

THE SITUATION OF ECODESIGN IN TURKISH INDUSTRY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

ECE GÜRAKAR

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
INDUSTRIAL DESIGN

SEPTEMBER 2008

Approval of the thesis:

THE SITUATION OF ECODESIGN IN TURKISH INDUSTRY

submitted by **ECE GÜRAKAR** in partial fulfillment of the requirements for the degree of **Master of Science in Industrial Design Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Assist. Prof. Dr. Bahar Şener-Pedgley _____
Head of Department, **Industrial Design**

Assist. Prof. Dr. Bahar Şener-Pedgley _____
Supervisor, Dept. of **Industrial Design, METU**

Examining Committee Members:

Assoc. Prof. Dr. Gülay Hasdoğan _____
Dept. of Industrial Design, METU

Assist. Prof. Dr. Bahar Şener-Pedgley _____
Dept. of Industrial Design, METU

Assist. Prof. Dr. Naz Börekçi _____
Dept. of Industrial Design, METU

Inst. Dr. Canan E. Ünlü _____
Dept. of Industrial Design, METU

İlknur Baylakoğlu _____
Chief Researcher, TÜBİTAK-UZAY

Date: September 5th, 2008

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Ece Gürakar

Signature :

ABSTRACT

THE SITUATION OF ECODESIGN IN TURKISH INDUSTRY

Gürakar, Ece

M.Sc., Department of Industrial Design
Supervisor: Assist. Prof. Dr. Bahar Şener-Pedgley

September 2008, 121 pages

Ecodesign is an approach for product development, which focuses on minimizing the environmental impacts of the product during the whole life cycle while maintaining the major concerns such as function, usability, aesthetic and ergonomic qualities. This approach is regarded as a fundamental step to achieve sustainable production, consumption and development.

The thesis examines the current situation of ecodesign in Turkish Industry, in relation to design and manufacturing. First, it introduces the literature on ecodesign in general, and more specifically, it presents a comparative analysis of six international studies with an aim to explore internal and external stimuli for promoting ecodesign, as well as reflections on barriers that were encountered. Then, literature review on ecodesign activities in Turkish industry is discussed. To complement these findings, the results of the interviews conducted with three stakeholder groups (i.e. government, universities and industry) are presented. Finally, the results of a study that was conducted in Turkish packaging, and electric & electronics sectors to understand approaches of environmentally-conscious product development, the drivers and the barriers of ecodesign implementation into these sectors are revealed.

The level of ecodesign implementation is found to be strongly related with the economic situation of Turkish context, which is the most important determining factor for the drivers and barriers found in the study. Acquiring a more stable economic situation, ecodesign will become a considerable competitive advantage through: (i) reduction of manufacturing costs in the long term, (ii) innovational approach in the manufacturing process and product development, and (iii) increasing brand awareness.

Keywords: Turkish industry, ecodesign, product development, developing economies.

ÖZ

ÇEVREYE DUYARLI TASARIMIN TÜRKİYE ENDÜSTRİSİNDEKİ DURUMU

Gürakar, Ece

Yüksek Lisans, Endüstri Ürünleri Tasarımı
Tez Yöneticisi: Y. Doç. Dr. Bahar Şener-Pedgley

Eylül 2008, 121 sayfa

Çevreye duyarlı tasarım, bir ürünün, fonksiyonel, kullanışlı, estetik ve ergonomik olma gibi temel özelliklerini sağlarken, tüm yaşam döngüsü içerisindeki çevresel etkilerini azaltmayı hedefleyen bir ürün geliştirme yaklaşımıdır. Bu yaklaşım, sürdürülebilir üretim, tüketim ve kalkınma için önemli bir basamak olarak kabul edilmektedir.

Bu tez, tasarım ve üretim ile bağlantılı olarak Türkiye endüstrisinde, çevreye duyarlı tasarımın yerini gözden geçirmektedir. Çalışma, öncelikle çevreye duyarlı tasarım ile ilgili genel literatürü ortaya koymakta ve uluslararası altı çalışmayı karşılaştırmalı olarak analiz ederek içeriden/dışarıdan çevreye duyarlı tasarımı destekleyen ve engelleyen unsurları araştırmaktadır. Ardından Türkiye’de yer alan çevreye duyarlı tasarım uygulamaları tartışmaktadır. Bulguları desteklemek için ise üç paydaş grubu (devlet, üniversite ve endüstri) ile röportajlar yapılmıştır. Çalışmanın sonunda, Türkiye’de çevreye duyarlı ürün geliştirme sürecinde, ambalaj ve elektrik & elektronik sektörlerinde destekleyici ve engelleyici unsurların rolünü araştırmak amacıyla bir çalışma gerçekleştirilmiştir.

Sonuç olarak çevreye duyarlı tasarımda uygulamalarının geldiği seviye, açısından destekleyici ve engelleyici faktörler arasından en önemlisinin, Türkiye’nin içinde bulunduğu ekonomik durum ile yakından ilişkili olduğu

bulunmuştur. Daha dengeli bir ekonomik pozisyon sağlandığı takdirde: (i) uzun vadede üretimde maliyet azaltımı (ii) üretim sürecinde yenilikçi bir yaklaşım (iii) ürün geliştirimi ve (iv) marka farkındalığını arttırmak mümkün olabilecektir.

Anahtar Kelimeler: Türkiye endüstrisi, çevreye duyarlı tasarım, ürün geliştirme, gelişen ekonomiler.

To my brother...

ACKNOWLEDGEMENTS

This thesis is the result of three years of work during which I have been accompanied and supported by many people. It is now my great pleasure to take this opportunity to thank them.

First of all, I would like to express my deepest gratitude to my supervisor Assist. Prof. Dr. Bahar Şener-Pedgley. I appreciate her useful comments on this work, but even more so, I appreciate his advices, comments, and willingness to discuss everything inside and outside of this thesis. I could not have wished for a better supervisor.

I am deeply indebted to Assist. Prof. J.C. Diehl and Duygu Keskin for embarking with me on this thesis journey, especially for my studies in Delft University of Technology.

I sincerely thank to Assoc. Prof. Dr. Gülay Hasdoğan, Assist. Prof. Dr. Naz Börekçi, Inst. Dr. Canan E. Ünlü and İlknur Baylakoğlu for serving on my thesis committee. Their constructive feedback and comments at various stages have been significantly useful in shaping the thesis up to completion.

I am also very thankful to Senem Tural, Aybike Tamer, Nazlı Cila for their direct contribution to my study as invaluable advices and background efforts.

I would like to extend my thanks to my dear friends, Okan Şenyurt, Cem Altıbaş, Volkan Emre, Selin Arslanoğulları, Diana Meschter, Şahap Aşçı, Onur Güven Apul, Evren Eser, Mehmet Turhan, Önder İlgen, Armağan Karahanoğlu, Ahmet Tamay, Evren Alibaba, Kezban Akyol, Alev Oksay, Mehmet Yıldırım, Sözüm Doğan, Diler Şimşek, Seda Özçetin as well as my teammates in VAKSİS and IKEA.

I am particularly grateful to the members of Ersanlı, Alkaya, Mengi and Oral families for their encouragement.

I was really lucky since my beloved Emrah Alkaya was always with me during my study. His emotional support and patience even at my most desperate and hard times kept me going. It would be impossible to finish this work without his existence...

Finally, my deepest thank is dedicated to my family for their endless support and tireless encouragement as well as remarkable patience. This thesis would not have been possible without the help of my lovely mom, grandma, brother and his wife.

TABLE OF CONTENTS

ABSTRACT.....	iv
ÖZ.....	vi
ACKNOWLEDGEMENTS.....	ix
TABLE OF CONTENTS.....	xi
LIST OF TABLES.....	xiv
LIST OF FIGURES.....	xvi

CHAPTERS

1. INTRODUCTION.....	1
1.1. Problem Definition.....	1
1.2. The Aim and Objectives.....	2
1.3. Structure of Thesis.....	3
2. ECODESIGN.....	5
2.1. A Historical Overview of Environmentally-Conscious Design.....	5
2.2. The Concept of Ecodesign.....	7
2.2.1. Life cycle Thinking.....	9
2.2.2. Ecodesign Innovation Levels.....	12
2.2.3. Ecodesign Strategies.....	14
2.2.4. Tools for Ecodesign.....	15
2.3. The Implementation of Ecodesign in Companies.....	19
2.3.1. Drivers, Barriers and Success Factors for Ecodesign Implementation in Companies.....	19
2.3.2. Integration of Ecodesign into Product Development.....	24
2.3.3. Ecodesign Implementation Processes.....	26
2.4. Studies Related to Integration of Ecodesign around the World...	29
2.4.1. Overview of the Studies.....	29
2.4.1.1. The Survey in the Netherlands.....	29
2.4.1.2. The Survey in Central America.....	31
2.4.1.3. The Survey in Baltic States.....	31

2.4.1.4.	The Survey in South America.....	33
2.4.1.5.	The Survey in France.....	34
2.4.1.6.	The Survey in European States.....	35
2.4.2.	Discussion on the Presented Surveys.....	36
3.	CURRENT SITUATION OF ECODESIGN IN TURKEY.....	41
3.1.	Brief Overview of the Turkey’s Economic Structure.....	41
3.2.	Overview of Turkish Industry.....	43
3.2.1.	Packaging Sector.....	45
3.2.2.	Household Appliances Sector.....	46
3.3.	New Product Development in Turkey.....	47
3.4.	Environmental Considerations in Turkey and Turkish Industry....	50
3.4.1.	Policy Framework.....	50
3.4.2.	Existing Company Activities in the Field of Ecodesign.....	54
3.4.3.	Ecodesign Related Training Activities for Companies.....	58
3.5.	Survey on Turkish Stakeholders.....	60
3.5.1.	The Perspective of Governmental Institutions.....	63
3.5.2.	The Perspective of the Educational Institutions.....	63
3.5.3.	The Perspective of the Industry (Private Sectors).....	64
3.5.4.	The Perspective of Other Stakeholders.....	65
3.5.5.	Discussion.....	65
4.	STUDY ON ECODESIGN IN TURKISH INDUSTRY.....	67
4.1.	Aim of the Study.....	67
4.2.	Design of the Questionnaire.....	68
4.2.1.	Selection of Companies.....	69
4.2.2.	Selection of Sectors.....	70
4.2.3.	Selection of Participants.....	71
4.3.	The Questionnaire.....	72
4.3.1.	Part-1.....	72
4.3.2.	Part-2.....	72
4.3.3.	Part-3.....	73
4.4.	Data Analysis.....	75
4.5.	Results and Discussion.....	76
4.5.1.	Results of Part-1 of the Questionnaire.....	77

4.5.1.1.	Arçelik.....	77
4.5.1.2.	BEKO.....	78
4.5.1.3.	VESTEL.....	80
4.5.1.4.	Kumtel.....	81
4.5.1.5.	Paşabahçe.....	82
4.5.1.6.	Olmuksa.....	83
4.5.1.7.	Korozo.....	84
4.5.2.	Discussion on Part-1 of the Questionnaire.....	85
4.5.3.	Results of Part-2 of the Questionnaire.....	88
4.5.4.	Discussion on Part-2 of the Questionnaire.....	89
4.5.5.	Results and Discussion on Part – 3 of the Questionnaire...	90
5.	CONCLUSIONS.....	99
5.1.	Literature Review.....	99
5.2.	Research Questions Revisited.....	101
5.3.	Limitations of the Study.....	107
	REFERENCES.....	109
	APPENDICES	
A.	COMPLEMENTARY STUDY.....	118
B.	FIRST PART OF THE QUESTIONNAIRE.....	119
C.	SECOND PART OF THE QUESTIONNAIRE.....	120
D.	THIRD PART OF THE QUESTIONNAIRE.....	121

LIST OF TABLES

TABLES

Table 2.1. The reasons of ecodesign concepts to implement.....	8
Table 2.2. Ecodesign innovation levels.....	13
Table 2.3. Characteristics that define innovative categories.....	13
Table 2.4. Ecodesign strategies.....	15
Table 2.5 Summary of the success factors and obstacles.....	20
Table 2.6. Drivers for ecodesign in three different regions.....	22
Table 2.7. Success factors for integration of ecodesign into product development.....	23
Table 2.8. A four-stage framework for organizational planning of ecodesign.....	27
Table 2.9. Australian ecodesign implementation process.....	27
Table 2.10. The results of the study.....	30
Table 2.11. The barriers found in the study.....	30
Table 2.12. Main outcomes of the reviewed ecodesign country or region research studies.....	39
Table 2.13 Main outcomes of the reviewed ecodesign country or region research studies.	40
Table 3.1. Export rates of Turkey between the years 2007 and 2008.....	45
Table 3.2. Turkish environmental directives adapted from EU directives	52
Table 3.3. The problems that firms come across in their cleaner production practices.....	55
Table 3.4. Regional differences in ecodesign among SMEs of the electrical & electronics sector.....	60
Table 3.5. Breakdown of the interviewed experts from companies, organizations and institutions.....	62
Table 4.1. The categorization of ecodesign strategies for Part – 2 of the Questionnaire.....	73
Table 4.2. External drivers.....	74
Table 4.3. Internal drivers.....	74

Table 4.4. Barriers.....	75
Table 4.5. Key actions.....	75
Table 4.6. The results of Part-1 of the questionnaire.....	88
Table 4.7. The most important barriers mentioned in the study.....	95
Table 4.8. The most repeated key action drivers of the participants.....	98
Table 5.1. Research questions and related chapters.....	101
Table 5.2. The most important barriers mentioned in the survey.....	106
Table 5.3. Action drivers mentioned in the study.....	107

LIST OF FIGURES

FIGURES

Figure 2.1. From ecodesign to sustainable development.....	7
Figure 2.2. Aspects of product design.....	8
Figure 2.3. Typical life cycle stages of a product.....	10
Figure 2.4. Product development cycles.....	11
Figure 2.5. The considerations of product design.....	11
Figure 2.6. Four types of ecodesign innovation.....	12
Figure 2.7. The ecodesign strategy wheel.....	18
Figure 2.8. Philips’s five focal areas.....	19
Figure 2.9. The product development process.....	25
Figure 2.10. The model of ecodesign integration.....	28
Figure 2.11. The Regions where the studies were executed through the World.....	
Figure 2.12. Evolutionary approaches in industry.....	36
Figure 3.1. Annual real GDP growth by the years.....	42
Figure 3.2. Recent annual GDP growth rate.....	42
Figure 3.3. The contribution of agriculture industry and services in GDP.	44
Figure 3.4. Breakdown of the packaging export materials by Turkey.....	46
Figure 3.5. Exports of four major household items (1,000 units)	47
Figure 3.6. Direct public R&D and innovation funds in Turkey.....	53
Figure 3.7. The distribution of the activities of product development process between the managers and designers.....	56
Figure 4.1. The environment management system of BEKO.....	79
Figure 4.2. The distribution of strategies used in different phases of product life cycle.....	90
Figure 4.3. External drivers of the Industries.....	92
Figure 4.4. Internal drivers of the industries.....	93
Figure 4.5. Barriers mentioned in the study.....	95
Figure 4.6. Key actions mentioned in the study.....	97

CHAPTER 1

INTRODUCTION

Environmental problems have changed rapidly in the past two decades, they become more global, significant and even complex. In that sense, the term 'ecodesign', referring to environmentally-conscious design, and to the minimization of environmental impact of products during their total life cycle, has emerged. It is regarded as one of the key solutions towards the bad course of environmental problems since the late 1980s.

A huge variety of products and systems (e.g. both simple and complex) are used in today's society. Parallel to the currently increasing consumption behaviors in the society, consumers purchase and consume more and more products. Therefore, the impact of products to the environment becomes an essential topic for the companies. In this respect, new environmental legislations at both international and national levels have been introduced to promote environmentally-conscious production and product development in the companies. Moreover, growing consumer and market demand to environmental issues have been other significant factors to encourage environmentally-conscious understanding in industry. For these reasons, recently, ecodesign has become a considerable competitive advantage in the manufacturing companies to reduce manufacturing costs in the long term, to improve innovational approach during new product development and especially during manufacturing, and to improve brand identity.

1.1 Problem Definition

In relation to the changes related to the environmental issues in the world, many innovative manufacturing companies shifted their focus to environmental considerations. They have made significant efforts for the development of environmentally-friendly products. Especially, European countries play an

important role in this as the initiators of implementing and disseminating ecodesign to the industry. While ecodesign is a widely accepted and applied approach in developed economies, such as the Netherlands, Germany, its importance is yet to be appreciated in developing economies. However, the adaptation and integration of ecodesign in developing economies may require different conditions than the ones in developed economies because of their limited sources, finance and time. In any case, it is a common sense that urgent precautions need to be taken to reduce the negative environmental impacts of industrial activities all around the world.

It is possible to see the same tendency for the environmentally-conscious approach in Turkish industry, which can be followed especially from the Government's five-year development plans, a number of legislations (e.g. 2002795/AT) and the international standards adopted (e.g. ISO 14000). Furthermore, the Accession Period between Turkey and European Union (EU) gave acceleration to this evolution of environmental considerations in Turkish industry (U Nations, 2002). Thus, there has been a growing concern and awareness about environmental considerations at different levels, including sustainable agriculture rural development, toxic chemicals, hazardous waste, and poverty combating in Turkey. Nevertheless, current efforts in the Turkish industry have stayed rather weak in addressing the environmental issues. Therefore, there exists a need for integrating environmental considerations in a more systematic way into the industry. Ecodesign is believed to be a promising starting point for Turkish industry to improve environmentally-conscious design and manufacturing.

1.2 Aims and Objectives of the Study

In the light of the aforementioned issues, this study aimed at understanding the current situation of ecodesign activities in Turkish industry (with specific focus on packaging and electric & electronics sectors) with regard to other countries around the world. These countries were mostly selected from Europe which have an influence on Turkish exports and Turkish production standards in a large extend because of high exporting rates to Europe.

The objectives of the study were:

- To gather the international references from literature of different countries, which were executed in recent years in order to discuss adaptation of ecodesign in different frameworks.
- To define the overlapping issues, similarities and differences between Turkish and other countries' contexts are investigated and compared.
- To reveal the current approach of Turkish companies,
- To reveal the forcing drivers and obstacles to develop more environmentally-conscious product development in Turkish industry.
- To discover key actions to improve environmentally-conscious manufacturing that match with the situation reality of Turkish industry.

Following research questions were addressed in the study.

- What are the determining factors (external and internal) as well as barriers of implemented ecodesign strategies in the world?
- Where does Turkey position itself relative to other countries in the world?
- What are the internal and external factors that are promoting the ecodesign activities in Turkish industry?
- What are the limitations of Turkish industry in relation to activities of adapting ecodesign?
- What could be the key actions to integrate ecodesign in Turkish industry?

1.3 Structure of the Thesis

The thesis structured under five chapters.

Chapter 1, Introduction, gives a brief background to the study and presents the problem definition, followed by the aim and objectives of the study, and the research questions.

Chapter 2 accumulates the literature on ecodesign. The first part of the chapter explains the ecodesign concept and ecodesign basics. The second part presents the literature about implementation of ecodesign in companies. Then, the international studies related to integration of ecodesign around the world are

discussed with a view to understand different approaches. Lastly, the comparative analyses of six international studies aiming to explore the internal and external stimuli for promoting ecodesign, as well as reflections on barriers are presented.

Chapter 3 exposes literature review on economic situation, product development and environmental considerations specific to Turkey and Turkish Industry in order to figure out the dynamics of the industry to adapt ecodesign. The chapter also presents the results of a mini-survey with three identified stakeholder groups (i.e. government, universities and industry) carried out to complement the finding of the literature review and to provide an insight into the Turkish stakeholders, opinions of people from key institutions through current and future developments, and to understand the nature of cooperation between the stakeholders.

Chapter 4 presents the results of a survey carried out with Turkish packaging and electronic sectors, with an aim to explore existing key drivers of ecodesign in Turkish industry.

Finally, in Chapter 5, main conclusions of the study are presented with specific answers to research questions; limitations of the study and the further research possibilities are also discussed.

CHAPTER 2

ECO-DESIGN

2.1 A Historical Overview of Environmentally-Conscious Design

During the last two decades, in which environmental problems have become more obvious, the terminology of product design integrating environmental concerns has changed with a shifting focus on ecology and design (Baumann et al., 2002). The variety in terminology shows evolution of the subject. The earliest term which came out in the 1980s was '*green design*'. Currently the term is also referred to as *ecological design*, *environmentally sound design*, *environmentally sensitive design*, *ecodesign* (Madge, 1997), *design for the environment (DFE)* (Allenby and Fullerton, 1991), or *environmentally responsible design*. Being the first environmental movement, green design focuses on a particular aspect element of the product life cycle. Likewise, DFE covers mainly end of life design and production process improvement (Loriot, 2003; Bhamra et al., 1999; Lambert, 2002). In fact, DFE can be considered as one of the DFX guidelines, where 'X' can refer to manufacturability and reliability (Simon et al., 2000). Then, the term of ecodesign was evolved, covering the whole life cycle of a product rather than single aspect of it. On the other hand, some studies in literature point out DFE as a synonym to ecodesign (Dewberry and Goggin, 1996; Mathieux et al., 2001; Stevels, 2001).

Ecodesign aims minimizing environmental impacts of the product by taking into consideration phases from material selection to disposal of a product. The concept of ecodesign started to be discussed in the early 1990s. Stevels (2001) discusses the developments of ecodesign by the time periods, which covers three periods between the years 1990 to 2001.

- The start-up period in the early nineties (1990-1995)
- The consolidation period in the mid nineties (1995-1998)
- Modern-business integrated ecodesign (1998-2001)

The first stage is regarded as the start-up period when some manuals related to introducing the ecodesign principles were developed and many demonstration projects were executed (1990-1995). The second stage is the consolidation period (1995-1998), when the drivers of ecodesign were identified whereby environmental understanding tried to be adapted into the organization. Finally, the last stage (1998-2001) can be regarded as modern-business integrated ecodesign. It was the period in which the importance of the strategic management approach was realized. Thus, environmental concerns were integrated in the entire business of company. This situation shows the evolution of ecodesign topic with time.

Then, in the late 1990s, ecodesign term was replaced with a much broader concept 'sustainable product design' (SPD). Sustainable design tackles the environmental issues in ethical and cultural level besides economical and environmental benefits. United Nations Environment Programme defines SPD as developing concepts within whole systems, which provide a service or function to meet human needs. The concept of 'sustainability' and 'sustainable development' came into question thirty years ago when the capacity of the world resources begun to emerge as an issue. However, sustainable product design or environmentally-conscious design has met the demands after the 21st century. The most widely known definition of sustainable development adopted by Brundtland Report (1987 in Madge, 1997) is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (p.51).

Consequently, there is a certain shift from 'green' to 'eco', then to 'sustainable' which refers to the evolution and growing interest on the combination of ecology and design (Madge, 1997). Parallel to the development of environmentally-conscious activities in the world industries, businesses have begun to think different than in the past. Bhamra (2004) defines this shift in business attitudes as: "They see environment as an opportunity rather than a threat, recognize that 'prevention is better than cure' and are attempting to 'design out' rather than simply manage the problems" (p.557). The relations between these terms that are mostly used in recent literature and in this study illustrated in Figure 2.1.

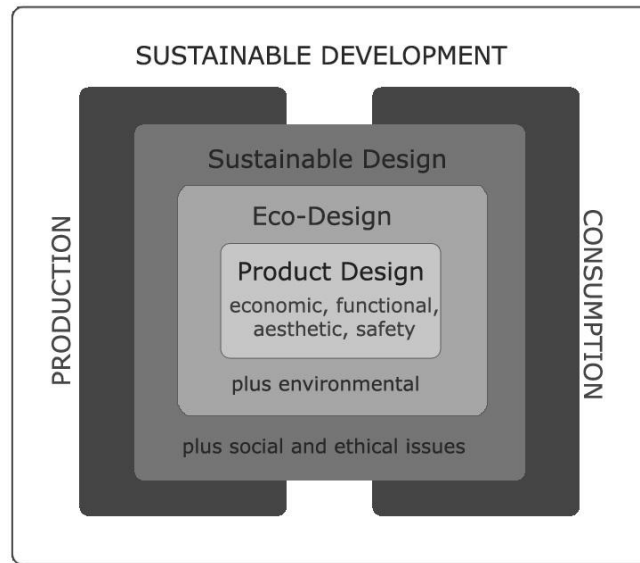


Figure 2.1. From ecodesign to sustainable development
(Ursula, 2000; reproduced by the author)

2.2 The Concept of Ecodesign

This part of the study discusses the notion of ecodesign in detail, which is 'one of the largest contributors to the sustainable development' in the product design phase (Loriot, 2003). The term 'ecodesign' indicates the actions involving product development stage striving for minimizing environmental impacts of product during whole life cycle. It is 'a pragmatic approach' rather than compressed data giving all solutions to avoid environmental problems in product development process (Schischke et al., 2005). Moreover, many authors have tried to clarify ecodesign definition in different ways. According to Lofthouse et al. (1999) ecodesign can be seen as "an industrial activity, which involves integrating environmental considerations into the design process, while maintaining price, performance and quality standards" (p.220). Sherwin and Evans (2000) give a broader definition: "ecodesign as the design of a product, service or system with the aim of minimizing the overall impact on the environment" (p.112). The first definition describes the main borders of ecodesign. It also emphasizes that ecodesign should be integrated into traditional design process with maintaining other main aspects of design (Figure

2.2). The latter covers not only product design but also designing service and system, which is a way moving towards sustainability.

