of Whirlpool is to create demand and earn trust in daily base. According to the company, in any function of the company, people can create demand and earn trust for stakeholders even if he/she doesn't directly impact on final consumers. If company can do this, this is the way how become the best. Each one of the employee has to do their best every day to create demand and earn trust.

Whirlpool has four streams into their strategy shown in Figure 14. The four are not silos, they are interdependent. These four streams differentiate Whirlpool from its competitors. These four streams are; 'Product and Brand Leadership, Operating and People Excellence'. Whirlpool believes if they can achieve these four things well, and execute, they will achieve their vision.



Source: Whirlpool Annual Report, 2018

Product & Brand Leadership and Operating & People Excellence together deliver the strategy. None of these stand alone, they are all interwoven in what we've got to deliver. On its own, Products and Brand Leadership will not happen, if the personal accountability will be not considered. Right people with the right training is needed to deliver the strategy.

- Product Leadership includes: best preferred product design, first or better quality, best cost, top ratings, leading iconic products and innovation.
- Brand Leadership includes: best preferred brand, highest consumer loyalty, delivers on brand promise, iconic products, marketing effectiveness and brand relevance.
- Operating Excellence starts with consumer and ends with consumer satisfaction translating into continuous improvement across the value chain. Operating Excellence consists of core business processes and established

competences. These core processes are: C2C (Product commercialization process that describes how ideas are turned into products, with clear accountabilities and structured tollgates to manage decisions and risks), S&OP (Sales and Operational Planning), Merchandising, Trade Partner Management, and Customer Service.

- The three components of People Excellence are: Extraordinary Performance, Great People and Winning Culture, which unleash individual and collective talents, inspires a winning culture and creates competitive advantage that delivers results well beyond expectations.

The factory in Manisa, was under the Indesit roof before 2014. Indesit started to the operational processes at 1987. In Manisa, first production started in 1990 with the refrigerators manufacturing, then in 2013, Washing Machine plant was built. After Whirlpool Corporation acquires Indesit Company in 2014, Manisa factory became the part of Whirlpool EMEA structure. Now, 2 million products (refrigerators, freezers and washing machines) manufactured every year, more than 1000 employees working with the average age of 36. The producing brand portfolio is still Hotpoint and Indesit and make 100% export all over the Europe.

Whirlpool EMEA have not such environmental decision criteria. Company conduct ‘Global Supplier Qualification Audit’ to their suppliers and in this audit the only questioned about environment is to having the ISO14001 Certification. See in below Figure 15.

Figure 15: Whirlpool Audit Information

Reason for Audit:	x	New Supplier		New Technology		Re-Audit (existing supplier)
		New Factory		Follow -up audit		Quality / Delivery Issues
Supplier Certificate:		ISO/TS 16949		OSHAS 18001		VDA 6.1
		ISO 9001		ISO 14001		RoHS
						Others:

Source: Whirlpool GSQA Audit File

Except that, they have not effectively developed a systematic method of integrating the measures into the supplier evaluation and selection decision. So, the problem was, as they do not collect that kind of information and no methodology is being used, managers had concerns and would find it difficult to evaluate the ‘greenness’ level of the suppliers. In the present case, the current indicators that

Whirlpool Manisa factory implementing on their factory was became a guide to identify and implement to the suppliers. This means, what Whirlpool observe and be attention about environment, can be the factor for the suppliers also. Besides, the current suppliers that is observed into this study is also located in Turkey. So, also about regulation perspective, but factories should obey the rules of Turkish government and this make sense, both parties have similar base of indicators at least.

3.4. RESEARCH STRATEGY

3.4.1. Scope of the Study

The research performed on Whirlpool Cooperation Company which is currently producing for white goods industry. The subject is dealt with on a supplier basis. So, the scope is not the entire supply chain, but on the purchasing function. The reason for selection Whirlpool is because they are global company with different locations all over the world and have high level of environmental awareness.

3.4.2. Methodology and Steps of the Study

In the first step of the research, the important environmental performance indicators identified after a detailed review of the literature. 15 indicators and 50 sub-indicators were selected according to the suitability of the manufacturing companies and the research scope.

In second step of the research, the document analysis conducted internally in the Whirlpool Company to see if there is a database currently in use to evaluate the suppliers. The database searched considering the availability of the environmental indicators that can be usable in the research but no data was reached related to the supplier evaluation and selection. However, there was a strong database that the company use on their own internal evaluation system, which is used also to identify the environmental performance indicators of this research.

In third step of the research, in-depth interviews conducted with the 3 experts, who are working as a managers in the applied company. The identified indicators

from literature was examined and 33 sub-indicators are selected out of the mentioned 50 sub-indicators and also 8 sub-indicators determined out of 15 indicators.

Then, the focus group interviews were performed to create the framework with the selected indicators and sub-indicators. Same experts, who attended to the in-depth interviews, also attend to the focus group interviews and the framework of the study is generated based on the identified indicators

As a final step, with the framework structured, the process of determining the relative importance of each criterion begins via AHP method which is a quantitative method for a comparison between alternatives to resolve complex decisions by restructuring the options into a hierarchical framework (Saaty, 1991). A nine-point scale is used in questionnaires to collect the participant's opinions with the preferences of 'absolutely important', 'very strongly important', 'strongly important', 'slightly important' and 'equally important'. Based on the literature review and the opinions among experts, it is found that, if there are more than seven factors in same cluster, it is very confusing and difficult for participants to make pairwise comparisons and also it is not suitable for the consistency of the study. Therefore, the most important sub-indicators are selected based on the company needs, features/specifications of the industry and the production methods related to that industry. These selected indicators are used in questionnaire and 3 experts are asked to fill out the questionnaire. Based on the results, the consistency of the pairwise comparisons is examined.

3.5. RESEARCH DESIGN

3.5.1. Validity of Construction

To ensure the construct validity, comprehensive literature review is done about supply chain management, purchasing function and environmental performance factors and the examples searched about the usage areas. The methods in the literature was checked about the similar researches and cases, the research area narrowed, and specific examination areas are determined.

3.5.2. Internal Validity

In order to create internal validity, in-depth and focus group interviews and document review are conducted. Data collection are done in different times of periods and different people involved in the research study. First, the in-depth interviews and then the focus group interviews are conducted. Then, the company internal documents checked to see if there are some activities or data that are already provided by the company about the supplier performance evaluation.

3.5.3. Reliability

For reliability, main point of reliability in case studies is to reach same result repeatedly with the same case. In this study, a protocol is developed to improve reliability of the case study and enable to the researchers to get the same results in each time the same protocol applied. Primary and secondary data collection methods are used. The protocol is developed by implementing the deeply literature review at the beginning. The data is collected from literature, from company managers by implementing in-depth and focus group interviews and from company documents. During the interviews the voice record and note taking methods are used. The data is analysed after the data collection steps and the protocol of a case study is performed.