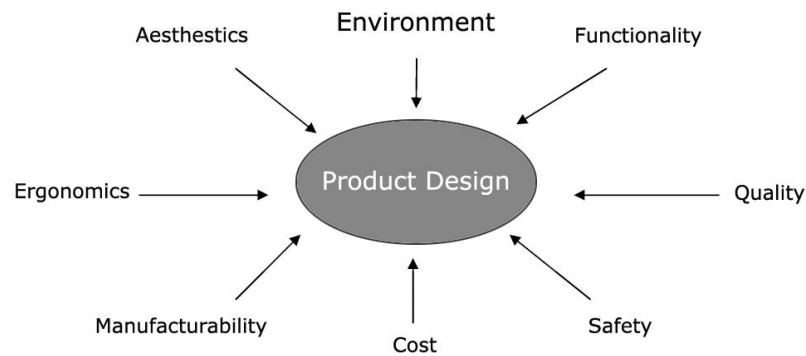


Figure 2.2. Aspects of product design (Ecodesign, 2008)

Environmental improvements can lead to a win-win situation, in which all business, customer and society opportunities can be created through more efficient products in economical and environmental dimensions. Business can reduce production costs, for example, by using less material, water and energy sources. On the other hand, user can possess more durable and reliable products and society will keep resources for needs of the future generation by the help of sustainable approach. Meinders and Meuffels (2001) sort the ecodesign benefits into three: material (money), immaterial (advantageous) and emotional (a variety of intangible factors of company) (Table 2.1).

Table 2.1. The reasons of ecodesign concepts to implement (Meinders & Meuffels, 2001).

Aspect	Stakeholder	Rationale: tangible benefit description
Material	Company	Cost reduction; higher margin/lower price
	Customer	Lower cost of ownership
	Society	Usage of less resources
Immaterial	Company	Simpler to produce, to sell
	Customer	Easier and more fun; better product
	Society	Better compliance to legislation and regulation
Emotional	Company	Employee motivation
	Customer	Feel good with product, quality of life
	Society	"We make actual progress in green" feeling

From this perspective, ecodesign creates competitive advantage to companies while shifting the attention of customers to ecodesign products and compelling environmental legislations (Akermark, 2003). As it was indicated before, business has realized these significant advantages of ecodesign in the last decade (Karlsson and Luttropp, 2006). Previously, while ecodesign products was seen as expensive and sometimes criticized for poor quality, now ecodesign has become a value for business, having a good environmental performance and increasing sales (Stevens, 1999).

Today, substantial efforts are being made in order to understand ecodesign in both academia and business. However, their focus points are different: academia deals with issues more close to sustainability; whilst industry is inclined to solve urgent problems such as energy consumption and resource use (Argument et al., 1998). Therefore, the topics related to ecodesign cover a wide range.

2.2.1 Life Cycle Thinking

The center of ecodesign is the concept of product life cycle. The life cycle of a product begins with the use of raw materials and continues with manufacturing, distribution and use before its final disposal (Figure 2.3). Environmental impacts occur in different phases of the product life cycle and should be accounted in an integrated way. By assessing the environmental impact of a product from 'cradle to grave' approach rather than 'cradle-to-cradle' (McDonough and Braungart, 1998) (where the cradle refers to raw material stage of product and grave means the phase of product waste), the enterprise will be able to find an efficient way to prevent pollution. Therefore, it helps to select the most suitable strategies for product improvement.

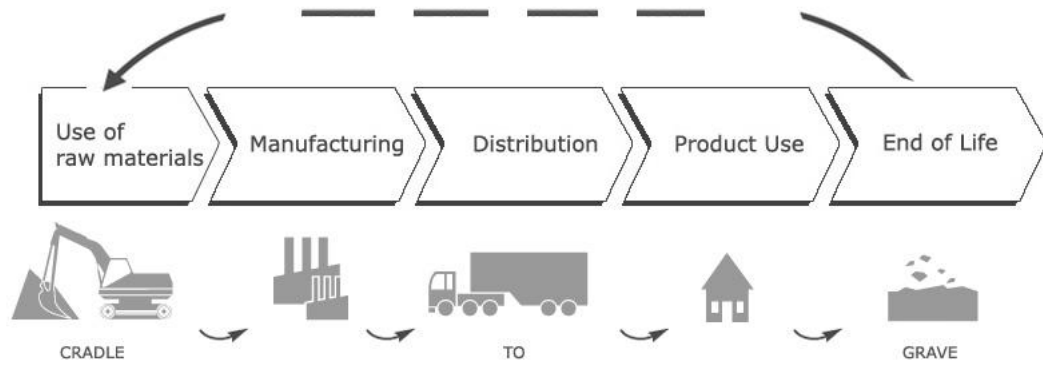


Figure 2.3. Typical life cycle stages of a product (Ecodesign, 2008; reproduced by the author).

In order to gain an environmentally-conscious approach, various strategies have been applied in industry. Some of them were built for the early stage of product development, others were adapted during the detailed design period, and the remaining were aimed after the product use. The strategies, implemented in different stages of life cycle of a product, will be elaborated in following parts.

The related literature specifically stresses the importance of the implementation of ecodesign at early design stages (Figure 2.4). There are studies emphasizing the fact that "between 80% and 90% of a product's economic and environmental cost - and thus resultant environmental impacts - are fixed at these early stages" (Sherwin and Evans, 2000: 112) In that sense, the designer gains insight into the environmental results of decisions in the design phase and a much broader perspective on the potential environmental improvements of the product through a life cycle thinking (Figure 2.5). Therefore, designer's responsibilities are not limited only with functional and aesthetic qualities of product. It should be also considered the environmental impacts of a product such as eventual consumption of energy or water consumption during the product usage, as well as the manufacturing costs. As a result, designer should make connection between traditional requirements of product and environmental qualities of it. For this reason, designers or product developers have crucial impact on product life cycle and, in a wider perspective, on a sustainable society. However, although the designer has a power to change present lifestyles of consumers in a less harmful level (Dewberry and Goggin,

1996), a very few of them are specialized on the environment according to Akermark's (2003) study, called 'The Crucial Role of the Designer in EcoDesign'.

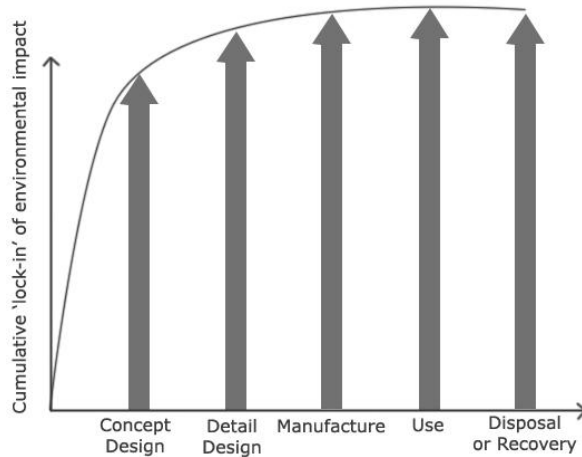


Figure 2.4. Product development cycles (Lewis and Gertsakis, 2001 in IDSA, 2004).

Ultimately, as a decision period, the product design stage has substantial effect on minimizing environmental impacts. Product designers have a central position in changing product life cycle with respect to environmental considerations. Therefore, product development can be defined as a phase "doing the right thing at the right time" (Ecodesign, 2008).

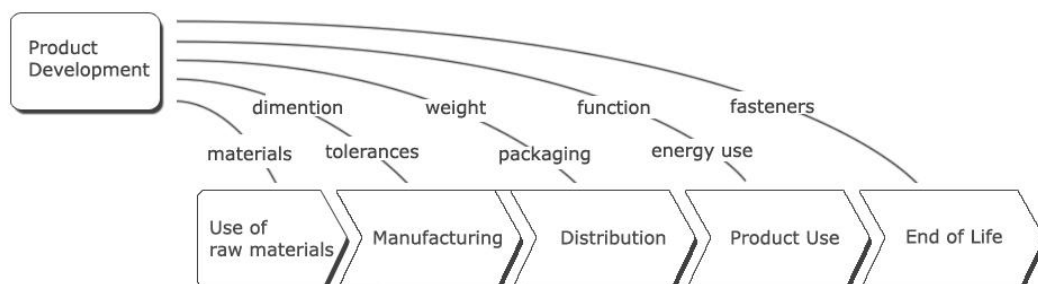


Figure 2.5. The considerations of product design (Ecodesign, 2008; reproduced by the author).

2.2.2 Ecodesign Innovation Levels

Ecodesign concept consists of four improvement levels in respect of eco-efficiency improvement factor, as can be seen in Figure 2.6 (Brezet, 1997; in Charter and Tischner, 2001). These levels can be referred to as innovation levels of product development from evolutionary (incremental innovation) to revolutionary stages (innovative or radical innovation) (Hemel, 1998). In other words, it forms a model which moves away from object to system-oriented. Likewise, Charter and Chick (1997) describe these levels with 4R's: Re-pair; Re-fine; Re-design and Re-think (Sherwin and Evans, 2000).

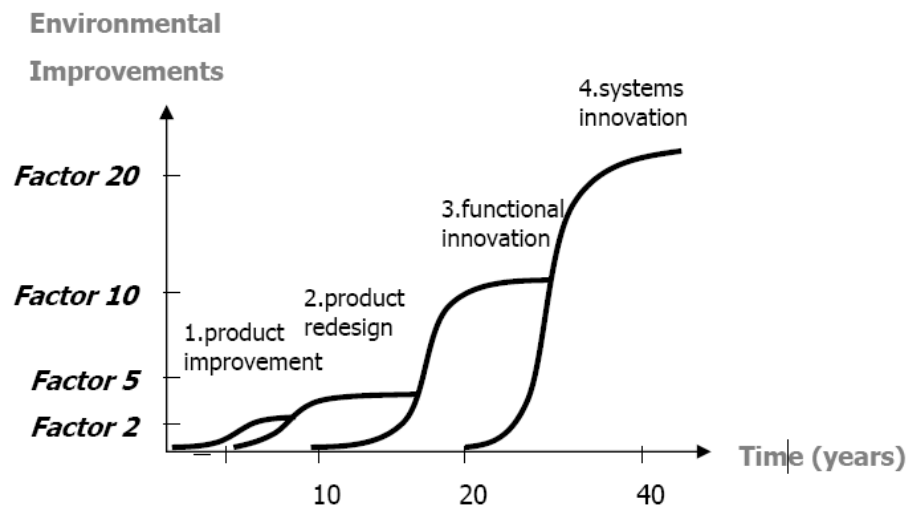


Figure 2.6. Four types of ecodesign innovation (Lambert, 2002).

On the other hand, Bakker (1995) describes the ecodesign in two stages, which is similar to Hemel's (1998) understanding; eco-redesign and beyond eco-redesign. Eco-redesign refers to basic ecodesign process so as to integrate environmental principles into product development stage. Beyond eco-redesign concerns in developing smart new products or services, which is strongly linked to sustainable living (Bakker, 1995). Table 2.2 summarizes these approaches.

Table 2.2. Ecodesign innovation levels.

	Charter and Chick(1997)	Brezet(1997)	Bakker(1995)
Level 1	Repair, with minor product changes.	Product improvement	Ecoredesign
Level 2	Refine, improving current product.	Product redesign	
Level 3	Re-Design, redesigning concepts but maintaining product functions.	Product innovation	Beyond Ecoredesign
Level 4	Re-Think, designing a totally new product or product functions a new product strategy.	System innovation	

The first stage of ecodesign innovation, improvement and redesign of an existing product provide incremental innovation or step-by-step improvement in the design phase (between factor0 to factor2). Therefore, it focuses on only single issues. In level 2, the product is developed further regarding environmental qualities of it during the design process. On the other hand, other stages, level 3 and level 4 require more radical changes of function and system in the design phase. It refers to new product and product-system approach which is the similar way of sustainable design.

This model, as illustrated in Figure 2.6., requires a significant time period (e.g. 30-50 years) to accomplish 4-types-level innovation. From factor 0 to factor 20, the changes are increasing. To clarify the changes in each innovation level, Ehrenfeld (2001) discusses three factors of change: the artifact, the organization, and the user (Table 2.3).

Table 2.3. Characteristics that define innovative categories (Ehrenfeld, 2001).

Category	Change in device concept	Change in infrastructure	Change in user learning
Process and product redesign	None to minor	None	None
Functional innovation	Significant	None to minor	Minor
Institutional innovation	None to minor	Significant	Significant
System innovation	Significant	Significant	Significant

Additionally, when increasing the innovation level of a product, higher cost and higher effort is needed as well as lower demand (Lofthouse et al., 1999). From this perspective, it conflicts with the benefits of the business. Therefore, manufacturing industry tries to find new ways and strategies so as to ensure the fulfillment of both innovation and marketing requirements (Loriot, 2003).

2.2.3 Ecodesign Strategies

Ecodesign strategies show various ways to reduce environmental impact of product involving whole product life-span. Hemel (1998) set out 33 specific strategies and incorporated as part of eight categories (see Table 2.4). This categorization facilitates the ecodesign process and gives an idea to what extent designer contributes to the environmental improvement of a product. It is a comprehensive guide in which the inclusion and complexity of the strategies increases in the list numbering. The strategies from 1 to 7 refer incremental improvements for providing the progress from short to medium term (Crul, 2003). The last one, new concept development, requires a longer term innovation. On the other hand, the key concern is to select the most appropriate strategy regarding a particular product or a project.

Fletcher and Goggin (2001) discuss the ecodesign strategies from a different perspective. They categorize the strategies in three broader clusters: product-focus, result-focus and needs-focus. The product-focus strategies change the quality of products by making existing products more efficient. The result-focus strategies try different ways to reach the same outcome. The need-focus strategies questions the need fulfilled by the object, service, or system, and how it is satisfied.

Table 2.4. Ecodesign strategies (Hemel, 1998).

Ecodesign strategies	Ecodesign principles
1. Selection of low-impact materials	Clean materials Renewable content materials Recycled materials
2. Reduction of materials usage	Reduction in weight Reduction in volume
3. Optimization of production techniques	Clean production techniques Fewer production steps Low/clean energy consumption Less production waste Few/clean production consumables
4. Optimization of distribution system	Less/clean/reusable packaging Energy-efficient transport mode Energy-efficient logistics
5. Reduction of impact during use	Low energy consumption Clean energy source Few consumables needed Clean consumables No waste of energy/consumables
6. Optimization of initial lifetime	High reliability and durability Easy maintenance and repair Modular/adaptable product structure Classic design Strong product-user relation
7. Optimization of end of life	Reuse of product Remanufacture/refurbishment Recycling of materials Safe incineration (with energy recovery) Safe disposal of product remains
8. New concept development	Shift to service provision Shared product use Integration of functions Functional optimization

2.2.4 Tools for Ecodesign

New product developers would need a guide to realize implementation of ecodesign strategies in their practices (Mathieux et al., 2001). Therefore, so far, many tools, guidelines, even software tools have been developed for designers and industry (Ryan, 2004). In the literature study carried out by Baumann et al. (2002) 650 articles related to ecodesign methods and tools were analyzed and 150 different tools were found. On the basis of these findings, they classified ecodesign tools into six groups: frameworks; analytical tools; checklists and guidelines; software and expert systems, rating and ranking tools and organizing tools. All of these groups serve to assist designers whilst determining critical of a product. However, which tool could serve better will be different with

the needs and knowledge of the user and the degree of improvement sought in a product (Gluckman et al., 2006). Therefore, before using any of these tools, it will be useful to analyze the existing ones and to develop customized ecodesign tools, where necessary, according to the needs of the company (Allenby and Fullerton, 1991; Boks, 2006). The selection should provide enough flexibility for a certain product, also should have a clear and a simple structure to be easily implemented.

Nevertheless, these tools could be very difficult and complex to understand, and they may fail to guide designers, example of which was experienced in European States (Tukker et al., 2000). Lofthouse and Bhamra (2001) states that the language of ecodesign tools is so complex that they generally address the engineers, but not designers. In accordance with the survey carried out by Baumann et al. (2002), the researches have rarely discussed efficiency and application of these tools. This shows that the literature has many examples of the creation of tools rather than finding a way how ecodesign tools can be integrated into the product development process (McAloone, 2000 in Lambert, 2002). For this reason, investigations have recently struggled to find more practical answers to be able to implement ecodesign into the industry. For example, a number of current practices about tools focus on powerful software for analysis (Mathieux et al., 2001). Furthermore, product requirements are becoming more complex and difficult, by changing situation of market such as limited time. Therefore, smarter solutions may be a good way in order to successfully apply ecodesign.

In the following part, three different tools will be introduced as examples for ecodesign tools. Life cycle assessment (LCA) is one of the commonly used tools in the industry. Ecodesign Strategy Wheel is a model which is structured at the Delft University of Technology (the Netherlands) for providing a visual map for the designer. Philips Five Focal Areas by Philips is created by co-operation (efforts) of both academy and industry.

LCA is one of the analytical tool (quantitative assesment) which is explained as "a way of evaluating all processes involved with a certain product or service, 'from the cradle to the grave'" (Robért, 2000:243). It provides considerable data for the product development process as well as production, and can be regarded as

a useful tool for designers to see the whole picture of a product's environmental impacts. However, LCA follows a very heavy methodology and complex, as it is emphasized in various sources and case studies (Akermark, 2003; Loriot, 2003; Lambert, 2002; Simon et al., 2000). Therefore, designers generally prefer using the results of LCA rather than using LCA tool by themselves. Although it is occasionally seen as time consuming by the industry, Nielsen and Wenzel (2002) consider LCA as a necessary tool to achieve environmental improvement in product development. They summarize the main benefits of LCA as:

- 1) Future modifications of the studied products can be tested quite easily from an environmental point of view before implementation.
- 2) Conclusions with respect to processes and materials can to a large extent be transferred from the studied product to other products in the same family.
- 3) New LCA models of other products in the same family can be based on the existing model and the existing database (Nielsen and Wenzel, 2002).

Another tool, structured by Hemel (1998), identifies 33 specific strategies within seven groups (see Figure 2.7). The tool is called as 'Ecodesign Strategy Wheel' (also called LifeCycle Design Strategies–LiDS wheel) and illustrates the progress of ecodesign strategies. It aims to guide designers in determining which ecodesign strategy is more useful to implement in a specific case. This is because some products have high impacts on environment during their use, while others have impacts during manufacturing and end-of-life.

The Ecodesign Strategy Wheel can give a visual map for designers in terms of environmental performance of new product against an existing one. Thus, designers can estimate how good or bad the product performs in each alignment. Figure 2.7 also shows comparison between an existing product and the improved one. The wheel can be also used to evaluate different technologies or different phases of the same product.

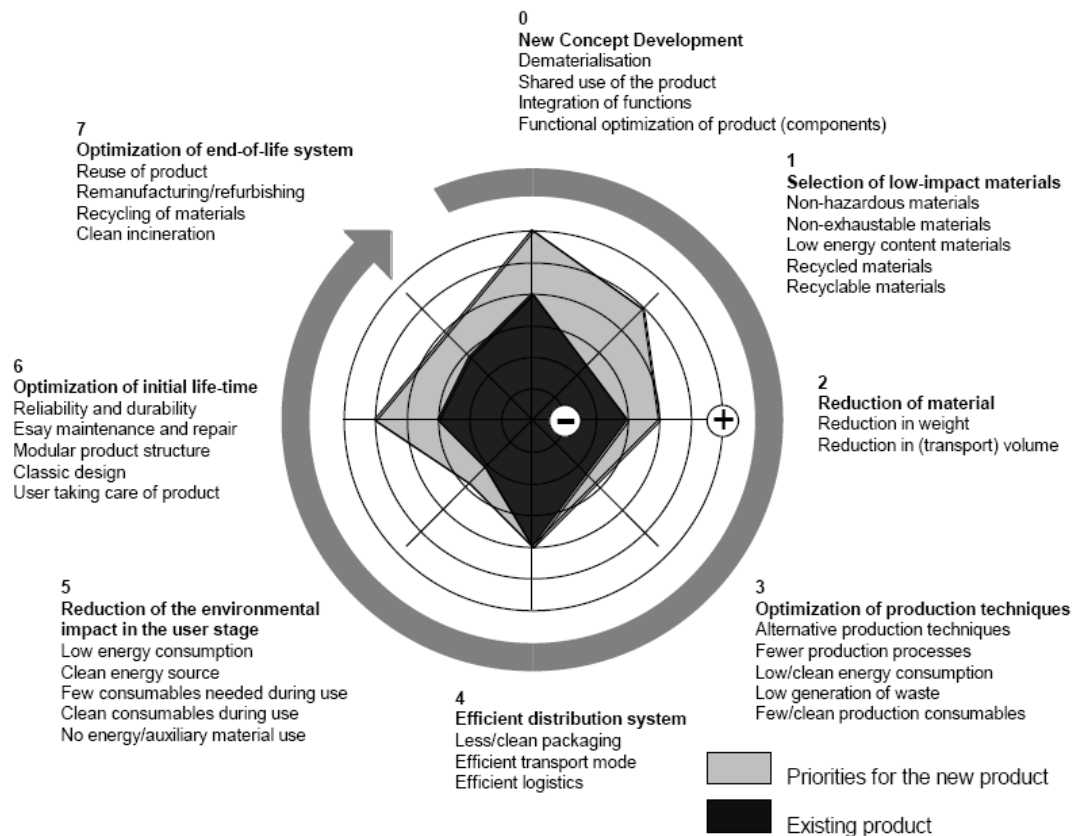


Figure 2.7. The Ecodesign Strategy Wheel (Brezet et al., 1994 in Bras, 1997).

'Philips Five Focal Areas' by Philips is a good example for co-operation of both academy and industry. Since 1997, there has been ongoing studies and activities to improve environmental benchmarking as well as related methods collaboratively carried out by the Delft University of Technology and Philips Consumer Electronics (Boks and Stevels, 2003). The study identified the five focal areas having the most priority for Philips. These are material and weight, potentially toxic substances, packaging, energy, and recyclability. While these areas display the strategies on which Philips Electronics focuses, the symbolic representation are also being used as visual indicators to inform the employed approach for a particular product in the reports or published materials (Figure 2.8).



Figure 2.8. Philips' Five Focal Area.

2.3 The Implementation of Ecodesign in Companies

In this part, the implementation of ecodesign will be discussed in detailed from the companies' point of view. First, drivers and barriers are presented, which are mainly experienced by firms. Then, facets of the integration of ecodesign into new product development are highlighted, and finally the ecodesign implementation processes are indicated in order to expose ecodesign actions in companies.

2.3.1 Drivers, Barriers and Success Factors for Ecodesign Implementation in Companies

There are two distinctions describing the motivations of companies that encourage the implementation of ecodesign on the grounds of business economics (Brezet and Hemel 1997). They are internal drivers, which are the values originated from dynamics of the company/organization itself, and external drivers addressing the stimuli from the pressures outside of the company. In addition to the driving forces, there are barriers that expose problems in the process of ecodesign integration. For example, providing cost reduction in raw materials/energy and production, improving brand image and enhancing product qualities are remarkable ecodesign motivations in the internal value chain of a company. There are also new market opportunities and innovational outputs in the new product development stage.

On the other hand, outside the company, some of the factors are prescriptive, like environmental legislations. The non-prescriptive factors also have significant influence on design decisions, like customer demand, and competitive

advantage in the market. Boks (2006) highlights a number of intangible factors for a company covering internal and external drivers, which he refers to them, as “soft side of ecodesign” (p.1347). In his survey, he identifies the major success factors and obstacles for implementation of ecodesign (Table 2.5). Accordingly, while success factors are considered as more conventional business aspects and most probably easily systematized issues, the obstacles are attributed to more social-psychological concerns, which is related to individual behaviors of the staff more than departmental qualities in the cooperation (Boks, 2006).

Table 2.5. Summary of the success factors and obstacles (Boks, 2006).

	Success factors	Obstacles
Dissemination of information among stakeholders	<ul style="list-style-type: none"> ▪ Customization ▪ Organization ▪ Commitment 	<ul style="list-style-type: none"> ▪ Gap between proponents and executors ▪ Organizational complexities ▪ Lack of cooperation
Application of ecodesign principles in final product	<ul style="list-style-type: none"> ▪ Integration in business ▪ Customization 	<ul style="list-style-type: none"> ▪ Lack of market demand ▪ Lack of goals and vision

Most studies in the literature have similar results in terms of external and internal drivers of companies. In general, the most important external drivers are listed as being legislative pressures, such as Waste Electrical and Electronic Equipment (WEEE), Energy Using Products (EuP) or the Restriction of the Use of Certain Hazardous Substances (RoHS), customer demand and market forces, as well as good position of competitors to achieve in environmental considerations. As internal drivers for the company, cost reduction/profit increase incentives, better product-market opportunities and environmental policy of company, are given higher importance among the companies. Other essential internal drivers include innovational opportunities, increase of product quality, and improvement of a corporate image. According to Tukker et al. (2000)’s study, which investigated 500 transnational companies in 15 EU countries, the main drivers were related to business-oriented factors rather than environmental concerns. The reason behind is that business cannot give priority to environmental issues

as much as other main design requirements. However, when the main obstacles addressing the environmental issues are reviewed, it can be seen that they are generally related to internal value chain of the company. This supports the idea why internal stimuli are more influential than external ones for a long term achievement in ecodesign.

According to Handfield et al. (2001)'s findings, the barriers that can be examined are as follows:

- The integration of environmental issues in the design process is limited to the use of checkpoints and exit requirements;
- The primary measures of ecodesign activities are material related, with only limited focus on cost and time-to market;
- Ecodesign is primarily evaluated in terms of environmental performance, specifically recyclability;
- Conventional tools are poorly understood and rarely used;
- The perception that doing ecodesign yields no rewards, only pitfalls;
- A large gap exists between ecodesign proponents and those that have to make it operational.

Moreover, Ries et al. (1999) categorizes the barriers into three main groups: barriers to product-oriented environmental management systems (EMS); barriers to environmentally oriented product development; and barriers with low incentive for environmentally sound products. Nevertheless, driving forces have different foci regarding as different regions as it is seen in Table 2.6 (Pfahl, 2001). These differences show to some extent the approaches of each industry to environmental issues, as well as the environmental impact in the society.

In addition to the internal and external value chain of the companies, literature also discusses the success factors in the organizations. Johansson (2002), Ritzen and Beskow (2001), and McAlloone (1998 in Bhamra, 2004) are the authors notably discussing these success factors for the integration of ecodesign in companies. There are two clear points, which overlapped the results of all three authors' studies.

Table 2.6. Drivers for ecodesign in three different regions (Pfahl, 2001).

Region	Drivers	Focus	R&D	Key programs
United States	Regulation	Factory	Manufacturing-focused	CFC Elimination VOC reduction Lead reduction
Europe	Customer & Regulation	Product	Model-focused	Design for environment
Japan	Government/Industry	Market	Product-focused	Hybrid engines Halogen free plastics Lead-free products

The first success factor is the enthusiasm of company to environmental issues. There has been an ongoing discussion on the importance of environmental champion/expertise that can motivate the organization to think about environmental issues. Johansson (2002) expresses the importance of environmental champion under the motivation part (see Table 2.7). He believes that presence of an environmental champion is a determining factor for companies and individuals are encouraged to take active part in the integration of ecodesign. Product developers and others affecting this integration in different departments should have indeed willingness to find solutions to problems, which is more important than the technical acknowledge (Johansson, 2002). Similarly, Ritzen and Beskow (2001) mention two more points: to develop individual competence, designers to 'know' and specialists to 'act', and to promote active participation in integration activities. Johansson (2002) proposed a model which incorporated to success factors for ecodesign implementation in detail.

The second significant success factor is commitment of the management and clear environmental goal (Allenby and Fullerton, 1991; Bakker 1995). McAlloone goes into more detailed list under the management commitment:

"Manifest through the provision of resources, company environmental visions statement, the commitment to achieve recognized environmental standards, the support of environmental training schemes, and corporate membership of external environmental forums environmentally conscious design does not become an integral part of the design process." (McAlloone 1998 in Bhamra, 2004: 564)

In general, authors agree with the idea that environmental commitment has to be adapted to the design process in an integrated manner.

Table 2.7. Success factors for integration of ecodesign into product development
(Johansson, 2002).

Success Factors	
Management	<ul style="list-style-type: none"> ▪ Commitment and support are provided ▪ Clear environmental goals are established ▪ The environmental issues are addressed as business issues ▪ Consideration the strategic dimensions of ecodesign rather than just operational dimensions ▪ Ecodesign is not only treated on an operational level, but also on a strategic level ▪ Environmental issues are included when establishing a company's technology strategy
Customer relationships	<ul style="list-style-type: none"> ▪ Adoption of a strong customer focus ▪ Training of customers in environmental issues
Supplier relationships	<ul style="list-style-type: none"> ▪ Close supplier relationships
Development process	<ul style="list-style-type: none"> ▪ Consideration of environmental issues early in the PDP ▪ Integration of environmental issues into the existing PDP ▪ Introduction of environmental checkpoints, reviews and environmental milestone in the PDP ▪ Use of company-specific environmental design principles, rules and standards ▪ Ecodesign is performed in cross-functional teams ▪ Support tools are applied
Competence	<ul style="list-style-type: none"> ▪ Education and training are provided to the product development personnel ▪ An environmental expert supports the development activities ▪ Examples of good design solutions are utilised
Motivation	<ul style="list-style-type: none"> ▪ A new mindset emphasizing the importance of the environmental issues is established ▪ Presence of an environmental champion ▪ Individuals are encouraged to take active part in the integration of ecodesign

Another vital factor for the management of a company is clear environmental goal, which leads to systematic way and determine the specific target for the design team.

There are additional success factors stressed in the literature. Mathieux et al. (2001)'s study emphasizes the cooperation as a key factor for successful ecodesign implementation in the companies, which is also underlined in Boks (2006)'s study. According to Boks study, marketing issue and the voluntary approach to learn ecodesign by practicing on specific projects are also considerable aspects to accomplish in ecodesign activities. Then, Tukker et al. (2000) adds following factors:

- the presence of potential marketing benefits resulting from achieving ecodesign awards;
- the implementation of Product-oriented Environmental Management Systems (POEMS);
- and most importantly, the presence of situations where ecodesign creates true business opportunities

In the review of ecodesign literature, although external drivers are seen as the initiator of ecodesign practices in the company, the internal drivers are actually the most powerful stimuli for the business to perform environmental improvements in the long term, as Van Berkel et al. (1997) emphasizes the same idea. By contrast, Vercauteren and Jansen (2001) believe that it is not easy to place environmental considerations into the companies as center as other conventional requirements such as price, functional and ergonomic qualities of product, and it only becomes reality if the external pressure increases. However, they also state that this could change into proactive approach if a company can see business benefits deriving from a responsible environmental image. Moreover, Rose et al. (2000 in Boks, 2006) stress that "without proper development of the internal value chain, the external value chain is difficult to manage" (p.1348). They also state that appropriate organization of the internal value chain will help to provide incentives for design improvements, and understanding and enhancing internal drivers for product designers can help environmental product improvement. Consequently, the companies are stimulated by the number of drivers from both inside and outside of their environment rather than a single stimulus (Hemel and Cramer, 2002).

2.3.2 Integration of Ecodesign into Product Development

Currently, increasing attention to the environmental issues has become a powerful motivation for the redesign of existing products and new product development activities (Olundh, 2006). The product developers make an important contribution to the improvement of products from an environmentalist perspective. Mackenzie (1997) describes the role of the designer as a bridge between manufacturing process and consumer, and between technology and marketing. Therefore, it is a new challenge for them to incorporate environmental issues in designing by ensuring the fulfillment of the market

demands and regulations. For this reason, designers should have enough knowledge about understanding and implementation of environmental improvement of product besides the technical abilities to design (Lofthouse et al., 1999). This can be achieved by the help of good cooperation and the information flow between the departments of company.

Some of the studies in the literature point out the benefits of the ecodesign implementation in the early stages of design process (e.g. Bhamra et al., 1999; Ries et al., 1999; Johansson, 2002; Sherwin and Evans, 2000). As illustrated in Figure 2.9, there are many design alternatives at the beginning of the project.

When the design process progresses towards later stages, decrease in design alternatives can be observed. The core needs for the product is determined by the help of the consideration of consumer surveys, benchmarking results and existing product and process activities at the product strategy (Lambert, 2002). Other stages, conceptual design and detailed design, stages decisions are made decisions in terms of the predefined requirements. Therefore, the most substantial reduction in the environmental impacts of a product can be made at the pre-specification period or primary design. However, designer rarely involves the pre-specification period, in which clients or senior management have a significant influence on the decisions about product qualities (Bhamra, 2004).

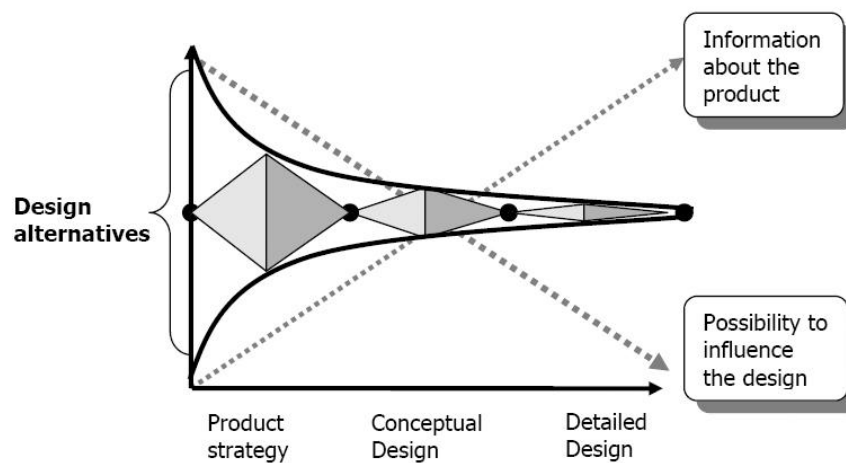


Figure 2.9. The product development process (Bhamra 2002, in Lambert, 2002).

Some highlights from the survey of Bhamra et al. (1999), which can be considered as key factors for the introduction of ecodesign into the early stages, are as follows:

- Pre-specification environmental design changes have greater impact on the environmental profile of the product,
- The later ecodesign is introduced into the design process, the harder it is to affect the environmental profile,
- It is imperative to include marketing and design jointly in early design so it was understood the need for ecodesign,
- Current ecodesign tools demand a high volume of data, but at the early stages of design, data is low in volume and of low quality,
- At all stages of design, designers often only want a tool which will allow quick alternatives analysis enabling them to make decisions about which material or other options to take. (Bhamra et al., 1999, p.332)

2.3.3 EcoDesign Implementation Processes

The implementation of ecodesign in new product development includes complicated steps. This is partly because the prioritization of a product's environmental considerations changes its functionality and business values. Therefore, it is hard to put into practice a specific set of rules to implement ecodesign (Brezet et al., 2001). On the other hand, it is possible to come across some studies in the literature trying to build frameworks. Simon et al. (2000) indicate that ecodesign can be managed in two levels: strategic and operational. Strategic level provides the determination of the issue within the entire organization, whilst the operational level targets the practice in product design. Thus, strategic level adapt infrastructure of the organization in terms of the requirements of ecodesign implementation. After the organizational structure, it can be moved on the operational stage. One of the good frameworks 'ARPI' is proposed as a result of Simon et al. (2000)'s survey. ARPI refers to four stages: Analyse, Report, Prioritize and Improve. Table 2.8 shows the detailed description about each stage of ARPI in both strategic and operational level.

Stevens (2001) provides more basic categorization of the execution of ecodesign during his studies carried out with Philips Consumer Electronics. These three categories are:

- Idea generation: determination the position of company in terms of the environmental benchmarking and green supplier assessment.
- Consolidation in the product specification and technical execution: determination the prioritization in line with all issues of product and execution in five local areas.
- Exploitation of results: feedback from the results (e.g. LCA) and overall evaluation of green benefits.

Table 2.8. A four-stage framework for organizational planning of ecodesign (Simon et al., 2000).

Step	Strategic level	Operational level
Analyze	Assess the external and internal drivers for EcoDesign and benchmark the organization.	Assess the product in light of specific drivers (e.g. legislation), using LCA or similar tools.
Report	Communicate the corporate environmental status and policy to improve environmental culture.	Communicate the results to the design team and obtain feedback.
Prioritize	Develop an EcoDesign strategy (within corporate product development strategy) and set overall EcoDesign objectives.	Set targets for the product for inclusion in the specification; targets may be chosen levels for company metrics.
Improve	Plan action such as pilot projects and training; develop or customize metrics, tools, and methods.	Carry out normal product design incorporating appropriate tools used by trained and aware designers.

Table 2.9. Australian ecodesign implementation process (Bhamra 2002, in Lambert, 2002).

Stage	Who involved
Analyse opportunities	Managers, designers, engineers, accountants and marketers
Promote EcoDesign within company	Managers
Set goals and identify strategies	Managers
Apply ecodesign tools	Designers, engineers
Develop the product	Managers, designers, engineers, accountants and marketers
Market the product	Marketers
Evaluate	Managers, designers, engineers

The example from an Australian study is remarkable at this point to present the distribution of tasks in the ecodesign implementation process (Table 2.9).

On the basis of an empirical study carried out in 32 companies across Europe and the USA, the model proposed by Bhamra and Evans (1999) includes three main stages for companies so as to combine their strategies with ecodesign. These are initial/sustained motivation, communication /information flow and whole-life thinking (see Figure 2.10). At the first stage of eco-design integration, companies begin to implement DFX principles through external forces, such as legislations or need to recycle. Top management understanding and commitment is main requirement to change reactive approach of companies into proactive and progress to another level. At the second stage, exchange of information between designers and other specialists is observed to understand the life cycle of a product. Thus, an introduction of some organizational learning about ecodesign principles can be transferred in the departments. Final stage involves high understanding of product life cycle phases. At this stage, there is an awareness of the long-term benefits of environmental improvements and life cycle thinking.

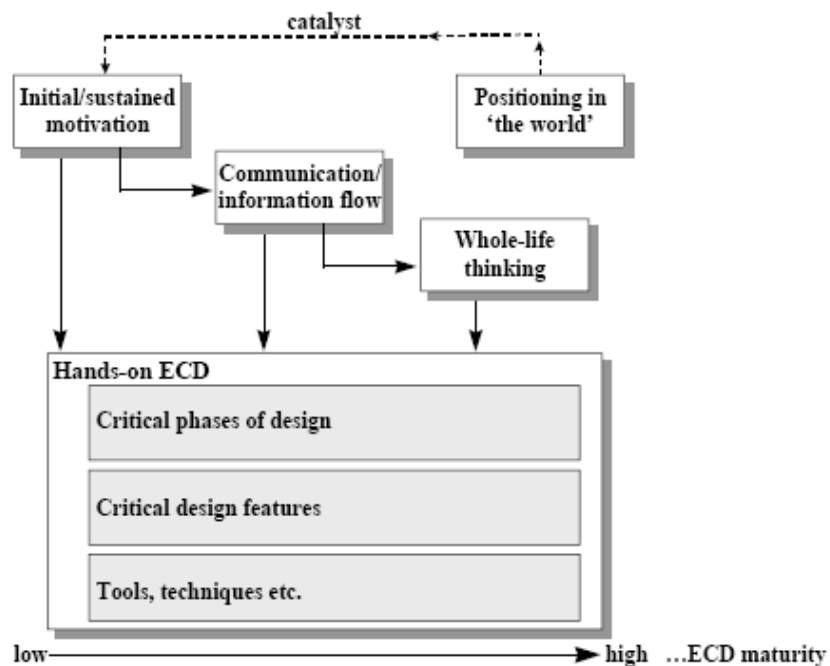


Figure 2.10. The model of ecodesign integration (Bhamra and Evans, 1999).

2.4 Studies Related to Integration of Ecodesign around the World

This part of the study presents the latterly researches related to ecodesign activities in different contexts. It is an effort to understand the current studies concerned in relation to environmentally-conscious design. It is also aimed to figure out in which contexts the other foreign countries tackle this issue. As mentioned before, selected recent studies are mostly from European countries. Only Central American study is an example from the U.S.A. This is because countries are selected both from developed and developing economies to see the differences between them. For this reason, Central American study has believed to present valuable information as a developing country.

The results of the studies give an idea about motivations, drivers and obstacles of companies while practicing and adapting ecodesign strategies. Therefore, the overview is considered as a useful learning before examining the Turkish context.

2.4.1 Overview of the Studies

The studies that will be presented in this part cover a wide range from the world including the Netherlands, Central America (Costa Rica, Guatemala, El Salvador), Baltic States (Lithuania, Latvia, Estonia), South America (Northeast Brazil), France and other European Countries (15 EU Countries).

2.4.1.1 The Survey in the Netherlands

Van Hemel and Cramer (2002) executed a survey on 77 Dutch SMEs. The survey aimed to discover which factors (stimuli and barriers) stimulate or hamper the Dutch SMEs towards environmental improvement in their design processes. Additionally, the most successful ecodesign strategies (based on the Ecodesign Strategy Wheel, LiDS Wheel) were investigated through the survey. Contrary to the literature, the most powerful factors stated in the study were internal factors for SMEs. Internal dynamics of companies in the survey shows that the companies were more aware of the ecodesign benefits which correspond with companies' traditional business benefits. Ecodesign was seen as an opportunity for innovation and new market and a tool for increasing of

product quality by SMEs in general. The most influential internal and external drivers for this study are presented in Table 2.10.

Table 2.10. The results of the study (Van Hemel and Cramer, 2002).

Internal factors	External factors
The opportunities for innovation	Customer demands
The expected increase of product quality	Governmental legislation
The potential market opportunities	Industrial sector initiatives

Van Hemel and Cramer (2002) also made a distinction between barriers; initial barriers and no-go barriers. Although initial barriers were mostly stated as an obstacle that decrease the success of an ecodesign option, no-go barriers exactly block the priority of the related ecodesign options. As it was emphasized in the survey, the improvement of ecodesign is not only dependent on comprehensive technical solutions but also interrelates with economical and social factors. From this perspective, no-go barriers address these tangible factors.

Table 2.11. The barriers found in the study (Van Hemel and Cramer, 2002).

Initial Barriers	No-go Barriers
Conflict with functional requirements	No clear environmental benefit
Commercial disadvantage	Not our responsibility
	No alternative solutions is available

According to results of the survey, the 10 most frequently suggested ecodesign solutions mentioned by the participants were determined among the 33 possible solutions of LiDS Wheel. These 10 suggested solutions are considered as the most successful ones as well. Four most successful strategies were recycling of materials, high reliability/durability, recycled materials and low energy consumption. Moreover, it was found that the success of a particular ecodesign

principle is closely linked with forces of high number internal and external drivers and few barriers.

2.4.1.2 The Survey in Central America

The survey was carried out by Crul (2003) between 1998 and 2002, which addresses the adaptation of ecodesign concept into a regional approach for the Central America. The project was executed in industries of Costa Rica, Guatemala and El Salvador, aiming to analyse and describe the process of introducing 'ecodesign' in companies in Central America.

The main idea behind the project was to describe the process of introduction of ecodesign in Brazilian SMEs in order to improve environmental aspects of products in the companies. The second purpose was the execution of demonstration projects, regional capacity and awareness building to achieve the aim of the study. For many companies in the Central American survey, that was the first experience of a structured product development regarding environmental considerations. As a result of the project, some of the companies designed new products and the rest re-designed existing ones by practicing ecodesign principles. Furthermore, environmental impact reduction between 10% and 50% could be achieved in the case studies. For the second phase, with the help of the findings of first phase, a transition towards local leadership and continuous learning approaches was made (e.g. developed UNEP manual).

It can be concluded that external factors were determined as mostly missing point in the region such as legislative or regulatory pressure and demand from the market. On the other hand, internal factors such as cost reduction, image, positive attitude, and to a lesser extent, environmental benefit were existing stimulator for the companies. Among the ecodesign options, the mostly preferred ones are materials reduction, optimization of initial lifetime and efficient distribution.

2.4.1.3 The Survey in the Baltic States

A survey titled 'Eco-design in the Baltic States' Industry: Feasibility study" was performed by LPPC (Latvian Pollution Prevention Center), APINI (The Institute of Environmental Engineering) and SEI-Tallinn (Estonian Institute for Sustainable

Development) in 2002 (Belmane et al., 2003). It was prepared to inform governments, different international support structures and other stakeholders about improvement of industrial environmental performance in the Baltic States (i.e. Lithuania, Latvia and Estonia).

The structure of the Baltic States industry consists of low and medium technology industries in a great extent and high technology industry in a lesser extent (3-4%) (Belmane et al., 2003). As mentioned in the survey in Baltic States, the innovation-based attitudes could be encouraged only in high tech products even the new innovation centers have been adapted in each country by the governments of the Baltic States. It was found that environmental improvement is not seen as an element of product development and product innovation in the Baltic States yet. Moreover, based on the findings of the Baltic States' study, there is a gap between academics/research institutions and industry. In accordance with the respondents, science environment did not have enough competence in product development.

The most important driver in Baltic States is legislation (Belmane et al., 2003). The regulations on packaging and chemicals are preliminary forces to stimulate the implementation of ecodesign in companies. Additionally, market demands and cost reduction are other significant factors. Apart from these, the international legislations (e.g. on electric electronic waste) compel the transitional companies to consider environmental improvements in product development, even before national legislations. There are substantial problems, which are generally connected to deficiencies in information base, hampering the integration of environmental considerations into business and these are (Belmane et al., 2003):

- lack of information on market possibilities,
- lack of competence and external support,
- lack of financial support and information on new technologies.

In parallel to these results, the most important point determined in the survey is the lack of education, and information and training related to ecodesign, which should be given priority before industry-specific issues.

2.4.1.4 The Survey in South America

The survey conducted in South America by Costa and Gouvinhas (2002) analyzed SMEs of Northeast Brazil in order to understand the directions of companies in relation to the integration of environmental issues in product development. It was revealed the internal and external drivers and 'roadblocks' (barriers) for the companies. The research proposed to find the mostly employed ecodesign strategies within SMEs.

The results of Brazilian survey pointed out that, environmental issues were not seen as strategic issues for the business. Companies feel responsibility if only the government legislations or competitor's initiatives push forward them to be more environmentally conscious (Costa and Gouvinhas, 2002). This can be the reason for companies' inadequate strategic frameworks which only provide short term solutions. In accordance with results of the survey, the four most important reasons to implement environmental issues into SME were found as:

- legislations,
- reduction of costs (lower cost price of the product),
- new market opportunities,
- interesting long term innovation opportunity.

There is little awareness of environmentally-friendly products among Brazilian consumer, in a sense; demand for eco products is low. Other barriers are:

- the lack of available new technologies,
- the lack of available educated staff.

On the basis of these findings, it can be concluded that the companies in Brazil tend to have reactive approaches instead of acting proactive regarding as environmental issues. The legislations generally force the industry. They do not take initiative so as to change the existing situation in a positive way, but just employ the rules.

2.4.1.5 The Survey in France

Reyes et al. (2006) carried out a survey with approximately 100 foreign experts (e.g. European, North American, Korean, and Japanese) and 150 French experts (consultants, researchers, and institutional managers) in France in order to understand the levels of the ecodesign integration into SMEs. Especially, they intend to analyse initial motivations, action drivers and evaluation factors of environmental performance levels.

The motivation of company is strongly connected with the manner (approach) of the company. In the France survey, two different behaviors considering the environment were mentioned; eco-defensive behavior and eco-offensive behavior (Reyes et al., 2006). This looks like reactive and proactive approach of companies to environmental issues. Eco-offensive behavior is an insight which fulfills the mandatory aspects and regards the environment as an only cost reduction parameter. Eco-defensive behavior considers the environment as a key aspect of the product development.

The most prominent motivations found in the survey can be summarized as:

- the respect of the regulation pressures,
- the internal strategy of the group,
- the economic and commercial profits,
- the satisfaction of stakeholders requirements,
- the initiative of the industrial sector.

These results exposed the main action drivers for consistent integration of ecodesign. The most significant ones were related to management, relations with stakeholders, knowledge management (e.g. educating the team or determining a competent leader), the use of tools and methods, operational application in the product development and market and competition.

The main obstacles were found to be the lack of top management commitment and the resistance to change. In addition, there are interesting points which experts mentioned, for example, not recognizing feedback from own employee, the poor incentive from the professional networks.

2.4.1.6 The Survey in the European States

The survey carried out by Tukker et al. (2000) covers the understanding of the industrial motivation to apply ecodesign in practice through the 15 European countries. Besides, activities regarding method development, dissemination and education were analyzed. During the survey, 500 (randomly selected) transnational companies from each country were cooperated to discover the implementation of ecodesign. As a consequence, the survey can be described as a quick search to see the present situation of ecodesign in Europe.

In the view of inquiry results of Tukker et al. (2000), the EU countries can be discussed in three groups: front runners such as the Netherlands, Germany, Austria, Sweden and Denmark form the first group which has comprehensive studies and plans about method development and dissemination for now and also for the following decade. The second group is intermediates who have set out the environmental programs in a relatively shorter period (five years). Belgium, France, Finland, Italy, Spain and Portugal are the examples of these countries. The third group, inactives are the Republic of Ireland, Greece and Luxemburg who lag behind the attitudes of SPD in the national structure. Obviously, it is difficult to practice the third step of ecodesign innovation (level 3) or, especially, level 4, even in front runners. In fact, practicing environmentally-conscious manufacturing has existed but this approach has not been transformed to product design in SMEs yet.

Among the drivers proposed in the survey, the most important one is to persuade companies for the ecodesign benefits from a business perspective. Consumer demand or cost reduction can be given as a good example of these benefits. However, the first filter for the consumer is in general price. As concluded in the survey, final consumer is not willing to pay more for eco products in general. This cannot be ignored by the industry.

The main industries implementing ecodesign are packaging, electronics and automotive industry, which have been strongly affected by the EU regulations related to waste reduction. This proves that both the national and international regulations are the key drivers for ecodesign activities. In that sense, transnational companies are more inclined to put good intentions into practice.

2.4.2 Discussion on the Presented Surveys

This section presents benchmark of six recent research studies on the adaptation and implementation of ecodesign in different regions in the world: France, Central America, The Netherlands, The Baltic States, Brazil and the European Union. Moreover, the summarized outcomes of the reviewed ecodesign country or region research studies are presented at the end of this part in Table 2.12 and Table 2.13.