3.6. CONSTRAINTS & LIMITATIONS OF THE STUDY

This study generated in Whirlpool Manisa factory where the manufactured product range are refrigerators and washing machines mostly. The writer of this study is working as a senior buyer for plastic injection commodity, so the scope of the investigation is limited to plastic injection commodity only. All environmental indicators was identified according to plastic injection manufacturing steps and technologies. Besides, Whirlpool Manisa is doing only thermoforming in-house which is one of the methods of plastic injection processes and then assembly of the purchased components. So, during the data collection, people involved to the study, mostly have knowledge on plastic injection operations and the effects on the environment.

In the literature, there are studies about the green SCM practices. The environmental performance indicators in this study was identified by reviewing the literature and in-depth interviews with the people who are experts in their fields. There were some criteria in the literature which were specific examples just only for their study. For instance; ‘wood/wood fiber consumption’ was mentioned as an indicator in one of the studies but for plastic injection commodity, there is no effect of wood. So, such indicators was not taken into consideration during the data collection.

Demographic and regional profiles of Turkey and also regulations about environment in Turkey is taken into consideration during data collection. When it comes to the environment, most of the determinant factors are considered as global and remain valid overall world. However, in some countries there may be different associations or voluntary programs. This study is evaluated based on Turkish companies.

ISO 14001 Environmental Management System is a systematic approach that ensures production in all kinds of production sectors by taking environmental impacts into consideration in every step from the first stage of the product to the consumer. ISO 14001 is an international standard that defines the process of controlling and improving the environmental performance of a company. So, in this study, unlike other similar studies, having ISO 14001 is evaluated as a criteria, not an obligation to have it for suppliers.

3.7. DATA COLLECTION

In this study, primary and secondary data collection methods are used. Data is collected with in-depth interviews, focus groups interviews, document analysis and AHP Analysis.

3.7.1. In-depth and Focus Group Interviews

It is possible to examine the qualitative data collection types under two general headings. These are the basic data collection methods and supporting data

collection methods, respectively. Basic data collection methods include participatory observation, natural observation, document review and in-depth interviews.

The in-depth interview is a conversation with a person who is interested in the subject of research. Ethnographic interview is one of the types of in-depth interviews. The main purpose of the ethnographic interview is to obtain information about the culture that the participant belongs to with the interview with the participant. Phenomenological interview, which is another type of interview, is intended to reveal how the participant perceives, conceptualizes and evaluates events or events related to the subject of the research. In other words, in the phenomenological interview, the researcher tries to understand how people are meaningful to external reality (Greasley and Ashworth, 2007).

In-depth interviews, also called one-to-one interviews, are a standard flow of questions, interviews with one or up to two people without a defined pattern. In general, the questionnaire, which consists of all open-ended questions and usually forms a questionnaire, is used to determine the details of the research and to better understand the concepts. Therefore, all in-depth interviews are carried out by expert and experienced staff.

In-depth interview, focus group interview, participant observation and document review are most popular methods. The researcher should identify one or more of these methods according to the nature of the topic he / she chooses and explain the extent to which they will be used. Since the validity of the data collected in the qualitative research and the accuracy of the results is an important issue, the researcher should try to prove the information obtained by using multiple data collection methods from different sources (Yıldırım and Şimşek, 2008).

In this research, in order to identify the environmental performance indicators, literature review was conducted. Although the previous studies identify the need and tendency to include environmental criteria in the supplier selection and evaluation process, they fail to systematize, categorize and detail a framework for this theme. The first selection and elimination of the indicators from the literature is done according to the suitability of the indicators to the current business case and plastic injection commodity. Then, because the study is implemented to Whirlpool Company, three of the experts were selected and in-depth interviews were conducted

using semi-structured interview form. The participants titles are; ‘Senior Commodity Manager, Plastic Injection Commodity’, ‘Senior Buyer, Plastic Injection Commodity’ and ‘HSE Manager’ who are the experts on their jobs and have the knowledge about purchasing and the field of environmental management and had primary responsibility for waste reduction and materials management within their organization. For more details, the questionnaire is in APPENDIX 1. The interview data is recorded by note taking and voice recording.

As a third step, the focus group interviews are conducted with the same participants to create a framework about the relationship of each environmental indicators. The model shows the company’s internal processes (all lifecycle) and the management system. The model is generalize to use also in different industries and can be performed with different participants. Similar with in-depth interviews, the focus group interview data is recorded by note taking and voice recording.

3.7.2. Document Examination

The Whirlpool Company database searched and the available data collected to use in the research. However, the company have no available database to evaluate their suppliers. The company environmental self-evaluation source and indicators are examined to use on supplier evaluation. The criterion are match perfectly because both companies are located in Turkey and respect the same regulations. On the other side, both companies have the plastic injection production type which is also another limitation for that study.

3.7.3. AHP Analysis

By using the AHP Analysis, the priority of the identified criterion was conducted. In this research, with the framework structured, the process of determining the relative importance of each criterion begins. Regarding the identification of the priority levels, 3 experts (same participants of in-depth interviews and focus group interviews) are asked to fill the questionnaire, which is composed of two parts: rating of sub-indicators and rating of the indicators.

3.8. DATA ANALYSIS

To conduct data analysis, all the data collected from the literature, in-depth interviews, focus group interviews, document analysis and AHP analysis recorded into an Excel sheet. A database is created in excel and includes every component of data collected in the scope of the study. The literature review and the Whirlpool document examination phase is done and all selected data was gathered as a source of interviews. The interviews results are analysed after the note taking and voice recording and the main indicators are identified and the framework is created. Then the pairwise survey created to perform the AHP Analysis. As a result of AHP questionnaire, full filled by the participants, the geometric mean is calculated, which indicates the central tendency of the participants results. Then these geometric mean is used to calculate the importance of the indicators. All the results examined in AHP calculation excel sheet and the results are found.

3.9. FINDINGS AND RESULTS

3.9.1 In-depth Interview Findings

3.9.1.1. Definitions of Environmental Performance Sub-Indicators and Indicators

The challenge in this study was to construction an AHP model that included relevant environmental criteria and could be applied to the companies working for white goods industry. Initially, a literature review to identify the environmental indicators is conducted. Then, the most relevant and main sub-indicators and indicators are obtained by in-depth interviews regarding to the industry, regional, demographic profiles and other mentioned limitations. These indicators and the explanations are as following;

List of Environmental Performance Sub-Indicators

Green/Recyclable Raw Material (RM) Usage: The usage of raw materials in the components or indirect consumed goods that can be recyclable and has a lower impact on the environment (unit of measurement: ton/ton product).