The drivers and obstacles found in the studies lead to similar results in general. 'Regulations', 'cost reduction' and 'market demand/competitors' initiatives' are main influential factors for companies. Especially, the external factors are indeed key dynamics of European States (Tukker et al., 2000). Tukker et al. believe in the importance of regulations and mentions that governmental regulations support ecodesign concept in two directions; first one is 'creating incentives', another direction is 'dissemination'. It means that policy action makes market demands enhance and it also shifts public attention to environmentally-conscious products. As a result, government should be first supporter to promote and disseminate environmental approach for both the consumer and the industry. On the other hand, improving environmental consciousness should not be perceived as just being related with government pressure (Belmane et al., 2003). Companies need to understand the advantages of ecodesign. From this perspective, three evolutionary levels through the understanding of companies related to integration of ecodesign were observed in the studies (Figure 2.12).

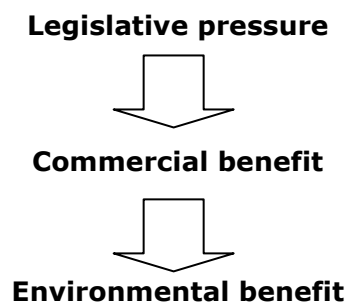


Figure 2.12. Evolutionary approaches in industry.

The countries newly combining their target with environmental considerations go along with the legislations. This top-down approach appears vital for especially developing economies to put ecodesign activities into action in industries. Then they realize a wealth of advantages from commercial perspective such as cost reduction, increasing product quality, encouraging innovative solutions. Therefore, companies make changes in organizational level to integrate ecodesign into their organizations. Further understanding matches with the realization of environmental benefits: to be aware of the bad course of environmental problems and to do something for preventing it. Beyond the commercial benefit, companies see their responsibilities to the environment in this level and take steps according to their environmental ideology. Van Hemel and Cramer emphasize that "an ecodesign improvement option only stands a chance, if it is supported by stimuli other than the expected environmental benefit alone" (2002:453).

The barriers observed in the surveys follow three clear ways. First one is the obstacles connected to dissemination of ecodesign information such as lack of knowledge, lack of information on market possibilities, lack of information on new technologies, and lack of training related to ecodesign etc. Second one arises from the internal values in company such as lack of top management commitment, conflict with functional requirements and commercial disadvantage. The last one refers to limitations especially economical constraints. Limitation of technology, limitation of investment and financial support can be given as examples for this group. It is an important issue especially for developing countries. Most of the obstacles to implement ecodesign in developing countries (e.g. Baltic States) depend on the economical limitations.

One of the remarkable problems, which noted in the Baltic States framework, is the troubles that they encounter in traditional product development. Enterprises are anxious about taking high risks by implementing new concept (ecodesign) into their business strategy since it requires extra effort, money and time for the companies in the beginning. In this respect, the companies do not want to treat beyond conventional values in product development. Therefore, their preferences are closely connected to the ecodesign strategies which match traditional business benefits such as cost-based strategies.

Another significant point is management structure. Corporate leader generally has central position to decide many tasks and strategies in the company. Therefore, managers should be willing to take initiative by means of ecodesign activities in organization. Although many studies highlight the designer as decision makers, as seen in the studies, the designer cannot take action by him/herself. On the other hand, innovation is seen as a new challenge in competitive market and environmental values can be point of origin to achieve in product innovation. In that sense, the role of designers in the production should be rethought to encourage innovative solutions in product development which will offer many benefits to companies.

Table 2.12. Main outcomes of the reviewed ecodesign country or region research studies.

Case	France	Central America	The Netherlands
Description	A survey (Reyes et al., 2006) of approximately 100 foreign experts (e.g. European, North American, Japanese) and 150 French experts (consultants, researchers, and institutional managers).	A PhD thesis (Crul, 2003) that addresses the adaptation of ecodesign concept into a regional approach for Central America.	Hemel and Cramer (2002) executed a study of 77 Dutch SMEs.
Aim of the study	To understand the levels of the ecodesign integration in France. Especially to analyse the initial motivations, action drivers and evaluation factors of environmental performance levels.	To foster environmental aspects of products by describing the process of introduction of ecodesign in SMEs in Central America.	To discover which factors (stimuli and barriers) stimulate or hamper Dutch SMEs towards environmental improvement in their design process.
Main drivers	Management, relations with stakeholders, knowledge management (e.g. educating the team or determining a competent leader), the use of tools and methods, operational application in the product development and market and competition.	Cost reduction, brand image.	The opportunities for innovation, the expected increase of product quality, the potential market opportunities, customer demands, governmental legislation, industrial sector initiatives.
Barriers	Lack of top management commitment, the resistance to change.	Lack of external barriers such as legislation.	Conflict with functional requirements, commercial disadvantage, no clear environmental benefit, not our responsibility, no alternative solutions is available.
The region		Costa Rica, Guatemala and El Salvador.	
Mostly preferred strategies		Materials reduction, optimization of initial lifetime and efficient distribution.	Recycling of materials, High reliability/durability, recycled materials and low energy consumption.

Table 2.13 Main outcomes of the reviewed ecodesign country or region research studies.

Case	Baltic States	Northeast Brazil	European States
Description	The survey (Belmane et al., 2003) is prepared to inform governments, different international support structures and stakeholders about improvement of industrial environmental performance in the Baltic States.	Costa and Gouvinhas (2002) analyzed SMEs of Northeast Brazil to understand the directions of companies in relation to the integration of environmental issues in product development.	Comparative analysis by Tukker et al. (2000) conducted with 500 transnational companies from 15 EU countries in order to discover the implementation of ecodesign.
Aim of the study	To collect and evaluate present situation of eco-design and product development so as to discover prominent strategies for introducing the ecodesign concept in Baltic States.	To understand the internal and external drivers and also "roadblocks" in the companies.	To explore the methodological approach and the policy implications of the countries related to ecodesign by each country studies
Main drivers	Legislation, market demands, cost reduction, international legislations.	Legislations, competitor's initiatives.	International and national legislations, cost reduction, stakeholder pressure, customer demands, better product/market opportunities.
Barriers	Lack of information on market possibilities, lack of competence and external support, lack of financial support and information on new technologies, lack of education and information and training related to ecodesign.	Little awareness of environmentally-friendly products, the lack of available new technologies, the lack of available educated staff, instability of the Brazilian economy.	Missing understandable tools and strategies (language barriers and cultural barriers), less considerations on environmental benefits in companies.
The region	Lithuania, Latvia, Estonia	The Rio Grande do Norte State, Northeast of Brazil	15 EU countries (including Turkey)

CHAPTER 3

CURRENT SITUATION OF ECODESIGN IN TURKEY

In the body of this chapter, a literature review on ecodesign activities in Turkish industry is presented from three perspectives, policy framework, existing company activities in the field of ecodesign and ecodesign related training activities for Turkish companies. First, economic structure, industry and product development activities in Turkey is analyzed to understand the current situation for adapt sustainable development. Then, the results of the inquiry with Turkish stakeholders to understand the perceptive of stakeholders to ecodesign are presented.

3.1 Brief Overview of the Turkey's Economic Structure

Turkey is ranked within 15 for having the largest economy in the world, and having the 6th largest economy within the European Countries (Invest, 2007). Currently, Turkish economy has one of the highest economic growths in the Organization for Economic Co-operation and Development (OECD). The increasing GDP growth per capita refers to the increasing standard of living in Turkey. Concerning the statistical information, the view of GDP growth rate has some drastic changes year by year related to the economic instability in Turkey (UNECE, 2007) (see in Figure 3.1). However, in recent years, the GDP growth rate has been more stable and the average rate between 2002 and 2007 is 7%, as can be seen in Figure 3.2.

The economic condition of Turkey has changed after 1980 in which Turkish industry was opened to international market. In the following years, considerable growth rate, by means of the increasing export ratios, was experienced. However, the expected development level could not be achieved which was overshadowed a number of problems including high inflation rate. Additionally, a few sharp decreases in GDP growth by the years are observed, as

a result of, for example, the Gulf crisis in 1994 and the big earthquake of Adapazarı in 1999. During these difficult times, the Turkish government had tried to take actions by the 'Stabilization and Structural Adjustment Package' released on 5 April 1994; fiscal adjustment plan in 1999, and a stand-by arrangement (SBA) with International Monetary Fund (IMF). Moreover, the initiation of the customs union period with European Union (EU) has been a good motivation for Turkish industry to improve itself in a direction towards more environmentally-conscious manufacturing and product development.

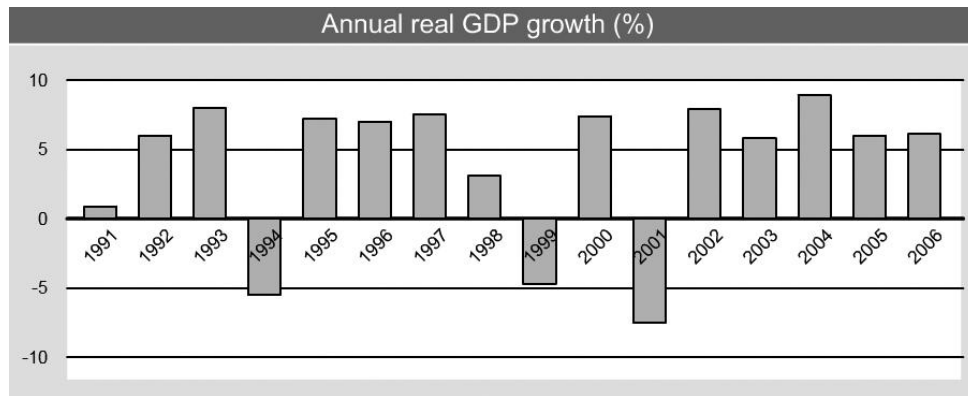


Figure 3.1. Annual real GDP growth rate by the years (The World Bank, 2006).

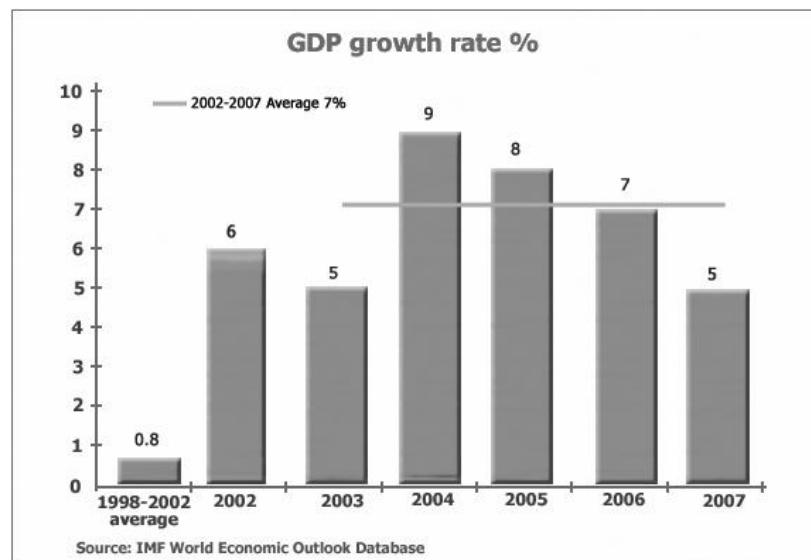


Figure 3.2 Recent annual GDP growth rate

After this course of economic situation in recent years, it can be said that Turkey has kept relatively more stable economic conditions because of successfully implemented structural reforms and effective policies of the government (IGEME, 2005). Minor changes (average 7% between 2002 and 2007) are a good example of this progress. However, the government has still fought population problem and unemployment rate. Therefore, Turkish economy can still said to be vulnerable, which is also put by the World Bank's expectation survey:

Notwithstanding the good economic performance of the past years, macroeconomic vulnerabilities remain. Turkey has weathered the recent uncertainties and the ongoing market volatility originating from US sub-prime mortgage losses, demonstrating the much-improved resilience of the economy... The country's widening current account deficit, one of the main sources of vulnerability (...) (The World Bank, 2007).

As a consequence, Turkey has suffered high inflation rate and their serious effects throughout over two decades. Many plans made for overcoming the high inflation rate, which has led to instability in the economy, inequality of incomes, and implicitly, decreasing the rates of Human Development Index (HDI) (Sagir and Yuksel, 2002). Nonetheless, there has been a hopeful growth in the economy in recent years (Figure 3.2). This positive performance is considered to be sustained and improved for more powerful economic structure.

3.2 Overview of Turkish Industry

The Turkish Industry holds many advantages from the perspective of international market, such as the wealth of natural resources, geographical position to export markets, the improvements of infrastructure and telecommunication systems, the existence of young and qualified human resources, and potential big domestic market (IGEME, 2005). According to the most recent information of CIA (Central Intelligence Agency), the sectoral contribution of agriculture, industry and services to total GDP is 8.9%, 30.8% and 59.3% respectively. The changes of growth rate for each sectors during the years between 1997 and 2005 can be seen in Figure 3.3.

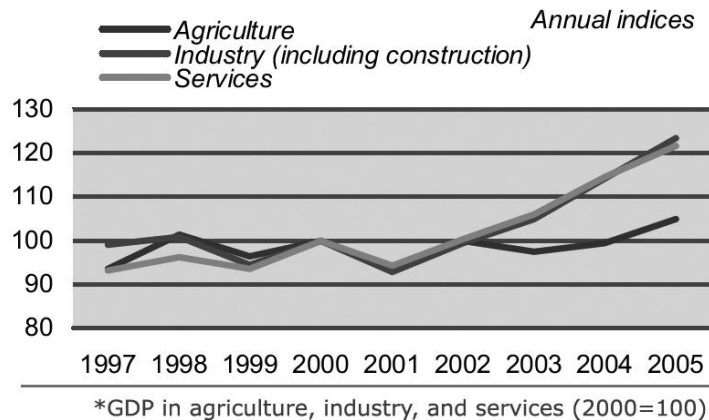


Figure 3.3. The contribution of agriculture, industry and services in GDP (United Nations Economic Commission for Europe UNECE Countries in Figures - 2007).

Nevertheless, the same positive performance could not be observed for the high-tech industry (e.g. pharmaceuticals, aircraft & spacecraft). The activities for high-tech industry, as well as research and development (R&D) have been recently in the agenda of the Turkish Government with the establishment of Technology Development Foundation of Turkey (TTGV) in 1991 and with involvements of the Scientific and Technological Research Council of Turkey (TÜBİTAK). However, the value of high technology exports of Turkey is still low (1.5%) while it was 1.2% in 1990 as it is mentioned in UNDP 2007-2008 report. Despite the attempts have been made to stimulate high-tech industry, the numbers indicate slow development in this field.

Turkish industry consists of private sector to a great extent. Currently, textile and clothing sectors are leading the industry with the largest share in manufacturing. Food products, chemicals, machinery, iron and steel, motor vehicles, rubber and plastics, ceramics, cement and glass are other major manufacturing industries with respect to their involvement in GDP (IGEME, 2005).

Additionally, industry exports have a big share (82%) in total exports. The main export sectors are clothing and textiles, automotive and parts, electrical machinery, iron and steel, food products, chemicals, rubber articles, plastic articles, gold jewellery, ceramics, glass and furniture. EU countries are the most

important market for Turkey with reaching over the half of the country's total exports. The breakdown of the countries, that Turkey exports can be seen in Table 3.1.

Table 3.1. Export rates of Turkey between the years 2007 and 2008 (TUIK, 2008).

Countries	August				January-August			
	2007		2008		2007		2008	
	Value	(%)	Value	(%)	Value	(%)	Value	(%)
Total Exports	8 737	100.0	11 038	100.0	67 295	100.0	92 489	100.0
EU (27) Countries	4 629	53.0	4 669	42.3	37 978	56.4	45 627	49.3
Other Countries	4 107	47.0	6 369	57.7	29 317	43.6	46 861	50.7

Value: Million \$

In the following sections (3.2.1 and 3.2.2), packaging and household sectors will be explain in more detail, which are the subject for the survey within this present study. The detailed information for why these sectors are chosen as focus sectors for the survey is given in Chapter 4.

3.2.1 Packaging Sector

Packaging sector is one of the fast-developing sectors in Turkey. With the increasing investments and the number of firms, the quality of the products also has been improved (Bektasoglu, 2007). It is an interesting point that this development also has close relation with the changing shopping habits especially in big cities (Erismis, 2007). This is because newly popularizing big shopping centers and hypermarkets, which improve packaging industry, have been a big part of life in Turkey. People have begun to prefer spending their spare time in these centers including big shopping markets, cinema, restaurants, café, bar, and sport centers.

Turkish packaging industry manufacture various types of packaging products, including paper, cardboard, wrapping film, tape, plastics, glass, metal and wood. Annually, about 3.5 million tons of packaging is consumed in Turkey (Bektasoglu, 2007). Paper, carton and corrugated board products are the leading sectors within the packaging industry with 33% of production rate.

Exports of the Turkish packaging industry follow the same increasing trend because of the modernization and technological improvements. Plastic industry is the leader in packaging exports. Other sectors share the exports as shown in Figure 3.4.

	2002	2003	2004	2005	2006
Plastic packaging (*)	489,639	607,116	769,241	955,420	1,107,265
Wood packaging	6,965	9,250	14,186	19,199	24,021
Paper and carton packaging	139,627	164,902	203,520	234,881	254,283
Glass packaging	25,500	23,417	23,909	17,915	16,547
Metal packaging	40,057	56,720	82,451	107,299	147,237
Other packaging	6,359	11,715	14,221	17,083	17,739
Toplam	708,146	873,120	1,107,528	1,351,797	1,567,094

Source: Undersecretariat of Foreign Trade

() including sacks and bags, of polyethylene or polypropylene strip or the like and flexible intermediate bulk containers for the packaging of goods*

Figure 3.4. Breakdown of the packaging export materials by Turkey (Bektasoglu, 2007).

3.2.2 Household Appliances Sector

The Turkish household appliances sector started its production as an assembly industry in the 1950s. With the increasing population and living standards, the sector has continually expanded. The sector has a wide product range such as refrigerators to electrical shavers, microwaves, and tabletop fridges. Household appliances sector is a good example in Turkish industry regarding the sectors high priority to innovation and new product development (Esen, 2007). The main aims of the Turkish household appliances sector through the production are (Esen, 2007):

- to consume with environment-friendly, and low water, energy, and detergent consumption,
- to provide convenience and consumer satisfaction (e.g. silent, user-friendly),
- to be affordable and comply with future standards.

From this perspective, quality, safety and the environmental aspects of production are the key factors for the sector. For example, companies which sell their products in Turkish market have fulfilled CE requirements (CE refers to as

Conformitee Europeenne' which certifies that a product meets EU health, safety, and environmental requirements). Since 2003, it has become mandatory both for while exporting to the EU and for the domestic market. Moreover, many of them have followed international standards, such as ISO 9000.

Exports of the Turkish household appliances sector have been growing considerably. Actually, most of the household production meets export demand. According to IGEME studies, Turkey was ranked as the 11th among the countries exporting household appliances worldwide. Refrigerators, washing machines, ovens, deep freezers and dishwashers are the highly exported products of the sector (Esen, 2007). (see Figure 3.5)

Product	2002	2003	2004	2005	2006
Refrigerators	2,247	3,035	3,361	3,640	4,796
Washing Machines	988	1,550	2,236	2,680	3,527
Dishwashers	149	239	288	366	570
Ovens	1,000	1,189	1,388	1,102	1,460
TOTAL	4,384	6,013	7,211	7,788	10,353

Source: Association of Turkish Household Appliance Industrialists

Figure 3.5. Exports of four major household items (1,000 units). (Esen, 2007).

3.3 New Product Development in Turkey

Industrial design is defined by Er (2001) as an activity in which the knowledge and the technology are transformed into the products that consumers can use. Beyond improving current qualities of product, industrial design is seen as a way of innovational thinking by designing new products or new systems. In that sense, it is a powerful element for companies in competitive market situations. However, from the perspective of developing countries or newly industrializing countries (NICs) like Turkey, new product development meet little effort because of the lack of technological opportunities and different priorities shaped by difficult economic situation. The following part will give some crucial improvements to stimulate new product development in Turkey.

With the free market economy introduced after 1980, industrial design has gained considerable importance. The desire of Turkish industry to be an international brand has led the industry through a way which creates brands through design (Suel, 2006). Thus, as Suel (2006) states, a need for a new product design development structure was emerged which means a new discourse for both academic environment and manufacturing industry. In other words, the industry has a desire to be in the competitive market with their products, whilst academia focuses on educating new design professionals. Within this context, the only professional organization in the industrial design field in Turkey, the Industrial Designers Society of Turkey (ETMK) was established in 1988. According to regulation of the Society (ETMK, 2005), the aim of ETMK is to introduce the industrial design profession to the society, to form and protect the rights of industrial designers, provide the communication and interdependence between the industrial designers and conduct studies with enterprises and corporations in order to ensure designing well-qualified products.

Another critical episode was the beginning of the EU accession phase in 1995, which has changed the standards and priorities in Turkish industry. Yazıcı describes (2006, in Suel 2006) this situation as:

The Turkish manufacturing industry faced with the responsibilities and sanctions to fulfill the requirements to oblige international production standards, improve competitive factors like technology, innovation, quality, research and development and respect to the issues like user priorities and environment. (p.42)

Within the context of customs union with EU, fundamental changes were implied in the Turkish trade, legislation and policies, and creates new opportunities and challenges for the Turkish economy. The Decree-Law No.554 on the protection of industrial designs was one of the aspects during this harmonization period. Thus, its aim is to protect the intellectual property rights of both industrial designers and firms in which industrial design is a part of their business. These examples show the course of industrial design. However, there are still few numbers of design corporations. Mostly, industrial design activity does not go beyond the product modification which includes redesigning of existing products even in big companies. On the other hand, governmental support for R&D activities has encouraged the innovation and R&D studies (even limited) in

product level during last ten years. Anyway, there is still a long way for enough better understanding of implementing comprehensive product design in Turkish daily business activities.

There are numerous examples of design promotion policies supported by the governments throughout the world, even in NICs like Taiwan and South Korea. Er (1997) associates the industrial design with economic development and governmental development strategies with the following words:

The absence of this kind of government involvement, in many cases, manifests itself as an underdevelopment of industrial design in Third World. Therefore, any meaningful attempt to link design to the economic development requires an evaluation of the role of design in the wider context of government development strategies. (p.299)

Until recently, the Turkish Government has not made significant attempts and developed a national strategy for promoting industrial design except from attending the launch of the industrial design education in state universities and the Decree-Law No.554. It was alluded to the growing importance of industrial design in five year development plans (2001-2005). However, no suggestion was made about how the design abilities will be gained and promoted by the government (Er, 2001). However, now, an important step has been taken for Turkish industrial design with contribution of Undersecretaries for Foreign Trade (DTM), Turkish Exporters Assembly (TIM) and Industrial Designers Society of Turkey (ETMK). It is Design Turkey Industrial Design Awards, which is a design evaluation system within the framework of TURQUALITY® programme to reward good designs in Turkey (Design Turkey, 2008). It has mainly two categorization: product design awards and conceptual design awards. Product design awards will be given for products that are produced and launched in the market, whereas conceptual design awards will be given to innovative ideas that have not been manufactured (Design Turkey, 2008). The theme for this year's conceptual design awards is 'Eco-Design: Design Competition for Sustainable Environment'. The results of jury for both categories will be announced end of October 2008.

It can be considered as the first branding programme in the world which is supported by the government. This perspective also gives a good indication that design has become an important facet of the Turkish industry and the

Government for today as well as for future. Additionally, it is important that ecodesign was selected as a first concept for this activity. This also shows increasing importance of ecodesign in Turkish industry.

3.4 Environmental Considerations in Turkey and Turkish Industry

Turkey has made progress for establishing sustainable development strategies on the national level and adapting environmental considerations into the industry. Nonetheless, this is a new issue for both business and the government and Turkey is still at the beginning of the journey towards the sustainable development.

Literature review about environmental considerations in Turkey reveals that many topics related to environmental issues have been categorized under the umbrella term of 'sustainability and sustainable development' with no direct focus to ecodesign. This shows the lack of specialization on this concept. For this reason, it is difficult to independently reveal the ecodesign-focused (industrial and commercial) activities in Turkey.

As a result, following sections will indicate the improvements of ecodesign (but sometimes sustainability and sustainable development) in Turkey but especially in Turkish industry with three perspectives; policy framework, existing company activities in the field of ecodesign, ecodesign related training activities for companies. It aims to figure out the situation of ecodesign in Turkish industry.

3.4.1 Policy Framework

The first step in Turkish policy related to environmental issues was the government's Sixth Five-Year Development Plan (1991-1995), in which the need for undertaking environmental issues and economic growth were stressed (UNIDO, 2002). The principles for the important legislations on waste management and environmental impact assessment were formed in spite of little emphasis on sustainable development.

Besides the five-yearly development plans, sustainable development has taken into account in strategies of governmental institutions to put the concept into practice. Moreover, NGOs and private sectors have met environmental issues and standards. These are the outcome of the international measures and the

restrictions of foreign trade especially after the establishment of the Customs Union Decision in 1996.

In 1998, the National Environmental Action Plan (NEAP) was adapted. This is because there was a need to adapt a different approach to prevent pollution and to solve environmental problems after the inadequate incorporation of the Seventh Five-Year Development Plan for 1996-2000 (UNIDO, 2002). This plan did not mention about products explicitly, except the introduction of eco-management and Audit Scheme to private sector. The guidelines on EU's Eco-Management Audit Scheme and ISO14000 were translated into Turkish and distributed to industry, which consists of two aspects: the evaluation of the organization and the product. Apart from this, environment-related R&D activities defined as a problematic point which should be encouraged to achieve cleaner technology and implicitly cleaner production.

On the agenda of the accession to EU, the action plans were also determined in 2003 for the adaptation of serious strategies including the principles of sustainable development and adaptation of sustainable development into the sectoral policies. Thus, 'the National Programme for the Adoption of the Acquis' (NPAA) was put into practice by the government, which led the establishment of the National Sustainable Development Committee (NSDC).

The environmental directives affecting Turkish industry have mostly been discussed in the Ministry of Environment and Forestry, and Ministry of Industry and Trade. The directive on Packaging and Packaging Wastes was forced in 2005 and RoHS directive was in forced in 2008 whilst the ongoing studies for the implementation of other directives have continued (Table 3.2). Additionally, CE Mark (i.e. mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements) was enforced on 11 January, 2002. Parallel to this, eco-labeling is another remarkable study for environmentally conscious product development in the framework of adaption to the EU directives. As a result of the workshop on eco-labeling by the European Commission in Ankara 2007, the Ministry of Environment and Forestry decided to give priority especially to tourism and to textile sector in Turkey.

When the vision of Turkey according to the Government's Ninth Five Year Development Plan (2007-2013) is examined, the main vision of Turkey is mentioned as:

"... a country of information society, growing in stability, sharing more equitably, globally competitive and fully completed her coherence with the European Union." (SPO, 2006:1)

Improvements in R&D and innovation activities were emphasized as important facets for globally competitive Turkey in the vision of the Ninth Five-Year Development Plan (2006). In Figure 3.6, the statistics show the investment on R&D and innovation activities as an evidence of this support, which can be seen in Figure 3.5. The finance for R&D activities has been funded mostly by the Prime Ministry State Planning Organization, TÜBİTAK and Unit of Scientific Research Projects (BAP) (TÜBİTAK, 2008). These positive attempts also provide an appropriate base for new product development activities.

Table 3.2. Turkish environmental directives adapted from EU directives.

Directives	Number	Foreseen transposition date	Foreseen implementation /enforcement date
Directive on the End-of-Life Vehicles	2000/53/EC	2007	2008
Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)	2002/95/EC	2007	2008 in force
Directive on Packaging and Packaging Wastes	94/62/EC	2004	2004 issued 2005 in force
Directive on Waste Electrical and Electronic Equipment (WEEE)	2002/96/EC	2007	2008
Directive of Energy Using Products (EuP)	2005/32/EC	2008	2008

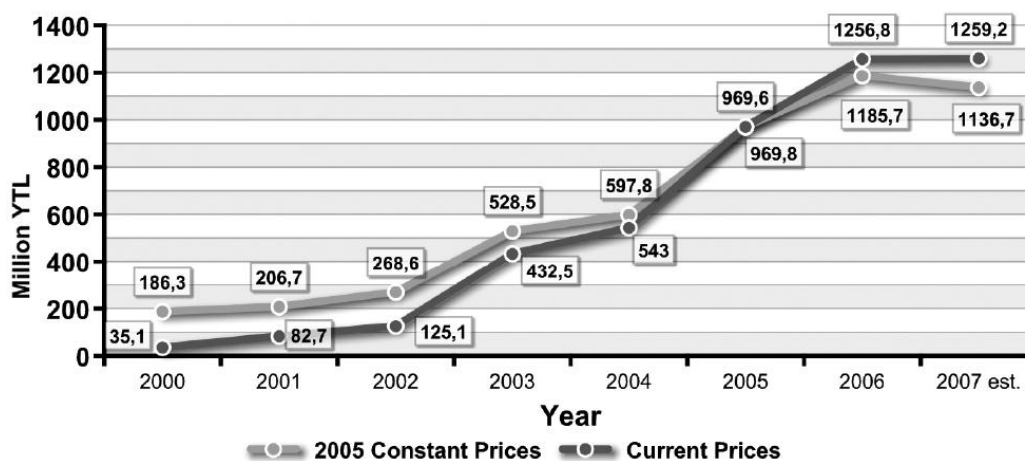


Figure 3.6. Direct public R&D and innovation funds in Turkey (TÜBİTAK, 2008).

As the part of these efforts, a project called “The Integration of Sustainable Development into Sectoral Policies”, conducted with the contribution of UNDP and State Planning Organization (DPT), was also completed. The project consisted of fisheries, forestry, energy, urbanization, and science and technology sectors. The project’s aim had three dimensions:

- 1) National and government level (national planning, decision-making and programming),
- 2) Regional/local and societal level grant programme (SD planning and initiatives),
- 3) Individual level (perception of SD and awareness).

The main outcomes of the project were:

- Sectoral sustainability policies developed for five pilot sectors were consolidated,
- Integration methodologies tested,
- Conflicting policies identified and resolution processes carried out (Temiz Üretim, 2008).

Consequently, national policies have tried to be established under the sustainable development topic. There is some specialization on ecodesign such as WEEE, RoHs, especially EuP directives promoted by the EU community. In

that sense, as noted in Chapter 2, this top-down approach is necessary and is a positive step for developing countries in order to provide an insight on environmental issues. However, the industry has also need to understand commercial and environmental benefits of environmentally conscious approach to adapt it for a longer term. Another discussion point is the viability of these legislations. As Mazlum (2004) states, there are some gaps between the goals and objectives in NEAP and the development planning. To enforce and implement the environmental legislations effectively, economic infrastructure of industry has to be improved. For that reasons, it is currently possible to discuss this concept in political base. On the other hand, as it will be explained in the following parts, implementation of ecodesign and environmental considerations are limited in both educational and industrial platforms despite some hopeful developments in particular sectors.

3.4.2 Existing Company Activities in the Field of Ecodesign

The Turkish industry has the seventh biggest share within the countries exporting to the EU (Yilmaz, 2008). Accordingly, this relationship has helped the Turkish entrepreneurs to improve their perspectives on environmental considerations in terms of the production and the management facilities. There are some high impact areas which are especially bounded by the international standards: textile, electric & electronics, packaging and automotive sectors. The firms acting in these sectors have to comply with the international standards in order to export their goods to EU and other countries. The non-tariff barriers are other measures for competitive international market as well as the Turkish. In that perspective, the number of Turkish companies having ISO14001 (an internationally accepted standard checking and organizing all actions of the organization in order to reduce environmental impact by maintaining profitability) determining environmental aspects and impacts of products/activities/services; planning environmental objectives and measurable targets; and implementing and operating programs increased from 91 in 2001 to 493 in 2005 (Yilmaz, 2008).

According to the study by Korkut and Hasdogan (1998) which was conducted with 24 Turkish firms, environmental factors had little influence on design decisions. Eight years later, another study by Suel (2006) illustrated a similar

picture for environmental considerations as it being one of the least important factors according to responses from 45 designers and 39 managers (Figure 3.7). The distribution of the weight of participation of the design team in the activities of product development process weighted averages of the managers' and designers' ratings between 1 (not participating) and 5 (leading) However, there are studies to understand the drivers and barriers of environmentally-conscious design in the Turkish industry. Some inferences from these studies can be drawn related to cleaner production. According to the investigation of Yuksel (2003) with 250 big companies in Turkey, the problems to implement environmental considerations in production generally originate from educational and financial aspects which are the common problems that developing economies are facing with, as it can be seen in Table 3.3.

As the results of this study show that although Turkish firms believe in the benefits of environmental technologies in both economical and competitive sense, they prefer end-of-pipe technologies rather than the more preventive and pro-active environmental approaches like ecodesign. This demonstrates the reactive approach of Turkish industry. In the same study, the firms mentioned that the attitudes of the government are very important in terms of suggesting more strict environmental laws and financial support to industry. In this respect, the challenge of the government should not only be to enforce regulations but also to establish control mechanisms (Yuksel, 2003). As a final point, Yuksel (2003) highlights that the establishing environmental information network is the main contributor to overcome difficulties in the implementation of environmental considerations.

Table 3.3. The problems that firms come across in their cleaner production practices (Yuksel, 2003).

Problems	Percentage
The lack of environmentally consciousness among the firms and employees of the firm and in the society.	30
Environmental issues cause important costs for the firms.	18
The difficulties of discharge of waste.	17
Difficulties in application of environmental laws.	10
Lack of support from the government.	10
Lack of education	8
Financial problems.	7

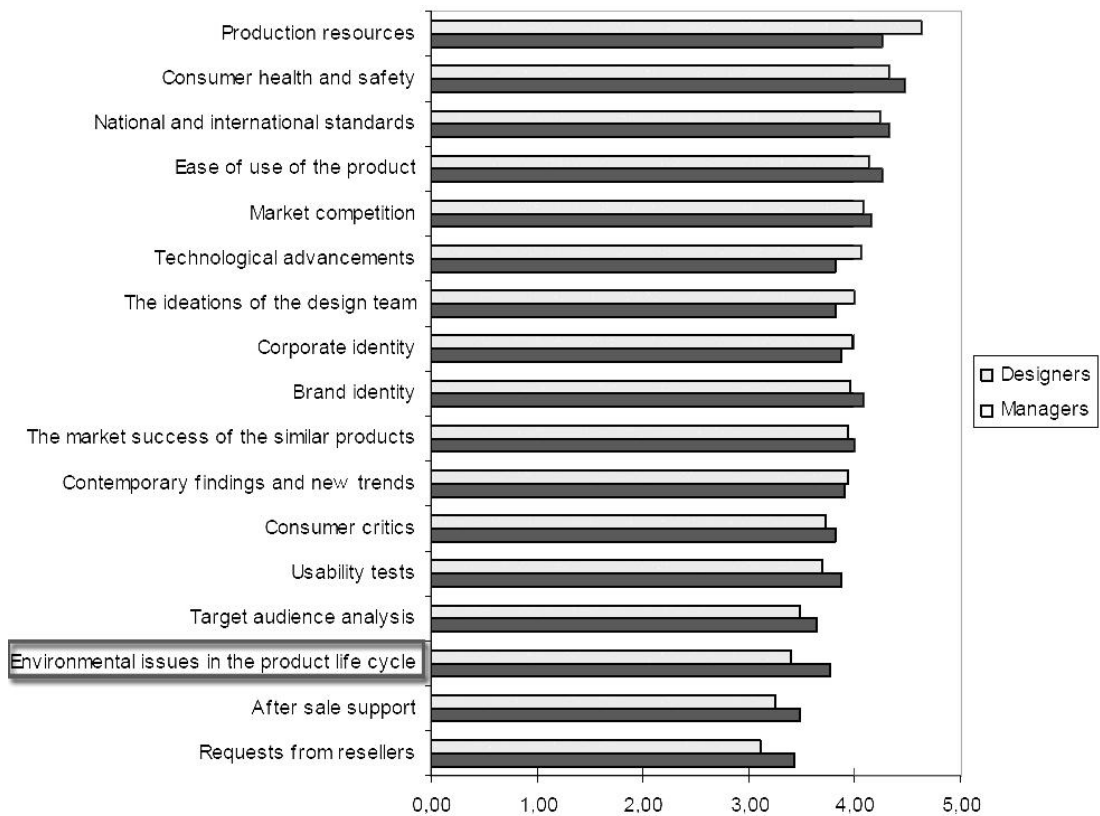


Figure 3.7. The distribution of the activities of product development process between the managers and designers (Suel, 2006).

On the other hand, there are good examples and outcomes of ecodesign implementation from Turkish big companies that are known as market leaders. According to the presentation conducted in “Ecodesign Raising Awareness” workshop in 2005, which will be explained in more detail in the following parts, VESTEL and BEKO Corporations presented consequences of the implementation of ecodesign strategies in their organizations. Some remarkable points can be summarized as follows:

At VESTEL Corporation by;

- reusing the effluent water of chemical treatment plant in dyeing-house, 30% of water saving was achieved;
- replacing the old injection machines with the ones, new in technology, 70% of energy per machine as well as 90% of saving for cooling water was

achieved (these measures also resulted in the reduction of the use of hydraulic oil for 1.5 tones);

- substituting the materials of cardboard boxes, approximately 2.7-3.7% reduction was attained in the weight of the boxes and in the usage of raw material as well; I
- taking the comments of the consumers into consideration, VESTEL commenced to use recycled paper. With this measure, the company was able to avoid the use of 312 tones of paper. This means that, every year, 530 tones of trees and 74880 liters of water can be saved besides 1.466.400 KWh electricity.

At BEKO Corporation by:

- reusing the faulty design in plastic materials, raw material usage was reduced by 20%;
- implementing a facility for the recovery of Styrofoam material, 12% of the raw material was recovered for further use;
- optimization of energy usage in stand-by mode of televisions and saving 87.600 megawatt-hour of energy per year was achieved;
- reducing the usage of plastic material, it was aimed to achieve a reduction of 27% of plastic raw material entering the manufacturing processes.

These results show commercial and environmental benefit of ecodesign, which are cost reduction-focused advantages in general. Undoubtedly, successful examples of such will help companies to understand commercial and environmental benefits of the environmentally-friendly product development.

Consequently, the Turkish industry has improved itself by means of the accelerating trend on the combination of ecology and production. However, the financial problems and inadequate awareness on environmental issues make ecodesign related activities difficult to implement. Furthermore, product designers, in general, still have little impact on the major decisions related to marketing or manufacturing (Suel, 2006), and in particular on the decisions related to the environmental aspects. Nonetheless, the legislative pressures and international standards force Turkish companies to have more environmentally-friendly product development and production. It is, in fact, seen as compulsory to survive in the international market. Therefore, especially Turkish exporting

companies have tried to adapt ecodesign into their production and product development process.

3.4.3 Ecodesign Related Training Activities for Companies

In many countries in the world, training activities are offered to increase the environmental awareness in the companies and to teach key processes to implement environmental considerations into the organizations.

In Turkey, Developing Environmental Leadership towards Action (DELTA) was one of the first programmes that set the first step towards an efficient environmental management system (EMS). It was initiated by the Sustainable Business Associates (SBA) in 1995. The purpose of DELTA is to make industrialists aware of eco-efficiency, and to introduce them to new business risks and opportunities related to environmental issues (SBA, 2004). In that respect, the Chamber of Environmental Engineers in Turkey undertook the responsibility of setting up an agency office to introduce DELTA Programme to Turkish companies in the years between 2000 and 2004. In this period, the Chamber of Environmental Engineers realized various projects with Turkish firms. Moreover, the chamber conducted workshops related to eco-efficiency in environmental management system and eco-mapping in different cities like, Gebze, Bursa, Ankara and Izmir (Cleaner Production, 2008). Representatives from 114 large size companies, the Ministry of Industry and Commerce, the Ministry of Environment the Chambers of Industry, NGOs, environmental consultancy companies were trained with regard to increasing eco-efficiency of the companies. Additionally, the DELTA document (guiding text) translated into Turkish.

Another important promotion activity, the Eco-design Awareness Raising Campaign was carried out by the Fraunhofer Institute for Reliability and Microintegration (IZM) in 20 countries over Europe in 2005. TÜBİTAK led the working group for workshop and focused on Turkish SMEs. This was important as being one of the first events on ecodesign for electrical and electronics SMEs for some countries such as Bulgaria, Turkey, Romania, and the Czech Republic (IZM, 2005). The main topics were the benefits of eco-design, basics in eco-design, how to deal successfully with EU-policy and legislation (e.g. WEEE,

RoHS, EuP), regional success stories, and discussion forum on implementation of eco-design.

In terms of the results of the campaign (Table 3.4.), Turkey can be said to have the lowest awareness level on ecodesign and lack of infrastructure compared to EU members.

Although this did not set a nice picture for Turkey, the ongoing projects and initiatives on large-size companies presented in the 'The Eco-design Awareness Raising Campaign' were setting good examples for other enterprises to reveal about the benefits of ecodesign and to lead further implementations in the industry. From the Turkish electric & electronics companies, BEKO and VESTEL provided examples of their ecodesign implementation attempts, and TÜBİTAK discussed the reliability considerations in ecodesign. To disseminate this sort of learning, conference held in 2006 by TÜBİTAK, which can be treated as the continuation of 2005 'the eco-design awareness raising campaign'.

Consequently, the purpose of trainings related to ecodesign is to enhance the awareness in the industry and introduce them to the key initial actions. They also offer informative and useful guidelines to keep continuous learning and development. For Turkish context newly facing with ecodesign, these kinds of learning activities are very important and useful to introduce the ecodesign concept more easily. However, there are few efforts that help companies gain knowledge of especially ecodesign in the product development stage. To disseminate the concept, these facilities should be supported by the companies, research centers, universities and other stakeholders.

Table3.4. Regional differences in ecodesign among SMEs of the electrical & electronics sector (Fraunhofer IZM, 2005).

region	SME awareness	infrastructure	approaches
Scandinavia	high	very good (academia focussed) <i>eco-design clusters: DK, SE</i>	LCA focussed, lot of funded projects undertaken
UK	high	very good (consultancy focussed) <i>eco-design cluster: England/Wales</i>	Based on RoHS, WEEE as entry point
Netherlands, Belgium	high	very good (research focussed) <i>eco-design cluster: Flanders</i>	LCA focussed, governmental support
Germany, Austria	high	very good <i>no dedicated cluster</i>	Technology focussed, tool development, backed by educational measures
Ireland	high	good	
Spain	high	good <i>eco-design sub-clusters: Catalonia, Basque country</i>	
Portugal	moderate	good	
France	moderate	good	
Greece	moderate	moderate	
Italy	moderate	moderate	
Baltic states	low	moderate	Educational approach
Poland	low	moderate	
Hungary	low	moderate	LCA focussed (academia)
Czech Republic, Slovakia	low	low	
Romania	low	low	
Bulgaria	low	low	
Turkey	low	low	
Slovenia	low	low	

3.5 Survey on Turkish Stakeholders

On the basis of the findings on the ecodesign integration in different countries, a network circle among the stakeholders in terms of the environmental aspects was identified, which strengthen practices of ecodesign. The relation between stakeholder groups is a strong motivation for the integration of environmental considerations into the industry. Therefore, creating efficient networks between stakeholders is a good starting point to build a strong infrastructure before implementing the concept. To do this, it is essential to understand and to get

insight in the current situation of the Turkish stakeholders. Besides the questions delivered to the stakeholder groups, it was considered useful to get opinions of some key institutions that play an important role in Turkish platform in terms of product development and environmental improvement. These included TTGV (Technology Development Foundation of Turkey), UNDP (United Nations Development Programme) Turkey, and Industrial Designers Society of Turkey (ETMK). These stakeholders will be explained under title of the 'Other Stakeholders'.

Therefore, to complement the findings of the literature on environmental considerations in Turkey, a survey was carried out with three stakeholder groups (i.e. government, universities, and industry). The purpose of the survey was to provide an insight into the Turkish stakeholders, opinions of expert people from key institutions through current and future developments, and to understand the nature of cooperation between the stakeholders.

The survey covered five questions. 36 experts from 24 different organization and institutions were contacted by e-mail. Of these, 23 people consisted of industrial designers, engineers, researchers and managers from 15 organizations and institutions, responded to the questions. In order to determine the key people for the survey, related organizations were investigated. Then they were selected from each stakeholder group. From the government, people working on environmental directives such as WEEE, RoHS and EuP were especially contacted for the survey. Expert people in particular companies were also contacted. Academics having any course or studies on environmentally-conscious design or studies affecting ecodesign were found in order to get their opinions about ecodesign in Turkish industry. An important point which should be indicated is that experts from selected institutions or organizations represented their personal ideas, not organizational explanations. The names and categorizations of organizations/institutions, and the number of participants contributed to the survey can be seen in Table 3.5.

The survey aimed to get insights on the following topics:

- importance of ecodesign for Turkey,
- roles of industry about environmentally-conscious design,

- positions that stakeholders take regarding environmentally conscious design or in a wider perspective sustainable development,
- responsibilities that stakeholders should have to integrate or develop ecodesign in Turkey,
- roles that stakeholders should play and activities they should undertake in supporting ecodesign.

The answers to questions (see Appendix A) are analyzed in relation to the perspectives of the governmental institutions, educational institutions, business, and other stakeholders, the highlights of which are discussed in the following sections.

Table 3.5. Breakdown of the interviewed experts from companies, organizations and institutions.

Universities	No. of Participants	Governmental Institutions	No. of Participants
Anadolu University Department of Industrial Design	1	The Scientific and Technological Research Council of Turkey (TÜBİTAK)	1
Marmara University Department of Industrial Design	2	Prime Ministry of State Planning Organization (SPO)	3
Istanbul Technical University Department of Industrial Product Design	1	Republic of Turkey Ministry of Environment and Forestry	3
Dokuz Eylül University Department of Environmental Engineering	1	Ministry of Industry and Trade	1
Manufacturing Companies	No. of Participants	Others	No. of Participants
VESTEL (electric & electronics sector)	1	Technology Development Foundation of Turkey (TTGV)	3
İSTİKBAL (furniture sector)	1	United Nations Development Programme (UNDP)	2
Polinas (packaging sector)	1	Industrial Designers Society of Turkey (ETMK)	1
BEKO (electric & electronics sector)	1		

3.5.1 Perspective of the Governmental Institutions

Two kinds of government perspectives were possible to distinguish. First perspective is optimistic about the developments in structure of the government and Turkish industry (especially electric & electronics, and packaging sectors). Second perspective is that Turkey is mostly at the beginning of the sustainable development. Main problems indicated were: the lack of implementation in the industry; and the lack of the bottom-up approach because of relatively low awareness level in the society.

The Ministry of Environment and Forestry believed that the enforced legislations adapted from EU directives (e.g. RoHS directive) were significant pushers for the industry and the high percentages of companies liable for these directives acted in compliance with environmental laws. TÜBİTAK was also hopeful for the improvements in the industry but it added that the stakeholders have to take more initiatives to improve the concept. Prime Ministry of State Planning Organization (SPO) and the Ministry of Industry and Trade were anxious about the further developments of ecodesign in Turkey because of the economic problems and low level of awareness in the public.

Suggestions made towards: more training activities related to ecodesign especially for SMEs about how ecodesign can be integrated and why it is beneficial in three dimensions: economy, environment and society. Importance of SMEs were mentioned since they do not have enough time and qualified employees but the implementation period is shorter than big companies due to the less hierarchy. Also, a champion, who is willing to take the responsibility and manage the network, was suggested.

3.5.2 Perspective of the Educational Institutions

Answers to questions from educational institutions pointed out three main points: problems connected to being a developing economy; not optimization of design profession; and EU accession period.

Problems connected to being developing economy

The conflicts between sustainability and political concerns were indicated by the number of participants and especially the permission for employment of polluter

technologies of foreign companies in Turkey was highlighted as a significant example of this situation. Likewise, the cheap labor and poverty were the discussing point, which is one of the biggest challenges in Turkey. Therefore, people can take any risk to earn money and regulations do not prevent it. In this respect, cost driver is expressed as a common criterion for the companies. Therefore, it is thought that besides internal dynamics, there has to be conditioned external pressure to push forward to industry like government and legislations.

Not optimization of design profession

In fact, the situation of ecodesign can be strongly associated with the state of product development activities. Among the participants, there was an anxiety about the status of the industrial design profession in Turkish industry. It was stated that considering environmental issues or creating a new product regarding environmental quality of product was rarely seen as a role of industrial design in Turkish companies.

EU accession period

The impacts of EU accession period were emphasized before. In the survey almost all participants remarked the influence of the EU on Turkish industry. It is a common sense Turkey has to develop their own plan and framework for environmentally-conscious design and furthermore sustainable development. However, Turkey is still trying to catch European standards according to the respondents. It was also noted that it is crucial to learn from the efforts and experiences of developed countries in the field of environmental problems in order not to repeat the same mistakes.

3.5.3 Perspective of the Industry (Private Sectors)

General interest within this section was in which context ecodesign matches or conflicts with the business benefits. It was stated explicitly through the survey that principles of environmental sensitivity and trade are not parallel with each other since it requires extra cost, effort and time. For all companies, the key concern is to earn more money and profit. From that perspective, it was frequently emphasized that the environmental improvements have to overlap with economical benefits rather than to conflict. Another important issue found

to be the governmental initiatives. In general, participants associated integration of ecodesign into the companies with governmental encouragement by means of the legislations and financial incentives. Although participants mentioned that it is not reasonable to demand everything from the government, companies have rarely taken initiatives for stimulating environmental consciousness and disseminating the implementation of it. Additionally, the low level of the Turkish consumer was associated with the lack of public disclosure of the concept and ecodesign related activities of the industry.

3.5.4 Perspective of Other Stakeholders

Other stakeholders interviewed (TTGV, ETMK and UNDP) in general, talked about a conflict between the current situation of Turkish industry and the environmentally-conscious product development, as was also indicated by the other stakeholders. A collection of suggestions made by other stakeholders about Turkey's future are:

- The first step should be consciousness of industrial designers' role in the production by the industry. Then, designer should be seen as a big contributor/stakeholder for ecodesign and environmental considerations in the product development and production.
- Turkish industry should convince the benefits of ecodesign and furthermore it is emphasized with the successful implementations in the industry. Additionally, since it is closely related to consumption pattern and lifestyle of the consumer, the successful products should be introduced to consumer and market to increase the environmental awareness.
- Ecodesign becomes a compulsory aspect of production. It will be an inevitable subject in the future. Therefore, Turkish industry has to match their strategies with the environmental considerations.