Energy Consumption / Total Energy Usage: The control of energy consumption (unit of measurement: ton/ton product).

Renewable Energy Usage: With the increasing population and developing industry, the need for energy is increasing day by day. While the reserves of fossil fuels such as coal, lignite, natural gas and gasoline are close to depletion, environmental factors are added to this situation. For all these reasons, the movement towards alternative energy sources is accelerating. Investments in renewable energy sources are increasing in many countries. (Unit of measurement: ton/ton product)

Water Consumption: The control of water consumption (Unit of measurement: ton/ton product).

Water Waste: The use of water in vain is called waste of water when we do not close the water when we are finished with it. In short, the use of water in vain. (Unit of measurement: ton/ton product).

Hazardous Waste: The quantity control and treatment of hazardous waste (Unit of measurement: mg/l). Hazardous wastes are carcinogenic, caustic, flammable, explosive and irritating harmful wastes which may cause danger to human and environment. Hazardous wastes can also harm other living species. Hazardous wastes are temporarily stored in hazardous waste facilities.

Solid Waste: The quantity control and treatment of solid waste (Unit of measurement: mg/l). Solid waste is solids and sewage sludge which is intended to be disposed of by the producer and which must be disposed of regularly in order to protect the peace of the society and especially the environment. If we define solid waste in another way, we can also describe it as any solid material that has expired and needs to be removed from the environment in which we live. Solid waste can be generated at home, at school, in the hospital, in industry, in gardens and many other places. Regular storage facilities are built in the protected areas for the disposal of solid wastes. In addition, the construction of a Solid Waste Transfer Station, research

of new disposal systems and rehabilitation of wild storage areas, garbage conveyors and transportation vehicles are provided.

Chemical Waste: The quantity control and treatment of chemical waste. (Unit of measurement: mg/l) Chemical waste defined by the International Environment Organization as “*wastes that have serious damages to human health and environment, disrupt the ecological balance and contain risks that may disrupt the environment.*” Chemical wastes are flammable, reactive and toxic due to their properties and cause serious harm to the environment. These wastes threaten both the environment and the lives of living organisms that live in this ecological balance.

Toxic Water Pollution: The quantity control and treatment of toxic water. (Unit of measurement: mg/l) Toxic water pollution occurs when people is degrading water quality and make it toxic by using harmful ingredients.

Gas Emission: The quantity control and treatment of gas emission (Unit of measurement: mg/m³). *Gas emission* means the emission into the earth's atmosphere of any of various gases, such as SO₂, NH₃, CO and HC1 that contribute to the greenhouse effect.

Second Tier Supplier Evaluation: The ability of the company to evaluate their suppliers.

Purchased goods from environmentally assessed suppliers: The level of assessing the suppliers about environmentally friendly base.

Third Party Certification (eco-labeling): Eco-mark is a voluntary method of worldwide environmental performance certification and labeling. An eco-label identifies products or services that have been proven to be environmentally friendly in a particular product or service category.

Non-compliance Fines: Doing something to harm the environment deliberately or by being careless can result in a pollution fine or penalty by government. The evaluation of company if they received any non-compliance fines or not.

Reputation and Legitimacy: It can be said that the stakeholder approach coincides with the legitimacy understanding of the resource dependency theory in the organization theory and the legitimacy approach matches the legitimacy approach of the institutional theory. This will again lead us to look at the concept of legitimacy from a strategic and institutional perspective. While those who approach legitimacy

strategically focus on the eyes of the organization executives, those who approach legitimacy focus on the inside of the social window. One of these societal expectations is environment, which companies must give priority to keep their well reputation in high levels.

ISO 14001 Certification: Having ISO 14001 Certification and having a global application of environmental standards

Reusable / Recyclable Packaging: It is used until it is impossible to re-use the packaging in its own life cycle, refilling without any treatment other than collection and cleaning, or used for the same purpose until the end of its life. After the use of waste materials in various physical and chemical processes and re-manufacturing processes as raw materials. Recycling of wastes that can be recycled is processed into various raw and physical and / or chemical processes and converted into secondary raw materials. In another definition, it can be defined as using the recyclable waste materials which are not used in any way by using various recycling methods as raw materials for re-manufacturing processes.

Reverse Logistic: Conversely, logistics can be considered as planning, implementing and controlling the flow of raw materials, in-process stocks, final products and related information from the point of consumption to the point of production in an efficient and cost-effective manner to preserve or ensure the proper disposal of product value. A product subject to reverse logistics can enter this reverse transmission / reverse distribution network for many different reasons.

Eco-friendly / Green Transportation: More than half of the world's population now lives in cities. Urbanization, people moving away from production points, changing / changing life culture cause various transportation problems. Dozens of transportation-related problems such as the inability of the poor to meet transportation costs, the quality and inadequacy of public transportation, traffic congestion and the difficulties experienced by disabled people in transportation are important factors that decrease the quality of life.

Environmental / Green Technology Usage: With the support of Green Technology Projects, it was aimed to support the practices aimed at increasing the environmental performance of industrial enterprises and reducing their production costs and thus increasing their competitiveness. In these projects, it is aimed to indirectly encourage

the development / production of such technologies with domestic means and resources by giving priority to domestic technologies.

Green R&D and Design Activities / Eco-design Products: Design step of products with the aspect of environmental friendly.

Green Process Planning: The level of green process planning. Green process planning technique is a key approach to improve the environmental friendliness of the manufacturing processes. Exploring for the innovative ways of green process planning can give a new direction to the research on environmentally friendly manufacturing.

Re-manufacturing / rebuild activities: Remanufacturing is "the rebuilding of a product to specifications of the original manufactured product using a combination of reused, repaired and new parts".

Reusable / Recyclable (eco-friendly) Products: Recycling means that wastes that can be reused can be recycled into the production process through various processes. The need for recycling emerged with resource shortages due to wars. The purpose of recycling is to prevent the depletion of resources and to reduce the amount of waste litter. Materials such as glass, paper, aluminum, plastic, batteries, motor oil can be recycled and reused, which plays an important role in the national economy. It also avoids problems such as the storage and transportation of solid wastes in countries.

Environmental trainee programs to foster employee awareness: The quantity control and treatment of trainee that the company implemented to their employees (unit of measurement: number/year).

Exchange of environmental information: Does the company share its negative or positive experiences or findings after audit or control processes with its customers?

Operation cost of environment issues: Spend for environmental operations (unit of measurement: capita/year).

Environmental investment per year: New investments for environmental issues (unit of measurement: capita/year).

Funds contributed to environmental organizations: Investments each year to the funds for environmental activities (unit of measurement: capita/year).