3.5.5 Discussion

According to the analysis of the literature and the complementary study following conclusions could be drawn about the stakeholders' view on the ecodesign concept in Turkish industry.

- There are some directives put in force and many studies related to environmental policy and sustainable development in the government have been executed by the help of the EU accession period. However, as a result of the complementary study, it can be concluded that there is a lack of control mechanisms and a lack of encouragement for the industry for producing more environmentally-conscious products.
- Training activities related to ecodesign are relatively low in the industry. This kind of information has to be disseminated to the industry by means of conferences, workshops. To be able to do this, there is also a need for qualified people on this topic.
- For the business, the most important consideration is the cost (reduction). For that reason, while they are adapting the environmental considerations into organizations, they want to keep traditional methods in production or make minimum changes to keep the expenses minimum. It is believed that more successful stories related to the implementation of ecodesign will move towards industry more environmentally-conscious activities.
- The investigation on the Turkish stakeholders shows that there is not a strong relation between the stakeholders. Furthermore, the activities inside of each stakeholder group are limited because of relatively low awareness level, economical limitations, and different priorities.
- A network of Turkish stakeholders has tried to be formed in particular projects and situations linked to environmental issues. There are some key intuitions like TÜBİTAK taking more initiatives to gather industry, academy and government. However, the relationship between stakeholders is not kept in long term because of other priorities of institutions or organizations like commercial concerns.

CHAPTER 4

STUDY ON ECODESIGN IN TURKISH INDUSTRY

This chapter presents the study on ecodesign in Turkish industry in order to understand the drivers and limitations (barriers) of companies encountered whilst implementing ecodesign in their organizations. First, the chapter gives the aim of the study. Then, design of the questionnaire is explained including a detailed account on the selection of the companies and specific sectors. After that, data analysis is described followed by the discussion on the results of the questionnaire.

4.1 Aim of the Study

In the previous chapters, literature review on ecodesign, ecodesign integration activities both around the world and in Turkish industry are presented. Additionally, a study with Turkish stakeholders to complement the literature was conducted and discussed from three perspectives: i) policy framework; ii) existing company activities in the field of ecodesign; and iii) ecodesign related training activities for Turkish companies. Thus, the picture of environmentally-conscious design in Turkish industry was, to some extent, revealed comparing the international examples related to ecodesign integration activities into the different industries. According to the combined findings from the literature review and the complementary study on the Turkish environmental stakeholders, it was seen that there are significant advantages of ecodesign concept for the companies, such as reduction of manufacturing costs in the long term, innovational approach in the manufacturing process and product development, and increasing brand awareness. However, it is not easy to integrate environmental considerations as in center as other conventional requirements such as price, functional and ergonomic qualities of a product. This can be more difficult in developing economies because of the economical

problems, technical limitations and limited time and qualified people related to the topic. Therefore, the adoption and the integration of ecodesign in developing economies may require different conditions than the ones in developed economies. For the Turkish context, ecodesign has recently been adapted into the industry. New environmental legislations, both in international and national level, have been a key promoter to develop environmentally-conscious product development and production in the industry. Moreover, export markets have helped the Turkish entrepreneurs to improve their perspectives on environmental considerations especially management facilities.

Nevertheless, as it was noted before, there are very few studies particularly about environmentally-conscious product development in Turkish industry. For that reason, it is believed that a questionnaire will help to find out clear answers and to explore much comprehensive information about particular sectors. In that respect, Chapter 4 seeks answers for the following research questions:

- What are the internal and external factors that are promoting the ecodesign activities in Turkish industry?
- What are the limitations of Turkish industry in relation to activities of adaptation of ecodesign?
- What could be the key actions to integrate eco-design in Turkish industry?

The outcomes of the study are expected to show the present situation of ecodesign in Turkish industry (by focusing packaging and electric & electronics sectors). Hence, it is expected to provide general information about the factors that should be developed more and barriers that the ways should be found to go beyond in order to adapt and improve the ecodesign concept more easily in Turkish context. This can be valuable information for designers and key persons related to environmentally-conscious product development in the companies.

4.2 Design of the Questionnaire

For the questionnaire, three selection criteria were defined: selection of companies; selection of sectors; and selection of participants, detailed explanations of which follows.

4.2.1 Selection of Companies

In the recent surveys carried out in other countries, small and medium enterprises (SMEs) have been focus point in general. This is because SMEs have significantly big share of the industrial sectors in many countries, hence they play an important role in the economy. On the other hand, SMEs in many industries lag behind development of new tools, strategies related with ecodesign comparing to big companies. However, as practiced in the survey on the Baltic States (see Chapter 2), investigating ecodesign facilities of big companies might be more reasonable in particular situation, especially countries that have newly introduced and adapted the ecodesign in their industry and policy. As can be seen in the cases executed in SMEs, there are many barriers to implement and integrate ecodesign into SMEs, some of which are as follows:

- low level of eco-innovation (Tukker et al., 2000),
- lack of awareness, knowledge, capacity and incentives (Gluckman et al., 2006),
- lack of educated staff and new technologies (Costa and Gouvinhas, 2002).

In this sense, big companies can be a good starting point to disseminate environmental approach to other enterprises. As mentioned before, although Turkish economy and product development in Turkish industry have improved in recent years, there are many steps to adapt environmental thinking in the product development process. Therefore, big companies were targeted for the questionnaire. Additional reasons behind selection of big companies were:

- Having high level of innovation capabilities and sufficient finance, they are open to big changes and inclined to take risk to improve their brand images and productivity. Therefore, they could be pioneer for Turkish industry as acting environmentally-sensitive.
- They could be good models for SMEs and their supplier. They could promote the implementation of ecodesign by displaying good examples and benefits of ecodesign to other companies.

- It is useful to see possible drivers and barriers of big companies, which can provide a way for SMEs to improve environmentally-conscious product development and production.

4.2.2 Selection of Sectors

After defining big companies as the focus of study, particular sectors were determined, to be investigated more specifically with regard to environmentally-conscious product development and production.

As mentioned in Chapter 3, environmental considerations are mostly defined by international and national environmental regulations, and requirements of international markets. In addition, for the study, it was thought that the sectors are important, in which product designers can have major impact on the decisions related to marketing or manufacturing and the environmental aspects. For that reason, while being selected sectors of interest, these criteria were considered:

- which Turkish key sectors mostly influence EU directives,
- which Turkish major sectors have important share in manufacturing exports,
- which Turkish main sectors the designer has a key role in production.

EU directives have been one of the most influential factors in determining sectors for the study. Within the context of customs union with EU, the industry has to take into account environmental consideration in manufacturing process to keep competitiveness ambitious on the foreign market. Therefore, these international incentives push toward a more environmentally-sensitive manufacturing and design process to Turkish companies. Within the European framework of integrating environmental policy into sectors, automotive sector and electric & electronics sectors have been primarily important because of WEEE, EuP and RoHS Directives (Gluckman et al., 2006). Moreover, packaging sectors have been promoted by a number of directives to reduce packaging waste and prevent non-replaceable raw materials in Europe since 1994. For that reason, environmental performance of product has become a considerable aspect for Turkish firms, especially for exporting ones. In that sense, the sectors having high rates in exporting to EU can be possible research field for the study.

As mentioned before, according to statistics given by Turkish Export Promotion Office (IGEME, 2005), food, automotive and automotive parts, electrical machinery, iron and steel and food products are the major sectors in manufacturing exports. Furthermore, these sector-based rates overlap with the area in which Turkish designers have important contribution to the production line (Suel, 2006). Another important data from the literature review is that the high impact areas which are especially bounded by the international standards in Turkish industry are textile, electric & electronics, packaging and automotive sectors.

On account of these findings, two different sectors in Turkish industry were selected for the study. These are packaging sector (by considering food products) and electric & electronics sector (by considering household industry). The reason for looking at two different sectors was to see the different approaches in Turkish industry and to compare their ecodesign related activities. After the selection of the sectors, leading companies within these sectors were investigated. The statistical data offered by the Istanbul Chamber of Industry, which lists the first 500 Turkish companies in respect of company sales, was used as a source to find the company names (İSO, 2007). As a result, four big companies that are known as market leaders for the household industry, and three big companies for food packaging industry are determined. Accordingly, Arçelik A.Ş., BEKO Elektronik, VESTEL A.Ş., and Kumtel are the companies selected from the electric & electronics sector. All these companies present a big production capacity both for domestic and international market. Amongst these, BEKO was taken out of BEKO Ticaret A.Ş.'s organization, and joined the Arçelik brand under the organization of Arçelik A.Ş. due to the restructuring of Koç Holding Durable Consumer Goods Group as of 2000. Companies selected for the packaging sector are Şişecam (Anadolu Cam Sanayii A.Ş.), Olmuksa A.Ş., and Koroza Ambalaj San. ve Tic. A.Ş., all of which present good performance in terms of the product quality and production capacity.

4.2.3 Selection of Participants

The participants of the questionnaire were selected from the designers, quality managers and key people related to environmental considerations in the companies. All questionnaires were sent through an e-mail. In total, 12

participants replied the questionnaire (i.e. 6 designers, 3 quality managers, 1 environment and energy manager, 1 director of food safety systems).

4.3 The Questionnaire

The questionnaire consists of three parts.

4.3.1 Part – 1

This part included four open-ended questions (Appendix B) that intended to reveal environmentally-conscious product development activities in the companies, and whether or not they have:

- i) An environmental policy,
- ii) Any (manufactured) eco-design products,
- iii) Any ecodesign methods that they facilitate,
- iv) Any staff having responsibility from ecodesign activities.

This part was important to enlighten the perspective of the companies, since it was questioning whether they regard ecodesign in the organization level or not. In this part, the questions were asked in a way that the participants would give qualitative responses. However, the actual aim was not to compare the numerical data gathered between the participants, rather, to encourage them to realistically think about organizational structure (regarding integration and implementation of ecodesign and ecodesign activities related to product design), and realized ecodesign developments in their companies.

4.3.2 Part – 2

Second part of the questionnaire was designed to understand the ecodesign strategies that companies mostly use. It was also aimed to evaluate whether the company taken into account the environmental considerations during the whole life cycle of the product in product development phase or not. In other words, holistic or life cycle thinking of companies, which is the main idea behind the ecodesign, was questioned.

Therefore, this part of the questionnaire looked into all aspects of the whole product life cycle, from the use of raw materials, through manufacturing,

distribution, product use and to end of life. To better represent this cycle, typical life cycle stages of a product was presented (see Chapter 2, Figure 2.3) with an accompanying list of ecodesign strategies under each period in the life cycle (see Appendix C for the full data set). The list of ecodesign strategies were taken from Hemel's (2002) study. As mentioned before, Hemel clustered these strategies into eight parts on the basis of the literature analysis. For this study, the categorization was considered valuable and redesigned according to five life cycle stages of a product (see in Table 4.1). However, new concept development strategies were not incorporated into the list of Part-2. This is because the list under the new concept development indicates the high level of ecodesign innovation, and not mainly applicable for the packaging sector. Moreover, the questionnaire executed on the Baltic States (2003) was availed by setting the statements of the list. Then, the participants were asked to tick off the relevant strategies at each period that were implemented by their companies. This allowed discussion of the distributions of the strategies in terms of the level of the significance.

Table 4.1. The categorization of ecodesign strategies for Part – 2 of the Questionnaire.

Hemel's Categorizations	Product Life Cycle
Selection of low-impact materials	Use of raw material
Reduction of materials usage	
Optimization of production techniques	Manufacturing
Optimization of distribution system	Distribution
Reduction of impact during use	Product use
Optimization of initial lifetime	
Optimization of end of life	End of life
New concept development	<i>Not considered</i>

4.3.3 Part – 3

The third part of the questionnaire was designed to find out the drivers, barriers and key actions of the companies. In this part, a list of significant internal and external drivers, barriers and suggested action drivers collated from the literature review were presented to the participants (see Appendix D). After a

detailed investigation on drivers and barriers experienced by companies, the extensive list of drivers and barriers was found in Hemel's (1998) study. Then, the list was designed on the basis of Hemel's findings (2000:p.63–80). They are summarized in Table 4.2 (external drivers), Table 4.3 (internal drivers) and Table 4.4 (barriers) and Table 4.5 (key actions). On the other hand, key actions were planned on account of the results of complementary study on Turkish stakeholders and literature review. Each participant was asked to choose the relevant ones to their company by ticking off the items. Finally, they were asked to order these items them according to their importance/priority for their companies.

Table 4.2. External drivers.

External Drivers
Legal requirements
Consumer demands
Competitive advantage in the market
Supplier demand
NGO's pressure
Media pressure

Table 4.3. Internal drivers.

Internal Drivers
Exporting to foreign countries
Providing business benefit
Creating new market opportunities
Cost reduction
Improving brand image
Improving product quality
Having environmentally-conscious manufacturing
Providing long-term innovation

Table 4.4. Barriers.

Barriers
Weak economic situation and support
To be realized only when supported by the legislations
Inadequate technical possibilities
Lack of time
Not to have long-term strategy in the organization
Not to have environmental management commitment
Not to feel the responsibility for the environment
Lack of information
Lack of used tools
Not to be seen as a long-term innovation
Not to believe in environmental benefits
Not to be open towards such a development

Table 4.5. Key actions.

Key Actions
To develop and implement environmentally-conscious product policy
To define responsible for environmentally-conscious product development
To support the activities related to the concept
To introduce the ecodesign products to the market
To develop methods for the product development of the company
To introduce the ecodesign products to the consumer
To disseminate the subject to the supplier
To gather sufficient information for the concept

4.4 Data Analysis

Answers to questions from all participants were collected, and each part of the questionnaire analysed as follows.

Part -1 of the questionnaire

Part 1 of the questionnaire was analysed to generate numerical data for i) the number of ecodesign-products manufactured in the company; ii) the number of ecodesign tools used; and iii) the number of available staff responsible from ecodesign activities.

This part was also analysed with the intention to understand - beyond the plans, efforts and wishes of the companies - the realized activities related to ecodesign. Similarly, the environmental policies were intended to be explored.

Part -2 of the questionnaire

Part 2 of the questionnaire was analyzed by assigning scores to all the items ticked off by the participants. First, 1 point was given for each selected strategy (i.e. ticked off item) by the participants. Then, all scores for each product phase were added together. It is then indicated as a percentage to show the overall importance for packaging, and electric & electronics industries (e.g. 100% = if the participant marked all strategies). This calculation helped comparing the level of significance of each phase for the packaging and electric & electronics industries. In other words, which phase was paid attention or which phase was subordinated by two industries was discovered.

Part -3 of the questionnaire

Part 3 of the questionnaire was analysed in terms of internal drivers, external drivers, barriers and key actions. In this part, the participants determined the most appropriate answers and ranked them according to their priorities. For this reason, the top priority score was given for each sub-section. For example, if there were six alternatives that a participant can select for internal drivers, the first priority was given 6 point, which is the highest score. Then, 5 point was given for the second choice, and so on. To calculate which items are significant for each sector, all grades were added. Then, the percentage of importance was calculated for packaging and electric & electronics industries (100% = if the participant marked all alternatives as the most important criterion).

4.5 Results and Discussion

Results of the questionnaire are presented in three directions: background of the companies about ecodesign activities (first part), mostly used ecodesign strategies (second part), drivers, barriers and key actions of the companies (third part). The results of the three parts of the questionnaire are presented for each company within each sector. Then, a comparison was made between the companies leading to conclusions within each sector.

4.5.1 Results of Part - 1 of the Questionnaire

All the companies participated in the study from the electric & electronics sector (i.e. Arçelik, BEKO, VESTEL and Kumtel) are the major brands in household appliances sector of Turkey. Also the companies from the packaging sector (i.e. Korozo, Paşabahçe and Olmuksa) have the biggest share in the domestic and international market. This is important dimension because the higher production means higher environmental impact of the products.

The results of the questionnaire will be presented in the following parts. However, there are some answers that do not have clear outcomes. Additionally, some information were sought from the web sites of these companies since some of the participants referred to their web sites for more information especially for their environmental policies.

4.5.1.1 Arçelik

i) Environmental policy

As suggested on their web site (2005), Arçelik Corporation demonstrates a comprehensive environmental policy that matches with the social responsibility idea of the company, which can be summarized with their following words:

Arçelik and its employees comply with all applicable national and international environmental laws and regulations; manufacture environment-friendly products in line with environmental management system based on continuous improvement. (Arçelik, 2005)

ii) Eco-designed products

Arçelik, on their web site, gives each product range including refrigerator, washing machine, tumble dryer, dishwasher and built-in oven as examples for eco-products (Arçelik-Environment-Friendly Products, 2008). Among these, the SmarTouch, which is the first dishwasher in the world with 11 sensors in 'AAA' performance, automatic program selection according to the quantity and dirt-level of dishes that is controlled by a single button, is given the highest importance.

The answers to the questionnaire supported this, and the participants from Arçelik indicated that all products are designed and produced considering environmental policy of the company. One of the recent examples of the products is given as a new version of eco washing machine, which supports the idea of ecodesign.

iii) Ecodesign methods

Life Cycle Assessment (LCA) is one of the ecodesign tools used in Arçelik. Though not very clearly specified, there are other tools being used, from choosing raw material to manufacturing processes (e.g. minimizing energy usage).

iv) Staff responsible from ecodesign

Although there is not a specialized department related to environmentally-friendly product design or production, it is emphasized by the participants that that different departments including quality managers, people working in R&D department and sales, plays a role in environmental decisions of the corporation.

4.5.1.2 BEKO

i) Environmental policy

On their website, BEKO describes its environmental policy (web Kaynak ???) in terms of the product life cycle periods, design, development, production and packaging of the product. The principles of BEKO are embodied in the following list:

- Use methods which least consume natural resources,
- Increase recycling and returning operations,
- Reduce waste materials passed on to air, earth and water to a minimum,
- Choose safe and environment friendly operations instead of those harmful to the environment and personal health,
- Follow up and adhere to environmental and health legislation,
- Carry out studies to save energy,

- Educate supporting industries and suppliers to become responsible establishments with regard to the environment,
- Train all personnel about all aspects of environmental issues.

One of the important aspects of the questionnaire was to find out in which context environmental policies of companies contain the product design phase. This question can be best answered with the chart taken from BEKO's website. BEKO's environmental management system and 'adherence to environmental criteria at the design stage' are important facets, as can be seen in Figure 4.1.

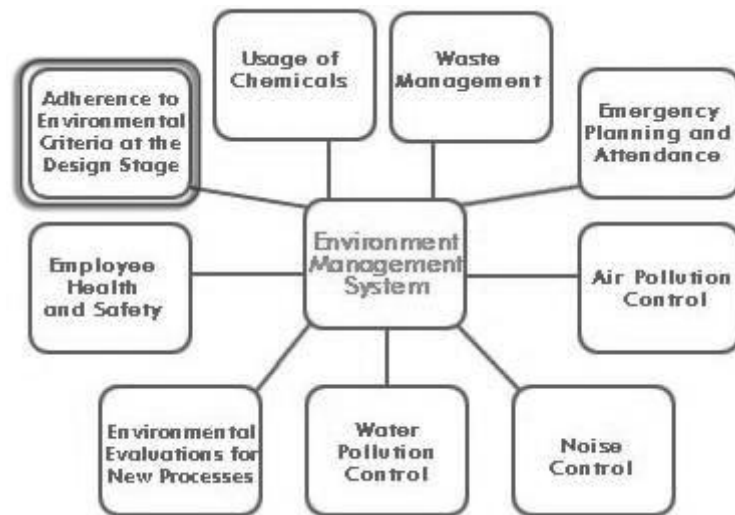


Figure 4.1. The environment management system of BEKO (BEKO, 2008).

The aim of the environmentally-conscious product design at BEKO is that "every measure is taken to minimize any environmental harm during the design stage." (BEKO-Environment, 2008). Some attitudes in product development phase are:

- Reduce electromagnetic pollution,
- Ensure usage of minimum raw materials resulting in minimum waste plastics,
- Choose materials with a high recycling ratio,
- Reduce stand-by power consumption,
- Reduce the hazardous materials in design process.

ii) Eco-designed products

BEKO has considered the environmental issues since the 1990s when the firm received the certification of environmental management system 'BS 7750', regarded as the world's first environmental management system standard. After that, the environmental considerations have tried to be adapted into the product design process by for example, selecting recyclable materials, using fewer resources than before, and reducing the hazardous materials.

iii) Ecodesign methods

In the questionnaire, there has not been any specific method mentioned under this section. On the other hand, the studies focusing ecodesign activities were mentioned by a participant. These are the projects focusing on energy consumption, reuse of the mechanical materials, and reduction of the electromagnetic pollution.

iv) Staff responsible from ecodesign

The key people connected to ecodesign activities in BEKO are found to be the quality managers, electronic and mechanics managers, and product design managers.

4.5.1.3 VESTEL

i) Environmental policy

VESTEL Electronic's target is set to increase the life quality both for its employees and its consumers by the help of its environmental policy, as claimed on their web site (VESTEL, 2008). There are key items determined by means of the environmental management system (ISO14000) and environmental laws. These are:

- Considering the environment factor when evaluating projects and operations of new products,
- Decreasing the use of harmful materials in product design and the production processes, and researching for the less polluting materials,

- Carrying out studies to decrease amount of waste materials, and to reuse and recycle them,
- Saving energy, water and natural resources by increasing the productivity and encouraging the use of new technology,
- Using recyclable packaging material where convenient,
- Arranging activities in order to constitute an environmental consciousness.

ii) Eco-designed products

The responses to questionnaire show that, at VESTEL, there are studies focusing on ecodesign. One of them is minimizing the energy when the televisions are on standby. Reducing the amount of hazardous materials in the products is another important concern.

iii) Ecodesign methods

Participants did not inform any special ecodesign tools. Only the studies related to methods for minimizing energy usage were highlighted.

iv) Staff responsible from ecodesign

The quality managers, designers and mechanical engineers are responsible for improving and conducting ecodesign activities in VESTEL.

4.5.1.4 Kumtel

i) Environmental policy

It was informed by Kumtel that environmentally-conscious approach is adapted into the product design and the manufacturing process. Especially, it was highlighted that the products are compatible with RoHS directive. However, environmental policy of the company was neither stated in the questionnaire nor found on the company's web site.

ii) Eco-designed products

According to the answers to the questionnaire, the number of products manufactured considering environmentally-conscious design and production, was between 60 and 70. However, it was not clear that how many of these products were especially introduced to market as ecodesign products or known as ecodesign products.

iii) Ecodesign methods

The ecodesign tool, LCA was indicated by the participants. Additionally, the tools for reducing the energy usage were highlighted without mentioning the specific tool of concern.

iv) Staff responsible from ecodesign

According to the results, designers and R&D people play an important role in implementing the ecodesign concept. On the other hand, quality managers control the process and keep the concept sustainable.

4.5.1.5 Paşabahçe

i) Environmental policy

On their website, environmental approach of Şişecam is pursued by the projects related to waste management and by environmentally safe operations policy that optimize use of natural resources, such as materials, water and energy. Their environmental policy is indicated in the following words:

Şişecam, as an organization aware of its responsibility towards the protection of environment, believes in the need to maintain the world as a livable place for future generations. This approach is considered as one of the pillars of Şişecam's strategic management and is integrated in every phase of its work processes.

Our aim is to carry out all the environmental protection activities at Şişecam within a framework of an environmental management system and continuously improve the system with the support of all our employees. (Trakya Cam, 2006)

Environment Group at the Glass Research Center in Şişecam carry out environmental assessment studies related with new investments, selection of appropriate waste management systems, emission measurements, and waste water purification experiments.

ii) Eco-designed products

Environmental approach of Şişecam focuses on 'raw material phase', such as reducing the raw material and selection of recyclable materials before the manufacturing process. In that respect, it can be said that all products are designed by considering environmental issues.

iii) Ecodesign methods

For this part, no special tool was mentioned, but it was highlighted that all material selection is made to reduce energy usage and to minimize material use.

iv) Staff responsible from ecodesign

Marketing managers and designers are said to be responsible from environmental considerations at Şişecam.

4.5.1.6 Olmuksa

i) Environmental policy

The information from website:

Olmuksa describes its environmental policy with the following points:

- The national and international laws and regulations in force are complied with,
- Natural resources are utilized in the most effective manner,
- Systems that will minimize our negative effects on nature as well as our wastes are developed,
- An environmental management system based on continuous development is implemented,

- Environmental awareness of all employees is increased.

The contribution of their product development phase to the environmental policy is not emphasized especially.

ii) Eco-designed products

Although, the environmental qualities of a product were said to be evaluated during the life cycle of the products, it was difficult to identify the number of ecodesign products.

iii) Ecodesign methods

No method was mentioned for this question.

iv) Staff responsible from ecodesign

Designers and quality managers are found to be the responsible people in the company, who follow up the activities linked to ecodesign.

4.5.1.7 Korozo

i) Environmental policy

Two dimensions of environmental policy of Korozo were highlighted in the answers to the questionnaire. First one is minimizing the raw material, and the second one is recycling.

ii) Eco-designed products

Most of the products are considered minimizing raw material and respectively minimizing the energy using. According to one participant, this approach also has to match with consumer demand.

In the light of rising activities in environmental care, Korozo suggest on their web site (Korozo, 2007) that a group of products that are called as an

'environmental products' have been developed new products in this area. Accordingly, there are two kinds of environmentally-conscious material that they work on: biodegradable films that can be biodegraded by micro-organisms, and oxodegradable films 100% of which is degraded by the help of air, sun, water, oxygen and microorganisms.

iii) Ecodesign methods

The participant indicated tools focusing on energy and raw material usage. However, it was not informed the name of the ecodesign tools used in the company specifically.

iv) Staff responsible from ecodesign

R&D people and sales managers are found to be responsible from the strategic decisions, whereas during the manufacturing phase, industrial designers play an important role.