Commitment to periodical environmental auditing: Give commitments to the customers for yearly base environmental audits and the level of perform.

Continuous environmental improvement: Sustainable development is the approach to ensure the rational management of natural resources in a manner that allows for continuous economic development by preserving human health and natural balance and leaving a natural, physical and social environment worthy of future generations.

Reduction of pollution and waste: Monitoring the difference between the previous environmental analysis and reports and the current reports to see if there is any reduction on pollution and wastes.

Long term plans for environmental sustainability: Focusing on structural, inclusive and strategic solutions is more meaningful in the medium and long term, rather than the most visible and short-term solutions.

List of Environmental Performance Indicators

Resources: While economic development aims to increase the welfare and happiness of people, global warming and global climate change threatens this foresight with socio-economic costs. It is possible to achieve economic efficiency by maximizing the net benefit resulting from the use of global resources through sustainable development policies. The purpose of establishment of companies is to provide service or production to the sector in which they locate. In order to ensure the continuity of this, in all circumstances, there must be inputs to ensure the continuity of the company in line with its purpose. In environmental perspective the aim of the companies are reducing waste while increasing the resources efficiency.

Green Supply Chain Initiatives: Green supply chain is a kind of supply chain management in which environmentally friendly product or service production strategies are combined. Not only does it reduce environmental negative impacts of companies, but it also increases efficiency and gives them a major competitive advantage in innovation and processes. Thus, improvements are seen in many factors, from efficient asset utilization to profitability. To realize that, organizations should fulfill the social and environmental responsibilities. Government also makes it imperative to avoid facilities damages to the environment. Three different approaches have been put forward on the basis of companies. They are reactive, proactive and value-creating. In the reactive approach, environmentally friendly green practices are minimal. In the proactive approach, it is not only the solution of

environmental problems, but also the prevention of these problems. In the value-creating approach, there are green activities that are defined as business strategy. Companies that implement this approach publish environmental decisions and share these decisions with their supply chain partners. (Sambrani and Pol, Journal of SC, 2016) According to study of Masoumi et al., the integrated framework for designing a Strategic Green Supply Chain, a relationship model should be developed specifying the factors that affect the supply chain manager's decision to adopt a suitable green strategy. Furthermore, this causal relationship model explains the linkage between these green strategies with the green initiatives associated with the operational areas of it. The output of this causal relationship model in terms of the factors and their relationship assist the decision makers to develop the decision making tool for prioritizing the green strategies and initiatives. (Masoumi et al., 2008)

Management Decisions & Competencies: Today's new responsibilities include organizing trainings for management staff, managing events, supporting more managers or a wider team, and even making important decisions on behalf of the business. The simplest definition of management decisions helps managers to be more productive and successful. They should learn how the company works, know the preferences of the boss, and be able to anticipate the needs that will lead to a sound relationship.

Environmental Performance: The Environmental Performance Index provides a global view of countries' environmental performance and provides information to decision-makers. It makes great contributions to the achievement of the United Nations' sustainable development goals and the achievement of the objectives of the international climate change treaties.

Suppliers Management System: As it can be understood from the name of the Supply Management System, it has been put forward as a solution that can be followed up and managed during the process of obtaining the needs, from making the first demand of the needs within the organization, evaluating the demands by the management, market research, procurement and inspection acceptance procedures.

Government Regulation & Certification: This dimension includes the eligibility of suppliers to the appropriate regulatory requirements and to be certified by third

parties about environmental systems and activities in consideration of the regulations and the global requirements.

Waste Management: Waste management is a form of management that includes the reduction of waste at source, separation according to its characteristics, collection, temporary storage, intermediate storage, recovery, transportation, disposal and control after disposal processes and the like. The Waste Management Pyramid is evaluated from upper to lower levels. In other words, the first step is to prevent the formation of waste, if this is not achieved, minimizing the waste, in other words minimizing the waste. Reuse of waste is then aimed at recycling and then energy recovery if this is not possible. After these methods, the last process to be made to the waste that we have left or to which we cannot apply these methods is disposed of.

Packaging & Logistics: Packaging and logistics refer to the packing and transportation of goods throughout the world. This dimension includes all activities after manufacturing.

3.9.2. Focus Group Interview Findings

3.9.2.1. Framework for Environmental Performance Attributes

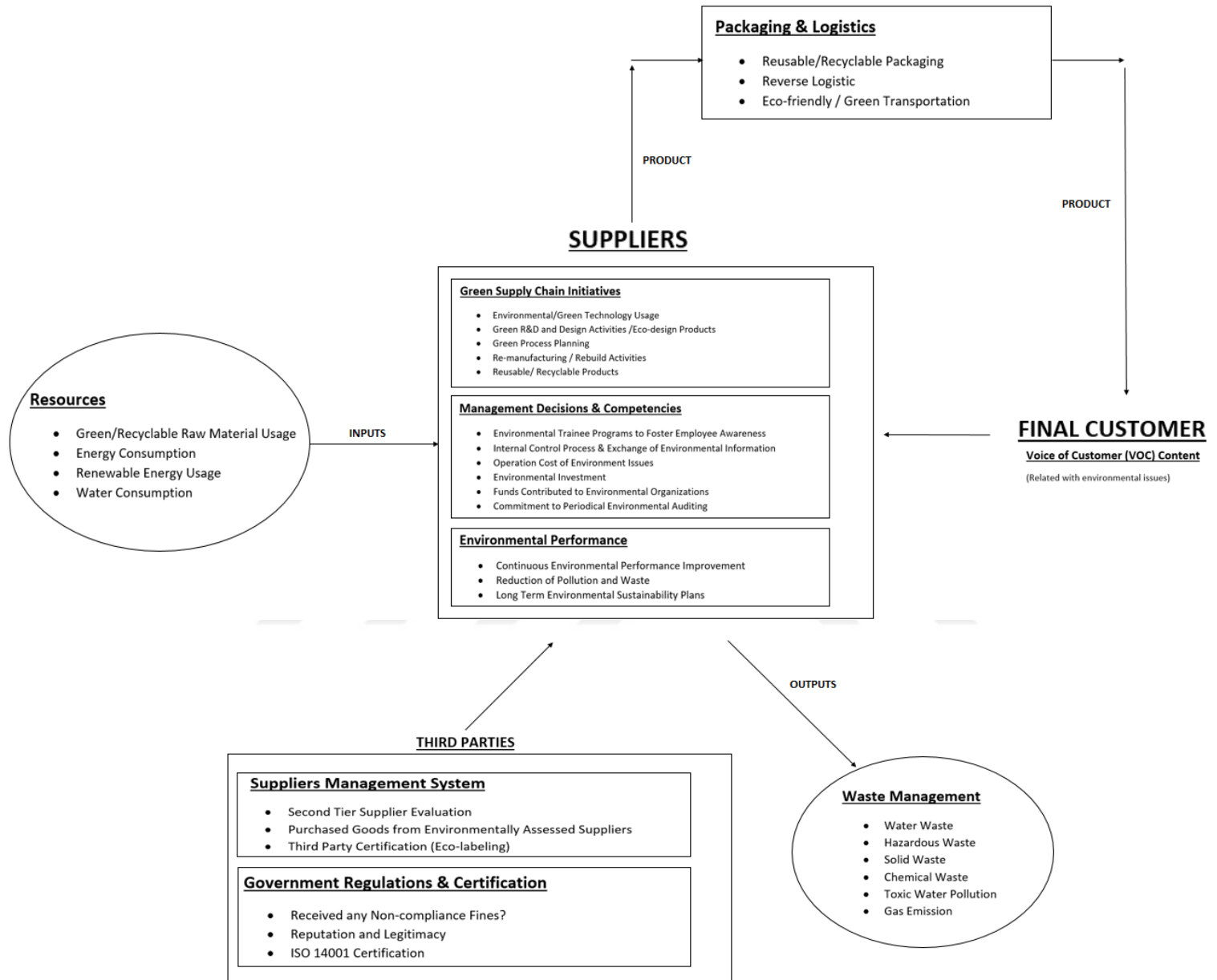
In order to develop a framework from the selected different types of environmental criteria shown in Table 1, brainstorming was done by the same participants with the support of literature. While developing the framework in this study, the objective or goal of the organization is to design applicable and efficient model while selecting and evaluating the suppliers. In order to achieve this goal, different decision components and elements should be considered but the most important point is to find a model which should reflect the real organization data and adopt the current ongoing system. The managers emphasized that if effective model is not available, at the end, the results not show the correct and reliable data. Another criteria to identify the framework is to represent the fact and capture the buying company's environmental strategic priorities. For instance, if the main company emphasizes the importance of recyclable packaging, the purchasing policies should reflect this and correspondingly the study and the model should reflect this.

As a result, by integrating the criteria and the sub-criteria, the framework developed to reflect the relationship of each major environmental attributes in the supplier's internal processes and management systems. The main property of the model is to be a general model that can be used for any type of supplier and industry.

From the Figure 16, each criteria and sub-criteria was identified under one of the each processes of the companies. For instance, to explain, resources are the inputs of the company's shows in the following flow. The criteria 'Supplier Management System' is evaluated under the 'Third Parties' which is related with independent companies who have direct effect on the evaluated companies. Also, Regulations and Certification criteria is the external factors have direct impact to the companies. 'Waste Management' is the outputs of the companies and also 'packaging and logistics' can be considered as the management of the finished goods in the overall flow. There is one more important category which is directly related with the suppliers' own internal processes such as management, planning and manufacturing. All other indicators which are 'Green Supply Chain Initiatives', 'Management Decisions & Competencies', 'Environmental Performance' are evaluated as a supplier internal processes.

In the framework, there is also 'Voice of Customer' content which is related with the customer of the evaluated supplier, but not considered as an indicator in this research. The reason is because it is the initiative that all companies should respect and it is not related with the suppliers' direct decisions or variables about environment.

Figure 16: The Framework for Environmental Performance Indicators used in AHP Model



3.9.3. AHP Analysis Findings

Today, companies under international competition conditions, quality, cheap and desired amount of products in order to obtain the necessary amount of information and environmental impact to occur in a large amount of information to

edit, dynamic and changing global market demands in order to respond to different types of decision-making mechanisms they need. Therefore, in order to maintain the existence of an enterprise, today's technological developments and intense competition conditions have made it necessary for business managers to make effective and correct decisions against very complex problems. The results obtained after executing the decision taken by the managers show the success of the managers in decision making, the opportunities obtained by the enterprise and whether the new economic values are created. Therefore, the effectiveness of decisions can be measured by reaching the desired results (Yaralıoğlu, 2001).

Today, many businesses take their daily decisions in a short time based on their knowledge and experience. However, instead of making an intuitive decision against a complex and long-term decision problem, it is necessary to allocate time for the process of data collection and analysis and to conduct a detailed research, and to use the most appropriate decision method for the solution process (Yaralıoğlu, 2001).

The Analytic Hierarchy Process was first introduced by Myers and Alpert in 1968, and was developed by Professor Thomas Lorie Saaty in 1977 as a model and made available to solve decision-making problems. In the early 1970s, Saaty worked on complex problems such as the planning of unexpected problems in the US Department of Defense, the analysis of the distribution of stocks in the electricity industry to contribute to the welfare of the society, the Middle East Problem, the development of a transportation system for Sudan. Many theoretical contributions to operations research and mathematics, Saaty has developed the AHP method, which is one of the modern decision support methods, which has become increasingly important in every field and has become widespread in every field (Saaty, 1994).

In decision-making, the inclusion of judges' judgments in the solution process has increased remarkably in recent years. In simple terms and in general terms, AHP and judgments are regulated from more general and less controllable, more specific and more controllable. AHP is a method that allows people to make better decisions by enabling them to recognize their own decision-making mechanisms instead of making a method of deciding how to make decisions (Saaty and Vargas, 1987).

AHP is an approach in which information, experience, individual's thoughts and hunches are logically combined. In addition, the main problem encountered in

multi-criteria decision-making problems is to determine weight, importance or superiority in order to make a selection by considering multiple criteria among various alternatives. In AHP, both subjective and objective considerations of decision makers in decision-making can be included. Therefore, AHP is a mathematical method that evaluates both qualitative and quantitative variables that take into account the priorities of the group and the individual in decision making. This makes AHP more powerful than other decision making methods (Chin and Tummala, 1999).

The Analytic Hierarchy Method is used to evaluate the factors that are independent of each other in a hierarchical structure. By using a predefined comparison scale, it converts the differences in significance of the decision points in the hierarchy to the percentage distributions. Thus, by using a systematic approach, numerical performance measurements are combined with subjective evaluations and results are obtained. As a result, it determines the AHP criteria priorities and evaluates the alternatives based on these criterion priorities and ensures that healthy decisions are taken to realize the goals or objectives. In doing so, the knowledge and experience of decision makers / experts is effectively utilized (Min, 1994).

There is no need to make too many assumptions, as historical data, advanced mathematics knowledge, and concrete and abstract criteria can be used together to establish and implement the model in AHP. Most importantly, the people who will take the decision and apply it will be able to understand, interpret and adopt the results because they are in the decision process and can reflect their evaluations to the model. This increases the likelihood of applying the results compared to other models.