4.5.2 Discussion on Part – 1 of the Questionnaire

Generally, the companies have environmental policy, which describes their own values about environment and in which context environmental considerations are adapted into the organizations. When the policies of the companies are compared, different ways or foci of the sectors could be seen.

i) Electric & electronics sector

Electric & electronics sector need to consider environmental quality of product not only the course of product design and production stages but also other life cycles of product such as product use. This is because of the product type and, its functional qualities. For example, the material selection, energy use, sometimes water use have to be taken into consideration in producing this type of products. For that reason, it could be said that electric & electronics sector assess product life cycle phase in a more balanced way and emphasize this in their environmental policies.

The number of ecodesigned products was not defined clearly by electric & electronics sector. However, the products in considering environmental considerations such as minimizing energy using, minimizing hazardous materials were highlighted by the participants. In fact, ecodesign innovation could be combined the new product development process (NPD) in electric & electronics sector as can be seen the examples of the products from the companies. There are many examples of which core concepts support the minimum water usage or minimum energy using. However, this level did not go beyond the changes in new product or system concept that provide the sustainable living.

The only specific method mentioned by the participants was LCA which was explained in literature review, Chapter 2. However, most of them did not indicated specific tool for ecodesign and any of them did not stated a method developed by the companies in terms of their internal dynamics. This may indicate that the companies do not follow more systematic way or do not need to take more initiative to implement ecodesign.

ii) Packaging sector

Packaging sector gives more priority to the raw material and manufacturing phase as it was inferred from the results. This is related with product type and product type of usage. Packaging products are in general used for protecting the main product from the heat, bumping, water etc. Therefore, the selection of material by thinking end of life cycle, reducing weight of material and hazardous material to destroy easily in the end of the product life are important concerns for the packaging production. In addition, to minimize and (sometimes) avoid completely the wastes, packaging sector use high technologies in the manufacturing phase or study on the degradation ways in R&D facilities. As a result, the differentiation in environmental policies of the sectors lies in the product type and this normally causes different focus points in the sectors.

Participants generally said that all products were designed in light of environmental qualities of product without determining number of products. This may be because environmental considerations were seen as a quality of product such as usability, ergonomics, and functionality, not especially the concept of the product. Therefore, it is difficult to make such a division in product range.

On the other hand, Korozo Corporation has this kind of product range, environmentally-conscious products, which has emerged the market and consumer demand. Therefore, this can be a reflection of the growing demand within ecodesign products.

The methods used in the companies are limited. Generally, LCA and the methods related to energy using, material selection and electromagnetic pollution were stated like it was in the situation of electric & electronic sector.

Based on the results of both sectors, designers, quality managers and people in R&D department were indicated as the main responsible staffs related to ecodesign activities in questioned companies. That is a good point to confirm the designer's contribution to environmental qualities of product in the firms and close relation with the R&D department and ecodesign concept. Table 4.6 presents the highlights of the results from part – 1 of the questionnaire.

Table 4.6. The results of part – 1 of the questionnaire.

	Environmental policy	Eco-designed products	Ecodesign methods	Staff responsible from ecodesign
Arçelik	+	(no definite number) There is a range that is introduced as environmentally-conscious products	LCA Other tools (from raw material to the manufacturing process)	<ul style="list-style-type: none"> • Quality managers • R&D department • Sales Department
BEKO	+	(no definite number) Studies on less energy using products and products including non-hazardous materials	No special tool Reducing energy usage Reusing mechanical materials Reducing electromagnetic pollution	<ul style="list-style-type: none"> • Quality managers • Electronic and mechanics managers • Product design managers
VESTEL	+	(no definite number) Studies on less energy using products and products including non-hazardous materials	No special tool Reducing energy usage	<ul style="list-style-type: none"> • Quality managers • Designers • Mechanical engineers
Kumtel	+	(approx. 60 to 70 products)	LCA Reducing energy usage	<ul style="list-style-type: none"> • Designers • R&D • Quality managers
Şişecam	+	(no definite number) All products are designed considering the environment.	No special tool Reducing energy usage Minimizing material use	<ul style="list-style-type: none"> • Marketing managers • Designers
Olmuksa	+	(no definite number) All products are designed considering the environment.	-	<ul style="list-style-type: none"> • Designers • Quality managers
Korozo	+	(no definite number) A group of products called 'environmentally conscious'	No special tool Reducing energy usage Reducing raw material usage	<ul style="list-style-type: none"> • R&D • Sales managers • Other related departments

4.5.3 Results of Part – 2 of the Questionnaire

The second part of the questionnaire was designed to understand the ecodesign strategies that companies mostly used during different phases of the product life cycle. 12 people responded to the second part of the questionnaire (3 from packaging sector, 9 from electric & electronics industry). Figure 4.3 represents the results from these two sectors, representing the most important phases for the companies regarding the mostly used ecodesign strategies. Similar results were observed for both industries to some extent. While electric & electronics sector gave attention to the manufacturing, product design and as well as the

product use stage, packaging sector focused on the raw material stage in a large extent. The differences were in line with the results of first part of the questionnaire.

i) Electric & electronics sector

Although the results from both sectors were quite similar in each phase, there was a significant difference in product use phase. Electric & electronics sector gave higher importance to product use stage than packaging sector more likely because of the functional quality of a product. However, the overall score was dramatically decreased for the distribution stage.

ii) Packaging sector

Packaging sector had fewer strategies for product use phase compare to electric & electronics sector, but it had more strategies for raw material stage. As it was indicated in the discussion of the first part, the strategies in product use are not relevant for packaging products, such as using less energy in product use, using renewable energy resources or providing easy maintenance and repair. However, raw material was the main stage that packaging sector could make a difference in environmental quality of product.

4.5.4 Discussion on Part – 2 of the Questionnaire

When the overview of the results are considered, it could be said that while the mostly used ecodesign strategies are in raw material and manufacturing stages, a considerable reduction after the manufacturing stage in both two sectors are observed. Figure 4.2 shows the decreasing attention to environmental issues after the manufacturing stage. However, the ecodesign concept stresses the minimizing environmental impact during the entire product life cycle. When being subordinated one of the stages in the product life cycle, it can cause more damages as it is expected. Therefore, the entire life cycle of product should be in a holistic way.

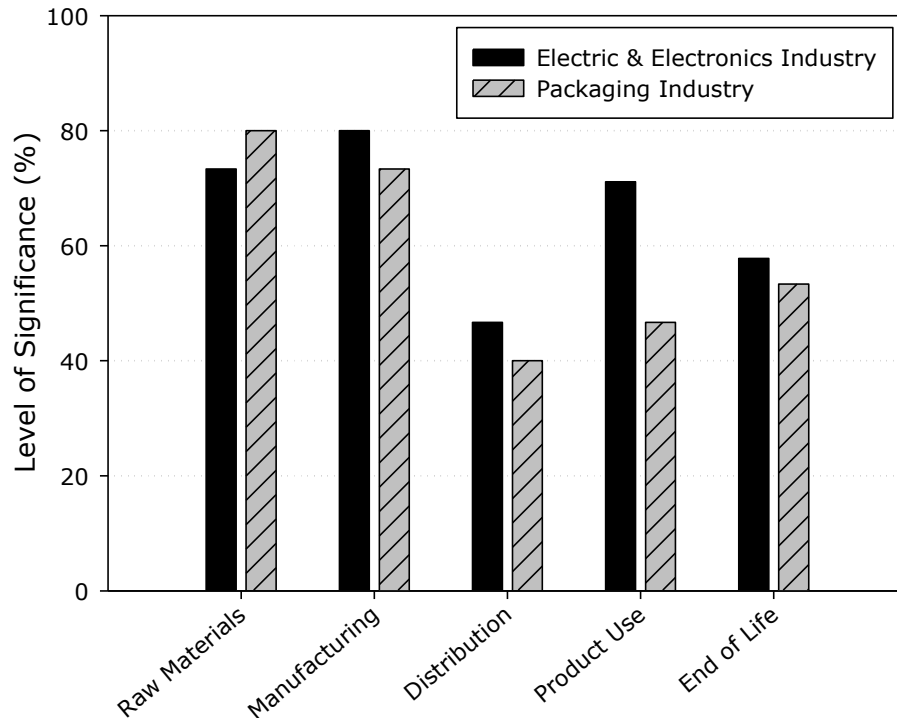


Figure 4.2. The distribution of strategies used in different phase of product life cycle.

Additionally, there is an interesting point that proves the relation between EU directives and ecodesign activities in Turkish industry. 'Reduction of hazardous or chemical materials in raw material', 'reduction of hazardous material in manufacturing' and 'energy using in an efficient way' are some of the mostly used strategies. This can be associated with the implementation of EuP and RoHS directives that force the companies to reduce the hazardous and chemical material and use the energy more efficiently.

4.5.5 Results and Discussion on Part – 3 of the Questionnaire

The third part of the questionnaire was answered by 12 participants (3 from packaging sector, 9 from electronic & electronic industry). The results and related discussion for this part are presented under the following headings:

- i) external drivers
- ii) internal drivers
- iii) barriers
- iv) key actions

i) External drivers

External drivers are the motivations of companies that encourage the implementation of ecodesign, which originated from dynamics of the outside of the company. Figure 4.3 illustrates the external drivers for electric & electronics, and packaging sectors.

According to the results, external drivers present similarities for both packaging sector and electric & electronics sector. Results show that 'legislations' has the highest score in the external drivers for both sectors. This may be because Turkey have newly encountered the environmental considerations and have tried to adapt this into the industry by the help of some limitations. As it was mentioned in the survey of the international examples (see Chapter 2), the first pushing factor is the legislations and its limitations for the countries. Then, commercial or environmental benefits of environmentally-conscious design can be perceived as a value by the companies. As a result, Turkey is at the first step of this understanding, which the legislations are a big concern for the industry to do something for environment. Consumer demand and competitive advantage in the market are the other key factors for both two industries. Surprisingly, consumer demand is suggested as the second choice by the participants.

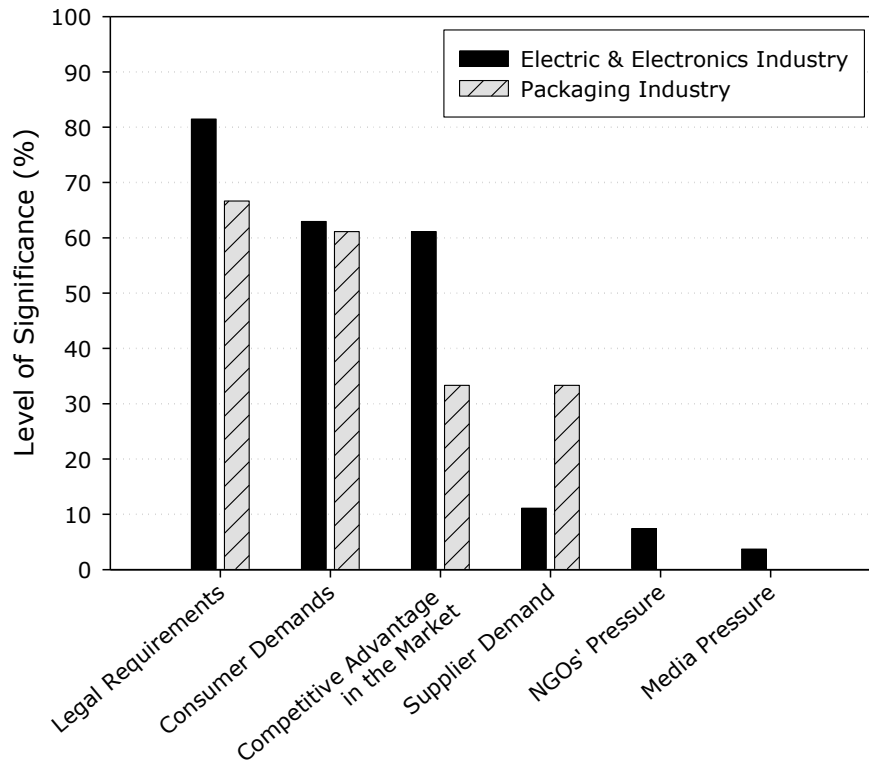


Figure 4.3. External Drivers of the Industries.

Six of the participants indicated the weak awareness level of Turkish consumer in the complementary study. Moreover, the Raising Awareness Campaign highlights the same outcomes from the workshop. However, in the light of the study, it can be said that this shows the growing attention of consumer to the environmental issues and respectively ecodesign products recently. Competitive advantage is also a big concern for Turkish companies in such a big domestic market. Therefore, companies are usually keen on pursuing similar developments with their competitors.

Besides these, two companies (one from electric & electronics and the other from packaging sector) especially named a new driver: 'social responsibility' as the most important driver for them.

Supplier demand, NGOs and media pressure were not considered as key drivers as the others. In fact, NGOs and media pressure were completely ignored in packaging sector.

ii) Internal drivers

Internal drivers are the factors connected to the dynamics of the company itself. Figure 4.4 represents the internal drivers of Turkish electric & electronics, and packaging sectors.

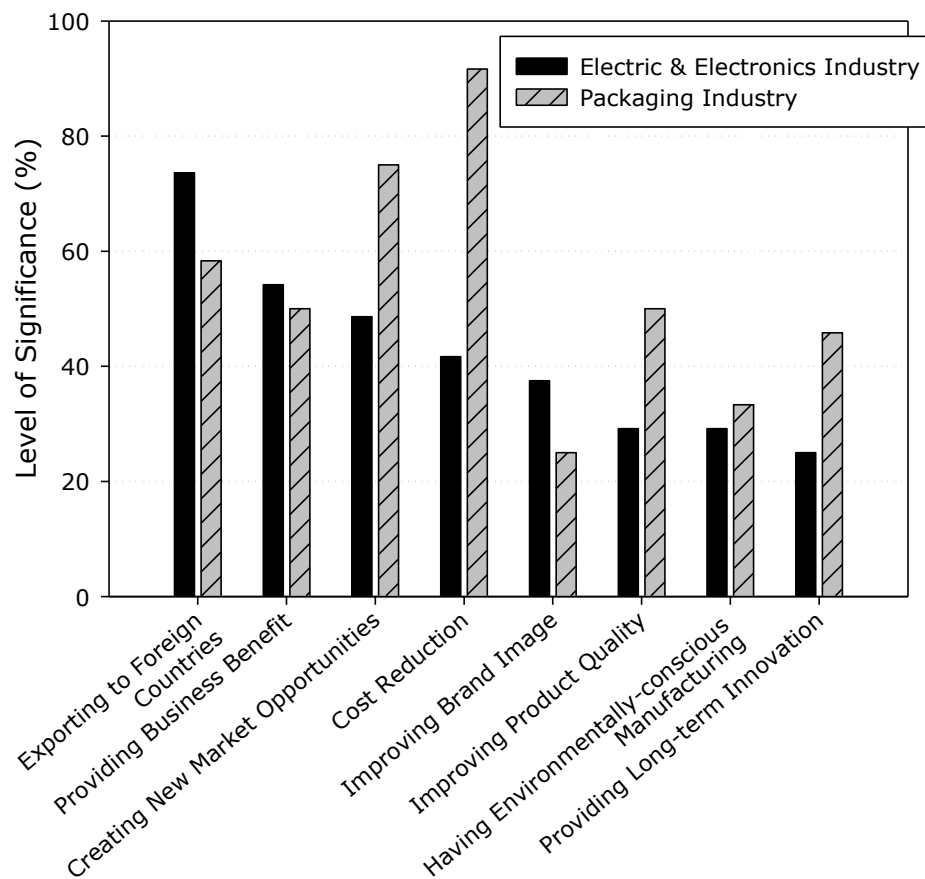


Figure 4.4. Internal drivers of the industries.

For the electric & electronics sector, the main internal driver was the exporting to foreign countries. This is an obvious consequence of EU accession period and the effect of international legislations to Turkish companies most of which the production depends on the international market. Other key internal drivers were found to be 'providing business benefit', 'creating new market opportunities' and 'cost reduction'. However, other drivers (e.g. having a policy that support environmentally-conscious manufacturing, improving brand image, improving product quality, and providing long term innovation) were not thought of the major reasons to implement the ecodesign concept. In the light of these results it can be said that the factors affecting decisions on product design (e.g. providing long term innovation, improving product quality) were not considered as much as the others, which were in general cost-oriented pushers (e.g. cost reduction, providing business benefits).

On the other hand, cost reduction is found to be the most important internal driver for the packaging sector. This considerable peak showed the focus of the packaging sector to adapt ecodesign strategies into their organizations. Creating a new market has taken the second place according to the prioritization of the companies. Other options for internal drivers have a quick decrease in terms of the results of packaging sector, as it is seen in Figure 4.5. It can be said that, providing long term innovation, having environmentally-conscious manufacturing and improving brand image were the least important drivers for packaging sector as well. As it was highlighted in Chapter 3, there are limited R&D activities in Turkish companies because of the economical problems and time consideration. For that reason, they cannot clearly see the advantages of the ecodesign concept without implementing and experiencing its benefits.

iii) Barriers

The companies encounter many barriers to adapt and implement ecodesign strategies into their companies. Figure 4.5 shows the barriers mentioned by Turkish electric & electronics and packaging sectors.

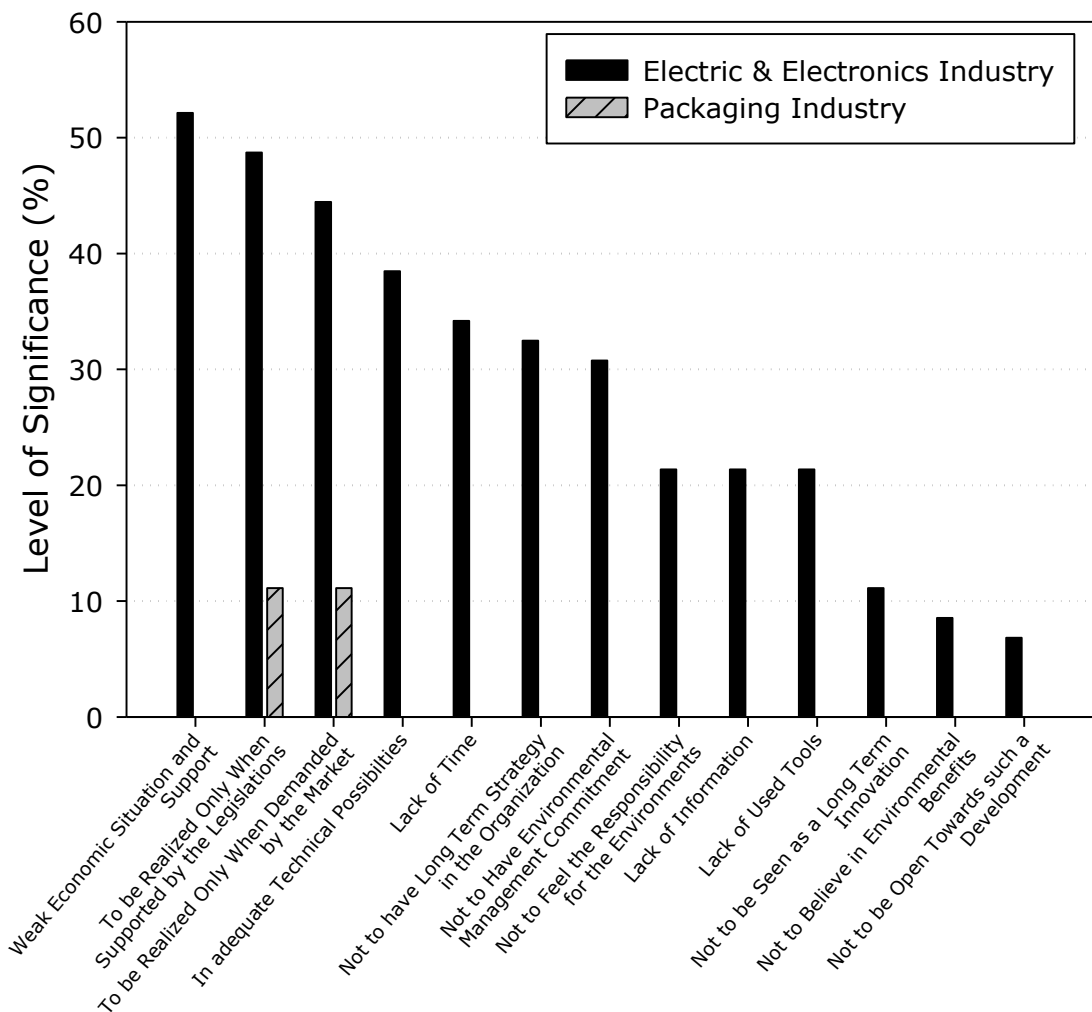


Figure 4.5. Barriers mentioned in the study.

Table 4.7. The most important barriers mentioned in the study.

The most important barriers	
Electric & electronics Sector	Weak economic situation and support Only related issue if it is supported by the legislations Only relate issue if it is demanded by the market Inadequate technical possibilities Lack of time
Packaging Sector	Only related issue if it is supported by the legislations Only relate issue if it is demanded by the market

As can be seen in Table 4.7, the overlapping results for both sectors are legislation and market demand. In general, legislations are found to be the most determining factors, so it is not a surprising result. Market demand is also a primary measure of ecodesign activities for the companies. Other obstacles selected by the electric & electronics sector generally reflect the common developing countries' problems not special for the subject, such as weak economic situation and support, inadequate technical possibilities and lack of time. On the other hand, the obstacles in the literature review discuss the barriers in a different point of view.

The barriers explored in the six case studies in the literature highlighted three important points: obstacles connected to dissemination of ecodesign information; the internal values of company; and the limitations, especially economical constraints. According to this categorization, the barriers found in the questionnaire are close to the third categorization which is directly related to the problems in developing economies. Moreover, it can be inferred from the questionnaire that the industry knows the environmental benefits or long term innovation of ecodesign. However, they cannot implement it because of the technical and economical limitations.

For this part of the questionnaire, because very few answers could be gathered, no conclusive results can be reported for packaging sector.

iii) Key Actions

This part intended to understand the key actions for Turkish industry. For this, companies' suggestions were taken into consideration. Figure 4.6 and Table 4.8 present the results.

According to the results, the key action for electronic & electronics sector was having and implementing an environmental policy (specific to each firm/organization). Changing in organizational level was found to be a good starting point for this sector. Other key action defined as important in the questionnaire, is defining responsible person for improving the ecodesign concept in electric & electronics sector, which also support the organizational restructuring for ecodesign concept. The action drivers offered by the electric & electronics sector are: having a management commitment, defining special

department or experts; introducing the concept to the market and supporting related activities to disseminate the concept; and increasing the level of awareness.

For the packaging sector, disseminating the subject to suppliers was the most influential way to improve ecodesign. The awareness of supplier and the continuation of this learning among suppliers could be a useful strategy to disseminate the concept in the chain of manufacturing.

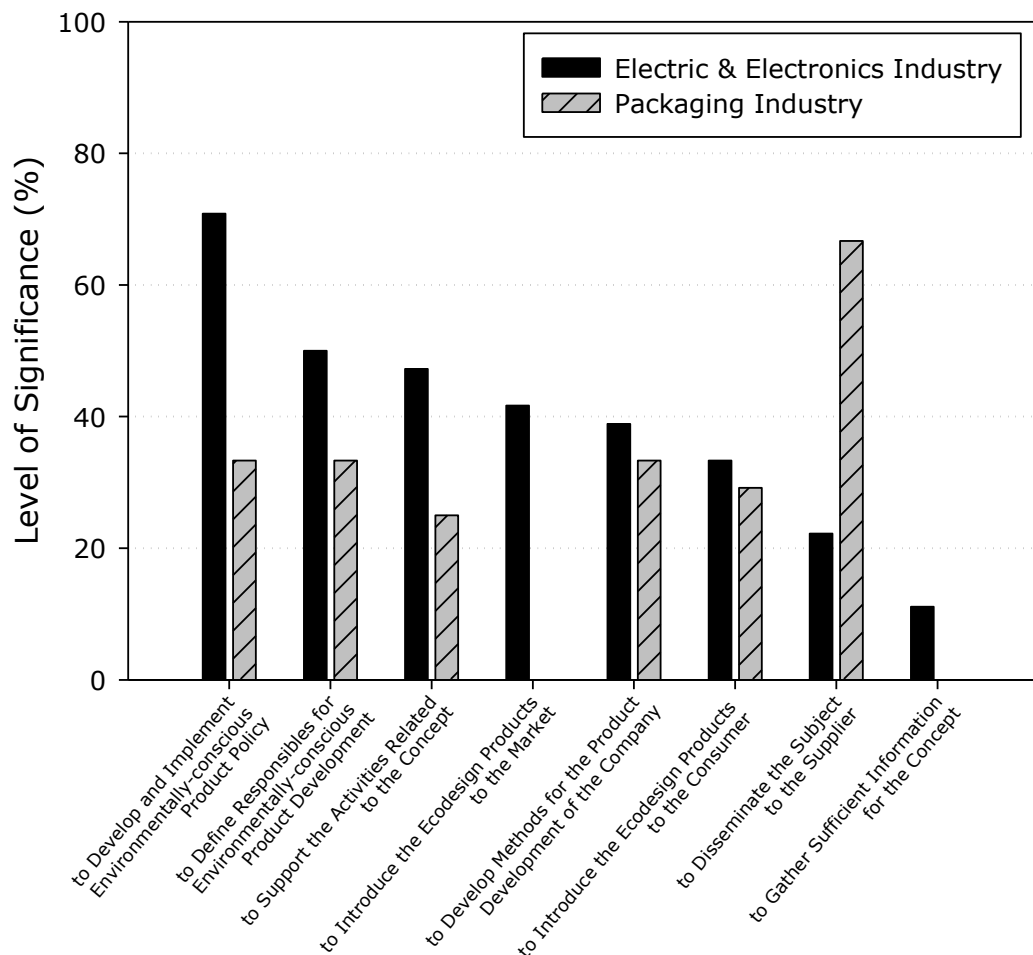


Figure 4.6. Key actions mentioned in the study.