The Analytic Hierarchy Process (AHP) is a quantitative method for ordering and selecting alternatives to multiple criteria according to the definition in Operations Management book by Russell and Taylor (Tektaş and Hortaçsu, 2003).

In other words, the Analytic Hierarchy Process is the process to rank and to give priority to meets the criteria. The Analytic Hierarchy Process selects the best alternative that captures all criteria of the decision maker and answer the questions like “Which one will we choose?” or “Which is the best?”.

Analytic Hierarchy Process use (Dağdeviren and Eren, 2001):

- Criterion: Anything that seems important (price, quality, distance...) to the decision maker.
- Standard Preference Table: It contains values that are important for determining the importance of each criterion to the decision maker.

In this research, with the framework structured, the process of determining the relative importance of each criterion begins. Regarding the identification of the priority levels, 3 experts are asked to fill the questionnaire, which is composed of two parts: rating of sub-indicators and rating of the indicators. The detailed questionnaire is in APPENDIX 2. The results of the two parts of the questionnaires are used to calculate the mean score of each criteria.

As a result of AHP questionnaire, full filled by the participants, the geometric mean is calculated, which indicates the central tendency of the participants results. Then these geometric mean is used to calculate the importance of the indicators.

First of all the primary indicators are observed, and the importance level are obtained which are shown in the Table 1. It is seen that the most important dimension is found to be ‘Government Regulations & Certification’, with 26.3% importance level. Then second important indicator is found to be ‘Waste Management’ and variety with 17.8% importance level, followed by ‘Green Supply Chain Initiatives’ with the 16.8% level, respectively.

Table 1: Environmental Performance Indicators Priority Table

	Government Regulations & Certification	Waste Management	Green Supply Chain Initiatives	Management Decision & Competencies	Resources	Supplier Management System	Environmental Performance	Packaging & Logistics
Row Averages	0.263	0.178	0.168	0.131	0.084	0.081	0.048	0.047
% Level	26.3%	17.8%	16.8%	13.1%	8.4%	8.1%	4.8%	4.7%
Priority Level	1	2	3	4	5	6	7	8

These results show that the ‘Government Regulations & Certification’ have higher priority for the company while selecting and developing their suppliers. The other indicators like ‘Management Decisions & Competencies’ with 13.1%, Resources with 8.4%, ‘Supplier Management System’ with 8.1%, ‘Environmental Performance’ with 4.8% and ‘Packaging & Logistics’ with 4.7% are ranked lower.

A similar procedure is carried out to calculate the priorities of the sub-indicators. The results are shown in Table 2. According to the final scores, for example, under ‘Waste Management’ the most important sub-indicator is ‘Chemical waste’ with a local priority of 29.8%, followed by ‘Toxic Water Pollution’ and ‘Solid Waste’ , with local priorities of 23.2% and 17.3%, respectively.

When the local importance ratios of needs are multiplied by the importance level of related sub-categories to obtain the global importance ratios of each sub-indicators. A comparison of all 33 sub-indicators show that the most important sub-indicator is ‘Non-compliance fines’, with a global importance priority of 12.01%. The second to fifth sub-indicators are ‘ISO 14001 Certification’ (10.64%), ‘Green R&D and design activities / eco-design products’ (6.63%), ‘Chemical Waste’ (5.3%), ‘Purchased goods from environmentally assessed suppliers’ (5.12%), respectively. On the other hand, ‘Long Term Environmental Sustainability Plans’, ‘Reverse Logistics’ and ‘Second Tier Supplier Evaluation’ are rated as the least important factors of supplier evaluation according to the researcher company requirements. The results are shown in Table 2.

Table 2: Local and Global Importance Levels of Sub-Indicators

Primary Indicators	Sub-Indicators	Row Averages	Row Averages (%)	Importance of Primary Indicators*Row Averaged	Importance of Primary Indicators*Row Averaged (%)	Local Importance Level	Global Importance Level
WASTE MANAGEMENT	Water Waste	0.064	6.4%	0.0113	1.13%	6	29
	Hazardous Waste	0.167	16.7%	0.0298	2.98%	4	10
	Solid Waste	0.173	17.3%	0.0308	3.08%	3	9
	Chemical Waste	0.298	29.8%	0.0530	5.30%	1	4
	Toxic Water Pollution	0.232	23.2%	0.0413	4.13%	2	7
	Gas Emission	0.067	6.7%	0.0119	1.19%	5	27
MANAGEMENT DECISIONS & COMPETENCIES	Environmental trainee programs to foster employee awareness	0.113	11.3%	0.0148	1.48%	4	24
	Exchange of environmental information	0.222	22.2%	0.0290	2.90%	2	12
	Operation cost of environment issues	0.086	8.6%	0.0112	1.12%	6	30
	Environmental investment per year	0.337	33.7%	0.0441	4.41%	1	6
	Funds contributed to environmental organizations	0.091	9.1%	0.0119	1.19%	5	28
	Commitment to periodical environmental auditing	0.152	15.2%	0.0198	1.98%	3	21
GREEN SUPPLY CHAIN INITIATIVES	Green Technology Usage	0.162	16.2%	0.0272	2.72%	3	15
	Green R&D and design activities / eco-design products	0.395	39.5%	0.0663	6.63%	1	3
	Green Process Planning	0.107	10.7%	0.0180	1.80%	5	23
	Re-manufacturing / Rebuild activities	0.177	17.7%	0.0297	2.97%	2	11
	Reusable / Recyclable Products	0.160	16.0%	0.0269	2.69%	4	16
RESOURCES	Green / Recyclable RM Usage	0.224	22.4%	0.0188	1.88%	3	22
	Energy Consumption	0.172	17.2%	0.0145	1.45%	4	25
	Renewable Energy Usage	0.325	32.5%	0.0273	2.73%	1	14
	Water Consumption	0.280	28.0%	0.0235	2.35%	2	17
GOVERNMENT REGULATIONS & CERTIFICATION	Received any non-compliance fines?	0.458	45.8%	0.1201	12.01%	1	1
	Reputation and Legitimacy	0.137	13.7%	0.0360	3.60%	3	8
	ISO 14001 Certification	0.405	40.5%	0.1064	10.64%	2	2
PACKAGING & LOGISTIC	Reusable Packaging	0.434	43.4%	0.0206	2.06%	1	18
	Reverse Logistic	0.132	13.2%	0.0062	0.62%	3	32
	Eco-friendly / Green Transportation	0.434	43.4%	0.0206	2.06%	2	19
SUPPLIER MANAGEMENT SYSTEM	Second Tier Supplier evaluation	0.119	11.9%	0.0097	0.97%	3	31
	Purchased goods from environmentally assessed suppliers	0.629	62.9%	0.0512	5.12%	1	5
	Third party certification (eco labeling)	0.252	25.2%	0.0205	2.05%	2	20
ENVIRONMENTAL PERFORMANCE	Continuous Environmental Performance Improvement	0.267	26.7%	0.0127	1.27%	2	26
	Reduction of Pollution and Waste	0.607	60.7%	0.0289	2.89%	1	13
	Long Term Environmental Sustainability Plans	0.126	12.6%	0.0060	0.60%	3	33

To ensure that the comparison matrices are acceptable, the consistency test is performed by calculating the consistency index (CI) and consistency ratio (CR). Since CR is less than 0.1, the expert's judgment is consistent for all level of indicators. If the consistency test is not passed, the expert will be asked to re-do the part of questionnaire. All the evaluation results of analysis are shown in Table 3.

Table 3: Consistency Ratio According to Indicators

INDICATORS/SUB-INDICATORS	CONSISTENCY RATIO
Waste Management	0.0199
Management Decisions & Competencies	0.0356
Green Supply Chain Initiatives	0.0998
Resources	0.0256
Government Regulations & Certification	0.0103
Packaging & Logistic	0.0000
Supplier Management System	0.0986
Environmental Performance	0.0984
Environmental Performance Prior Indicators	0.0042

CONCLUSION

In 21st century, people are much more aware about the importance of the environment than the previous centuries. There are several reasons behind but at the end, in business perspective, procurement functions have big responsibility such as buying the service or products with the low cost, higher quality level but also having some responsibilities about environment. So, the overall need and requirement nowadays, is to find a best solution to monitor the supplier's effects on environment. Only by applying best protocol and methods, companies can prevent the harmful effects on environment caused by the supplied companies. That is also disincentive way for the companies, to combine the most important criteria (supplier selection & evaluation) into the supply chain, with an environmental aspects.

A case study on a white good manufacturing company is conducted and data is collected via in-depth interviews, focus groups interviews, document reviews and AHP Analysis.

The study began by exploring the literature and deeply reviewing to the Whirlpool company database. In the company interview and document review, the main point was the company approach, vision and mission. The company also producer of plastic injection components, so that features provides the researcher a strong background and using information from the company's infrastructure has shed light on how to make supplier selection. On the other hand, the participants to the interview are the experts on their fields and different departments show different importance to the aim of the projects. Also, the different perspectives brings a useful brainstorming activity during the interviews. In this study, purchasing function and environmental perspective are merged and during the interviews, the experts included from all related functions.

During the data analysis phase, it is seen that all received data are mesh together at the end of literature review, interviews and document reviews. The framework support the managers to identify the general view of the life cycle of final products and the points that should be focused on.

The framework proposed in this research can guide the industry managers to develop their own supplier evaluation methods. The most advantage of all the

research is that can be implemented in different fields, such as automotive industry, aerospace industry so on. The only restriction is because the implementation field is plastic injection, the priorities may change according to different commodities and fields.

The next stream of study deals with the calculations of AHP. AHP survey was done by the experts and that method is provided to the managers to identify and rank the importance levels of the environmental factors.

As a result, the most important indicator about the environment was found as ‘Government Regulations & Certification’. This means although suppliers have their own auditing and tracking systems about environmental aspects, the most important criteria is still regulations. If company does not proper to implement and oblige the rules of the government and have received some fines (the first prior important sub-indicator), this shows that the company have poor environmental vision from the beginning. Second important indicator is waste management, which is directly related with many internal processes and management systems.

Overall, this study examines the environmental indicators and the case study implemented in White Goods industry to determine the most important environmental criterion while selecting and evaluating the suppliers. The main contribution of this research is providing data that allow companies to evaluate their supplier performance in terms of their adoption of environmental practices. This study can be implemented to the different companies in different fields and also can guide to the further studies.

Few suggestions for the further studies;

- By using the framework and AHP model, for a single supplier, the monthly or yearly results can be monitored and the progression can be tracked to evaluate the environmental performance.
- On the other side, 2 or more suppliers can be compared according to the environmental indicators priority levels and the selection can be done accordingly.
- In this study, only environmental factors were taken into consideration during purchasing decisions. However, it is known that ‘traditional methods’ are prioritized especially when making supplier selections, such as, quality and cost. For

the further studies, an assessment can be made by considering these traditional methods in addition to environmental factors and a priority list can be created accordingly. This provides a broader perspective on supplier selection and evaluation.

- This study is based on Turkish suppliers and plastic injection production, but there are also opportunities to extend the scope to the other industries.
- As a next step, a detailed supplier database can be created to store the supplier environmental performance information that could be used by all purchasing managers and engineers in all divisions of the company. In many companies there are such evaluation systems based on the quality levels, which can be adapted to the environmental base. Or for example, the further studies can be done about the topic of combination of quality levels of suppliers with the environmental competences.
- The AHP system could also be used to identify the poor environmental performers within the supplier base and help the purchasing functions to change the supplier development strategies.

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APPENDICIES

Appendix 1: In-depth Interview Questions

Name and Surname: Hande Oğuz

Section: Business Management - English

Class: Thesis

Interview Purpose: Environmental Performance Evaluation of Suppliers: A Case Study on White Goods Industry

Interview Topics

1. What is the company Whirlpool environmental mission ?
2. Does Whirlpool have an environmental management system based on international standards ?
3. What is the general sense about environmental factors while selecting and evaluating suppliers ?
4. What is the Whirlpool's most important environmental management event ?
5. What is the most important factor required for suppliers environmental management system ?
6. What are the supplier selection criteria of Whirlpool ?
7. Does Whirlpool pursue the suppliers' environmental indicators or asking environmental data from their suppliers ?
8. Does Whirlpool have any supplier performance evaluation system ?
9. What is the most important environmental indicators for the suppliers having regard to the limitations of demographics, industrial area and production area ?

Appendix 2: AHP Questionnaire

THE SUBJECT OF THE QUESTIONNAIRE

The aim of this study is to introducing the environmental dimensions into purchasing decisions. In the first step of this study, the environmental performance indicators were determined by using the literature and in-depth interviews with two managers and one senior buyer who are experts in their positions of purchasing and environment. At this stage, the priority of environmental attributes will be calculated through this form, and the relative importance levels of each criterion for supplier evaluation and selection activities. This questionnaire is the bilateral comparison of the indicators. Before filling this form, please see the examples below to understand how to do the comparison. Thank you for your contribution to our study.

Hande OGUZ
DEU FACULTY OF BUSINESS
Master of Business Administration Student

EXAMPLE

INTRODUCTION (Please read this section before you start to make your assessments from Part 1)

For example; suppose we have two environmental indicator which are "Green technology Usage" and "Green Process Planning". I would like to ask you, which criterion is more important than the other. According to you, if Green Technology usage is **strongly important** than the Green Process, than your assessment should be marked with "**X**" as follow:

LEVEL 1										
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Green Technology Usage			X							Green Process Planning

According to you, if the view of the Green Process is **slightly important** than Green Technology, than your assessment should be marked with "**X**" as follow:

LEVEL 1										
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slighly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Green Technology Usage						X				Green Process Planning

In short, the comparison between the A and B criteria, for example if A is more significant than B, the appropriate option should be marked which is close to A (left). If B is significant, from the scale the appropriate option should be marked which is close to B (right). If A and B are equally important criteria, than the middle "Equally important" option should be marked.

PART 1: COMPARISON OF ENVIRONMENTAL SUB-INDICATORS

LEVEL 1	RESOURCES (In terms of RESOURCES, how the following expressions are important relative to each other?)								
	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important
CRITERIA A									CRITERIA B
Green / Recyclable RM Usage									Energy Consumption
Green / Recyclable RM Usage									Renewable Energy Usage
Green / Recyclable RM Usage									Water Consumption
Energy Consumption									Renewable Energy Usage
Energy Consumption									Water Consumption
Renewable Energy Usage									Water Consumption

LEVEL 1	GREEN SUPPLY CHAIN INITIATIVES (In terms of GREEN SUPPLY CHAIN INITIATIVES, how the following expressions are important relative to each other?)								
	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important
CRITERIA A									CRITERIA B
Green Technology Usage									Green R&D and design activities / eco-design products
Green Technology Usage									Green Process Planning
Green Technology Usage									Re-manufacturing / Rebuild activities
Green Technology Usage									Reusable / Recyclable Products
Green R&D and design activities / eco-design products									Green Process Planning
Green R&D and design activities / eco-design products									Re-manufacturing / Rebuild activities
Green R&D and design activities / eco-design products									Reusable / Recyclable Products
Green Process Planning									Re-manufacturing / Rebuild activities
Green Process Planning									Reusable / Recyclable Products
Re-manufacturing / Rebuild activities									Reusable / Recyclable Products

LEVEL 1	ENVIRONMENTAL PERFORMANCE (In terms of ENVIRONMENTAL PERFORMANCE how the following expressions are important relative to each other?)										
	CRITERIA A	Absolutly important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutly important	CRITERIA B
	Continuous Environmental Performance Improvement										Reduction of Pollution and Waste
	Continuous Environmental Performance Improvement										Long Term Environmental Sustainability Plans
	Reduction of Pollution and Waste										Long Term Environmental Sustainability Plans

LEVEL 1	MANAGEMENT DECISIONS & COMPETENCIES (In terms of MANAGEMENT DECISIONS & COMPETENCIES, how the following expressions are important relative to each other?)									
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Environmental trainee programs to foster employee awareness										Exchange of environmental information
Environmental trainee programs to foster employee awareness										Operation cost of environment issues
Environmental trainee programs to foster employee awareness										Environmental investment per year
Environmental trainee programs to foster employee awareness										Funds contributed to environmental organizations
Environmental trainee programs to foster employee awareness										Commitment to periodical environmental auditing
Exchange of environmental information										Operation cost of environment issues
Exchange of environmental information										Environmental investment per year
Exchange of environmental information										Funds contributed to environmental organizations
Exchange of environmental information										Commitment to periodical environmental auditing
Operation cost of environment issues										Environmental investment per year
Operation cost of environment										Funds contributed to

issues										environmental organizations
Operation cost of environment issues										Commitment to periodical environmental auditing
Environmental investment per year										Funds contributed to environmental organizations
Environmental investment per year										Commitment to periodical environmental auditing
Funds contributed to environmental organizations										Commitment to periodical environmental auditing

LEVEL 1		SUPPLIER MANAGEMENT SYSTEM (In terms of SUPPLIER MANAGEMENT SYSTEM, how the following expressions are important relative to each other?)								
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Second Tier Supplier evaluation										Purchased goods from environmentally assessed suppliers
Second Tier Supplier evaluation										Third party certification (eco labeling)
Purchased goods from environmentally assessed suppliers										Third party certification (eco labeling)

LEVEL 1	GOVERNMENT REGULATIONS & CERTIFICATION (In terms of GOVERNMENT REGULATIONS & CERTIFICATION, how the following expressions are important relative to each other?)									
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Received any non-compliance fines?										Reputation and Legitimacy
Received any non-compliance fines?										Having ISO 14001 Certification
Reputation and Legitimacy										Having ISO 14001 Certification

LEVEL 1		PACKAGING & LOGISTICS (In terms of PACKAGING & LOGISTICS, how the following expressions are important relative to each other?)								
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Reusable Packaging										Reverse Logistic
Reusable Packaging										Eco-friendly / Green Transportation
Reverse Logistic										Eco-friendly / Green Transportation

LEVEL 1		WASTE MANAGEMENT (In terms of WASTE MANAGEMENT, how the following expressions are important relative to each other?)								
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B
Water Waste										Hazardous Waste
Water Waste										Solid Waste
Water Waste										Chemical Waste
Water Waste										Toxic Water Pollution
Water Waste										Gas Emission
Hazardous Waste										Solid Waste
Hazardous Waste										Chemical Waste
Hazardous Waste										Toxic Water Pollution
Hazardous Waste										Gas Emission
Solid Waste										Chemical Waste
Solid Waste										Toxic Water Pollution
Solid Waste										Gas Emission
Chemical Waste										Toxic Water Pollution
Chemical Waste										Gas Emission
Toxic Water Pollution										Gas Emission

PART 2: COMPARISON OF ENVIRONMENTAL INDICATORS

LEVEL 2		ENVIRONMENTAL PERFORMANCE INDICATORS (In terms of ENVIRONMENTAL PERFORMANCE INDICATORS, how the following expressions are important relative to each other?)									
CRITERIA A	Absolutely important	Very strongly important	Strongly important	Slightly important	Equally important	Slightly important	Strongly important	Very strongly important	Absolutely important	CRITERIA B	
Resources										Packaging & Logistics	
Resources										Green Supply Chain Initiatives	
Resources										Management Decision & Competencies	
Resources										Environmental Performance	
Resources										Waste Management	
Resources										Supplier Management System	
Resources										Government Regulations & Certification	
Packaging & Logistics										Green Supply Chain Initiatives	
Packaging & Logistics										Management Decision & Competencies	
Packaging & Logistics										Environmental Performance	
Packaging & Logistics										Waste Management	
Packaging & Logistics										Suppliers Management System	
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