Table 4.8. The most repeated key action drivers of the participants.

The most repeated action drivers	
Electric & electronics sector	To develop an and implement environmentally-conscious product policy
	To define a champion or develop related department for environmentally-conscious product development
Packaging sector	To disseminate the subject to the suppliers

CHAPTER 5

CONCLUSIONS

This chapter begins with summary of the literature. Then the answers to the research questions are exposed in relation to the findings from the literature discussed in Chapter 2 and Chapter 3, and from the empirical study presented in Chapter 4. Finally, the chapter discusses the limitations of the study and brings to a close with the suggestions for further study.

5.1 Literature Review

The literature review discusses the ecodesign concept in different perspectives, which has been a widely accepted and applied approach in developed economies since the late 1980s.

First, the study investigated the ecodesign topic throughout the context of ecodesign basics, the implementation of ecodesign into the companies (see Chapter 2). Accordingly, general understanding of the environmentally-conscious design was explored considering the traditional product design process. Then, six studies related to integration of ecodesign around the world (the Netherlands, Central America, Baltic States, Brazil, France and European States) were investigated to understand approaches of companies or the drivers and obstacles of them in implementing of ecodesign in different contexts. These international examples showed that the economic situation was closely related to the level of ecodesign implementation or the level of ecodesign innovation. According to the different adaptations in developed and developing countries, three evolutionary levels were observed. First, the limitations such as national and international legislations support the implementation of ecodesign. This top-down approach appears vital for especially developing economies. Then companies realize a wealth of advantages from commercial perspective. Further understanding matches with the realization of environmental benefits. As a

result, the adoption and integration of ecodesign in developing economies may require different conditions than the ones in developed economies.

Then, the study focused on Turkish context in Chapter 3, which is one of the newly industrializing countries. It discussed the present situation of Turkey related to ecodesign activities in Turkish industry by help of the findings from the literature and the study executed with the Turkish stakeholders in order to understand the perceptive of stakeholders to ecodesign.

The picture of environmentally-conscious design in Turkish industry was revealed comparing the international examples related to ecodesign integration, to some extent. It is possible to see the same tendency (growing attention to the environmental issues) in Turkey, especially the government's five-year development plan, a number of legislations (e.g. 2002795/AT) and international standards (e.g. ISO 14000). However, as mentioned in literature review and findings from the stakeholder study, the current efforts in the Turkish industry have stayed rather weak in addressing environmental issues. Furthermore, there were very few studies particularly about environmentally-conscious product development in Turkish industry. For that reason, it was believed that a study on the ecodesign in Turkish industry made the survey more clear and explored information about the particular Turkish sectors.

The purpose of the study was to discover the internal and external drivers, barriers and key actions of Turkish packaging and electric & electronics sectors in more detail. Arçelik A.Ş., BEKO Elektronik, VESTEL A.Ş., Kumtel are the companies selected from the electric and electronics sector. Şişecam (Anadolu Cam Sanayii A.Ş.), Olmuksa A.Ş. and Koroza Ambalaj San. ve Tic. A.Ş. are the companies selected from packaging sector. In total, 12 people (designers, quality managers or people that involve company activities or decisions related to ecodesign) participated to the study.

5.2 Research Questions Revisited

In the course of the survey, research questions suggested in Chapter 1 were intended to be replied in different chapters of the thesis. Table 5.1 displays the relation between research question and related chapters of the thesis.

Table 5.1. Research questions and related Chapters.

Research Questions	
CHAPTER 2: Literature Review	<ul style="list-style-type: none"> ○ What are the determining factors (external and internal) as well as barriers of implemented ecodesign strategies in the world?
CHAPTER 3: Literature Review	<ul style="list-style-type: none"> ○ Where does Turkey position itself relative to other countries in the world?
CHAPTER 4: Study on ecodesign in Turkish industry	<ul style="list-style-type: none"> ○ What are the internal and external factors that are promoting the ecodesign activities in Turkish industry? ○ What are the limitations of Turkish industry in relation to activities of adapting ecodesign? ○ What could be the key actions to integrate eco-design in Turkish industry?

Answers to specific research questions found through the literature review and study on ecodesign in Turkish industry are as follows.

Q1: What are the determining factors (external and internal) as well as barriers of implemented ecodesign strategies in the world?

It was researched six recent research studies on the adaptation and implementation of ecodesign in different regions in the world: France, Central America, The Netherlands, The Baltic States, Brazil and the European Union. This is to understand the current design practice concerned with environmentally-conscious design and the context of other countries that tackle this issue. The results provide an overview about motivations, drivers and obstacles of companies, practicing and adapting ecodesign.

In general, the most important external drivers are legislative pressures, customer demand and market forces as well as good position of competitors integrating environmental considerations in the product development processes. Cost reduction/profit increase incentives, better product-market opportunities and environmental (responsibility) policy of company are examples of internal drivers that are the most frequently mentioned factors in the literature.

On the basis of the findings on six recent research studies, regulations, cost reduction and market demand/competitors' initiatives are the main drivers for companies to adopt ecodesign. External factors are especially key dynamics of European States, especially legislations. Tukker et al. highlight the importance of regulations to support ecodesign concept in two directions: creating incentives, and dissemination. On the other hand, long term achievement is only possible by embedding the internal drivers in the organization. This showed that internal drivers are more crucial aspect to implement ecodesign in the organizational level as a long term strategy.

One of the most important barriers found in the studies was that the companies do not want to make radical decisions and changes beyond the conventional values in product development. Therefore, their preferences are closely connected to the ecodesign strategies which match with traditional business benefits (e.g. cost-based strategies). This is because enterprises are anxious about taking high risks by implementing new concept (ecodesign) into their business strategy since it requires extra effort, money and time for the companies in the beginning. In that sense, ecodesign which requires changes in production level and in system level is not perceived as an applicable concept for the companies.

In general, the barriers observed in the surveys follow three ways. First one is the obstacles connected to dissemination of ecodesign information, such as lack of knowledge, lack of information on market possibilities, lack of information on new technologies, and lack of training related to ecodesign. Second one arises from the internal values in company such as lack of top management commitment. The last one refers to limitations especially economical constraints such as limitation of technology, limitation of investment.

Q2: Where does Turkey position itself relative to other countries in the world?

On the basis of the findings on the ecodesign integration in different countries, a network circle among the stakeholders in terms of the environmental aspects was identified, which strengthen practices of ecodesign. The relation between stakeholder groups was a strong motivation for the integration of environmental considerations into the industry. To do this, it is essential to understand and to get insight in the current situation of the Turkish stakeholders that play an important role in the environmentally-conscious position of Turkey. Therefore, to complement the findings of the literature on environmental considerations in Turkey, a study was carried out with three stakeholder groups (i.e. government, universities, and industry).

The survey aimed to find answers to:

- importance of ecodesign for Turkey,
- roles of industry about environmentally-conscious design,
- positions that stakeholders take regarding environmentally conscious design or in a wider perspective sustainable development,
- responsibilities that stakeholders should have to integrate or develop ecodesign in Turkey,
- roles that stakeholders should play and activities they should undertake in supporting ecodesign.

The main outcomes of this study are:

- There are some directives put in force and many studies related to environmental policy and sustainable development in the government that have been executed by the help of the EU accession period. However, as a result of the complementary study, it can be concluded that there is a lack of control mechanism and a lack of encouragement for the industry to produce more environmentally-conscious products.
- Training activities related to ecodesign are relatively low in the industry. This kind of information has to be disseminated to the industry by means of conferences, workshops. For this, there is also a need for qualified people on this topic.

- For the business, the most important consideration is cost (reduction). For that reason, while they are adapting the environmental considerations into organizations, they want to keep traditional methods in production or make minimum changes to cut off extra expense. It is believed that more successful stories related to implementation of ecodesign will move towards the industry more environmentally-conscious activities.
- The investigation on the Turkish stakeholders shows that there is not a strong relation between them. Furthermore, the activities carried out within each stakeholder group are limited because of a relatively low awareness level, economical limitations, and different priorities.
- A network of Turkish stakeholders has tried to be formed in particular projects and situations linked to environmental issues. There are some key intuitions like TÜBİTAK taking more initiatives to gather industry, academy and government. However, the relationship between stakeholders is not kept in long term because of other priorities of institutions or organizations like commercial concerns.

In the light of these findings, it can be said that Turkish industry has made attempts to introduce ecodesign most recently. Therefore, according to the Brezet's model, level 1 (Product improvement) and level 2 (Product redesign) can describe current state of ecodesign activities in Turkish industry (Brezet, 1997 in Charter and Tischner, 2001). Moreover, it is clear that the legislations are more determinant stimuli rather than business benefits and environmental benefits in general.

Q3: What are the internal and external factors that are promoting the ecodesign activities in Turkish industry?

This question found the answers of the internal and external drivers of Turkish electric & electronics sectors.

According to the results of the study (Chapter 4), the external drivers have the similar results both in two sectors. As it was expected, 'legislations' has the highest score in the external drivers for packaging and electric & electronics sector. As it has been mentioned in the surveys of the international examples

(Chapter 2), the first pushing factor is the legislations and its limitations for the countries. As a result, Turkey is in the first step of this understanding, which the legislations are the big concern for the Turkish industry to do something for environment. Surprisingly, consumer demand is second chose of the participants. Six of the participants indicated the weak awareness level of Turkish consumer in the complementary study. On the other hand, by the light of the study, it can be said that this shows the growing attention of consumer to the environmental issues and respectively ecodesign products in recently. 'Competitive advantage' is also a big concern for Turkish companies in such a big domestic market. Therefore companies usually pursue the developments in other competitor firms. Supplier demand, NGOs and media pressure were not considered as key drivers as much as the others. In fact, NGOs and media pressure were completely ignored in packaging sector.

On the other hand, cost reduction is the most important internal driver for the packaging sector. This considerable peak showed the foci of the packaging sector by adapting the ecodesign strategies into their organizations. Then, creating a new market is taken place the second sequence according to the prioritization of the companies. Other options for internal drivers have a quick decrease in terms of the results of packaging sector. It can be said that, providing long term innovation, having environmentally-conscious manufacturing and improving brand image were the least important drivers for packaging sector as well. As it has been highlighted in Chapter 3, there are limited R&D activities in Turkish companies because of the economical problems and time consideration. For that reason, Turkish companies can not see clearly the advantages of the ecodesign concept without implementing and experiencing its benefits for the product and their organization.

Q4: What are the limitations of Turkish industry in relation to activities of adapting ecodesign?

For the participants, ecodesign is only related issue if it is supported by the legislations or if it is demanded by the market. Without these pushers (regulatory constraints and market demands), company had a weak motivation

for both sectors. Therefore, the drivers in organizational level did not support the companies' environmental considerations as much as the external drivers.

Other obstacles selected by the electric & electronics sector generally reflect the common developing countries' problems not special for the subject, such as weak economic situation and support, inadequate technical possibilities, and lack of time (It can be followed from Table 5.2). This shows that the economic situation of a country is strongly parallel issue with the adaptation of ecodesign into the industry. For the companies, it means extra money, extra time and effort. For this, big size companies can take initiatives because of the better capitals and opportunities in their companies. However, as it was explored in the study, even big companies have many obstacles related to economic situation of its organization or the market demand (see Table 5.2).

Table 5.2. The most important barriers mentioned in the survey.

The most important barriers	
Electric & electronics sector	<ul style="list-style-type: none"> ○ Weak economic situation and support ○ Only related issue if it is supported by the legislations ○ Only relate issue if it is demanded by the market ○ Inadequate technical possibilities ○ Lack of time
Packaging sector	<ul style="list-style-type: none"> ○ Only related issue if it is supported by the legislations ○ Only relate issue if it is demanded by the market

Q5: What could be the key actions to integrate eco-design in Turkish industry?

According to the results, the key action for electronic & electronics sector was having and implementing an environmental policy (specific to each firm/organization). Changing in organizational level was a good starting point for this sector. Moreover, other choices such as defining responsible person support this organizational alteration to improve the ecodesign concept in electric & electronics sector. The action drivers offered by the electric &

electronics sector follow the reasonable way; having a management commitment, defining special department or experts, introducing the concept to the market and supporting related activities to disseminate the concept and increase the level of awareness.

For the packaging sector, disseminating the subject to suppliers was the most influential way to improve ecodesign. The awareness of supplier and the continuation of this learning among suppliers could be useful to disseminate the concept in the chain of manufacturing.

Table 5.3. Action drivers mentioned in the study.

The most repeated action drivers	
Electric & electronics sector	<ul style="list-style-type: none"> ○ To develop an and implement environmentally-conscious product policy ○ To define a champion or develop related department for environmentally-conscious product development ○ To support the activities related to the concept ○ To introduce the ecodesign products to the market
Packaging sector	<ul style="list-style-type: none"> ○ To disseminate the subject to the suppliers

5.3 Limitations of the Study

Distribution of selected participants by the sectors

The study on the ecodesign in Turkish industry was presented in Chapter 4. Though the intention was to choose the same number of companies from both sectors, 3 companies from packaging sector 4 companies from electric & electronics sector were completed the study. Unfortunately, one company from packaging sector could not reply the questionnaire because of their limited time. Ideally, it would be more preferable to work with a larger number of companies, however time limitation (both for the researcher and the companies) is usually a limitation. Nevertheless, it is believed that the results of the study are still valid to reveal answers to the questions addressed in the study.

Number of participants for the study

12 participants responded to the questionnaire for the study on ecodesign in Turkish industry. The questionnaire with an explanation note was sent to the companies with an invitation to at least three people to respond to the questionnaire. This was to gather three different perspectives on the same questions within the same company. However, some companies either replied back with a single response sheet that had all the related departments' approval or they sent back collective responses. Therefore, the answers were accepted as the company perspectives.

According to the results, the key action for electronic & electronics sector was having and implementing an environmental policy (specific to each firm/organization). The organizational change was found to be a good starting point for this sector.

It is important to mention again that the participants exposed their individual opinions about ecodesign and developments in the companies that they work; their answers to the questionnaire cannot be regarded as the companies' general views.

REFERENCES

- Akermark, A. (2003). The crucial role of the designer in ecodesign. *PhD Thesis*. Royal Institute of Technology, Stockholm, Sweden.
- Allenby, B.R. and Fullerton, A. (1991). Design for environment-A new Strategy for environmental Management. *Pollution Prevention Review Winter*, 51-61.
- Argument, L., Lettice, F. and Bhamra, T. (1998). Environmentally conscious design: matching industry requirements with academic research. *Design Studies*, 19(1), 63-80.
- Bakker, C. (1995). Environmental information for industrial designers. *PhD Thesis*. Delft University of Technology, Delft, the Netherlands.
- Baumann, H., Boons, F. and Bragd, A. (2002). Mapping the green product development field: engineering, policy and business perspectives. *Journal of Cleaner Production*, 10, 409-425.
- Bektasoglu, S. (2007). *Packaging industry*. Export Promotion Center of Turkey (IGEME). Sectorial information of IGEME.
- Belmane, I., Karaliunaite, I., Moora, H. Uselyte, R. and Viss, V. (2003). *Eco-design in the Baltic States industry feasibility study*. Nordic Council of Ministers, Copenhagen.
- Berkel, R., Willems, E. and Lafleur, M. (1997). Development of an industrial ecology toolbox for the introduction of industrial ecology in enterprises-I. *Journal of Cleaner Production*, 5(1-2), 11-25.
- Bhamra, T.A. (2004). Ecodesign: the search for new strategies in product development. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 218, 557-568.

Bhamra, T.A. and Evans, S. (1999). An ecodesign model based on industry experience. *Engineering and the Environment - How It Affects You! (Ref. No. 1999/097)*, IEEE Seminar, 1999, 8, 1-4.

Bhamra, T.A., Evans, S., Simon, M., McAlloone, T. C., Poole S. and Sweatman, A. (1999). Integrating environmental decisions into the product process: part 1 the early stages. *Proceedings of First International Symposium on Environmentally Conscious Design and Inverse Manufacturing*. Tokyo, Japan, 1999, 329-333.

Boks, C. (2006). The soft side of ecodesign. *Journal of Cleaner Production*, 14, 1346-1356.

Boks, C. and Stevels, A. (2003). Theory and practice of environmental benchmarking in a major consumer electronics company. *Benchmarking: An International Journal*, 10(2), 120-135.

Bras, B. (1997). Incorporating environmental issues in product design and realization. *Industry and Environment, Special Issue on Product Design and the Environment*, 20(1-2), 1-19.

Brezet, H. and Hemel, C. (1997). *Ecodesign, a promising approach to sustainable production and consumption*. United Nation Publication, UNEP, Paris.

Brezet, H., Diehl, J.C. and Silvester, S. (2001). From ecodesign of products to sustainable systems design: delft's experiences. *Proceedings of EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 2001, 605-612.

Bruntland, G. (1987). *Our Common Future: The World Commission on Environment and Development*. Oxford, Oxford University Press.

Charter, M. and Chick, A. (1997). Welcome, to the issue of the journal of sustainable product design, *Journal of Sustainable Product Design*, 1, 5-6.

Charter, M., and Tischner, U. (2001). *Sustainable solutions: developing products and services for the future*. Sheffield, United Kingdom, Greenleaf Publishing. In

Brezet, J. C. 1997. Dynamics in eco-design practice. *UNEP Industry and Environment*, 20(1-2), 21-24.

Costa, G.J., and Gouvinhas, R.P. (2002). The utilisation of ecodesign practices within brazilian sme companies. *Proceedings of Toward Sustainable Product Design 7th International Conference*, London, 2002. 7th International Towards Sustainable Product Design Conference Proceedings - CD rom. Netherlands : Kluwer Academic Publishers, 2002.

Crul, M. (2003). Ecodesign in Central America. *PhD Thesis*. Delft University of Technology, Delft, the Netherlands.

Dewberry, E. L. and Goggin, P. (1996). Spaceship ecodesign. *Co-design. The interdisciplinary journal of design and contextual studies*, 5(6), 12-17.

Ecodesign, (2008). *Product development*. Last accessed June 12, 2008. Available at: <http://www.ecodesign.at/>

Ehrenfeld, J. (2001). Designing 'sustainable' product/service systems. *Proceedings of EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 2001, 916-920.

Er, A. (1997). Development Patterns of industrial design in the third world: a conceptual model for newly industrialized countries. *Journal of Design History*, 10, 3.

Er, Ö. (2001). Endüstriyel tasarım, teknolojik yenilik, ar-ge: türkiye'deki mevcut teşvik uygulamalarında endüstriyel tasarımın yeri ve politika önerileri. *Proceedings of ERC/METU International Conference in Economics V*, 2001, ERC/METU International Conference in Economics V Proceedings and Conference CD-ROM, Ankara, September, 2001, 10-13.

Erismis, M.C. (2007). Sürdürülebilir oluklu mukavva ambalaj tasarımı: olmuksa örneği. *MS Thesis*. Istanbul Technical University, Istanbul, Turkey.

Esen, B. (2007). *Household Appliances*. Export Promotion Center of Turkey (IGEME). Sectorial information of IGEME.

ETMK, (2005). *ETMK Dernek Tüzüğü*. Last accessed August 20, 2008. Available at: <http://www.etmk.org/modules.php?name=Content&pa=showpage&pid=9/>

Fletcher, K.L. and Goggin, P.A. (2001). The dominant stances in ecodesign: a critique. *Design Issues*, 17(3), 15-25.

Fraunhofer IZM, (2005). *Final report: ecodesign awareness raising campaign for electrical & electronics SMEs*. Last accessed June 1, 2008. Available at: <http://ecodesign.izm.fraunhofer.de/servlet/is/160/>

Gluckman, J., Allan, T. and Astill, J. (2006). *Sustainable product design & develeopment exploring the applicability of European experience*. Locusresearch Sustainable Design & Development. The Report for Ministry for the Environment.

Handfield, R.B., Melnyk, S.A., Calantone, R.J. and Curkovic, S. (2001). Integrating environmental concerns into design process: the gap between theory and practice. *IEEE Transactions on Engineering Management*, 48(2), 189-209.

Hemel, C. and Cramer, J. (2002). Barriers and stimuli for ecodesign in SMEs. *Journal of Cleaner Production*, 10, 439-453.

Hemel, C.G. (1998). Ecodesign empirically explored: design for environment in Dutch small and medium sized enterprises. *PhD Thesis*. Delft University of Technology, Delft, The Netherlands.

IDSA, (2004). *Okala ecological design course guide*. Last accessed August 1, 2008. Available at: <http://www.invest.gov.tr/InvestorsGuide.aspx?ID=2/> In Lewis, H. & Gertsakis, J. (2001) *Design + Environment: a global guide to designing greener goods*. Greenleaf Publishing, Sheffield, United Kingdom.

IGEME, (2005). *Industry*. Last accessed June 19, 2008. Available at: <http://www.igeme.org.tr/english/turkey/pdfView.cfm?sec=tr&secID=1&subID=/>

Invest, (2007). *Cost of doing business in Turkey*. Last accessed June 10, 2008. Available at: <http://www.invest.gov.tr/InvestorsGuide.aspx?ID=2>

İSO, 2007. *Türkiye'nin 500 büyük sanayi kuruluşu – 2007*. Last accessed June 19, 2008. Available at: <http://www.iso.org.tr/tr/web/besyuzbuyuk/bb1-25.htm>

Johansson, G. (2002). Success factors for integration of ecodesign in product development: a review of state of the art. *Environmental Management and Health*, 13(1), 98-107.

Karlsson, R. and Luttrupp, C. (2006). EcoDesign: what's happening? An overview of the subject area of ecoDesign and of the papers in this special issue. *Journal of Cleaner Production*, 14, 1291-1298.

Korkut, F. and Hasdogan, G. (1998). The Profession of industrial design in Turkey: the correspondence between education and practice. *Proceedings of IDATER 98: International Conference on Design and Technology Educational Research and Curriculum Development*, Loughborough, Loughborough University, United Kingdom, 1998, 125-131.

Korozo, 2007. *Environmental Products*. Last accessed August 11, 2008. Available at: <http://www.korozo.com.tr/index.php?mid=314>

Lambert, J.L. (2002). The Introduction of Sustainability into Competitive Design Network (CDN). *MS Thesis*. Cranfield University, United Kingdom.

Lofthouse, V.A. and Bhamra, T. (2001). Making things better - An industrial designer's approach to ecodesign. *Proceedings of D3 Desire, Designum, Design: Fourth European Academy of Design Conference*, Aveiro, Portugal, 12 April 2001, 10.

Lofthouse, V. A., Bhamra, T. and Evans, S. (1999). Effective Ecodesign: Finding a Way Forward for Industry in *6th International Product Development Management Conference*, University of Cambridge, Cambridge. England, July 1999, 2, 717-723.

Loriot, C. (2003). Implementing environmentally conscious product development in the Canadian industries: an industrial design systemic perspective. *MS Thesis*. Lund University, Sweden.

Mackenzie, D. (1997). *Green Design: Design for Environment*. Laurence King, United Kingdom.

Madge, P. (1997). Ecological design: a new critique. *Design Issues*, 13(2), 44-54.

Mathieux, F., Rebitzer, G., Ferrendier, S., Simon, M. and Froelich, D. (2001) Ecodesign in the European electr(on)ics industry: an analysis of the current practices based on cases studies. *The Journal of Sustainable Product Design*, 1, 233-245.

Mazlum, S.C. (2004). The politics of sustainable development: sustainable planning in the UK and Turkey. *The European Union and the Mediterranean: The Mediterranean's European Challenge – Volume V*, Peter G. Xuereb (Ed.), Malta: University of Malta European Documentation and Research Centre, 629-653.

McDonough, W. and Braungart, M. (1998). The next industrial revolution. *The Atlantic Monthly*, 282(4), 82-92.

Meinders, H. and Meuffels, M. (2001), Product chain responsibility – an industry perspective. *Corporate Environmental Strategy*, 8(4).

Nielsen, P. H. and Wenzel, H. (2002). Integration of environmental aspects in product development: a stepwise procedure based on quantitative life cycle assessment. *Journal of Cleaner Production*, 10, 247-257.

Olundh, G. (2006). Modernising ecodesign: ecodesign for innovative solutions. *PhD Thesis*. Royal Institute of Technology, Stockholm, Sweden.

Pfahl, R.C. (2001). Journey to a sustainable world. *Proceedings of EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 2001, 895-899.

Reyes, T., Millet, D. and Brissaud, D. (2006). Study of ecodesign integration process in French companies. *Proceedings of 13th Cirp International Conference on Life Cycle Engineering*, Leuven, Belgium, 2006, 267-274.

Ries, G., Winkler, R. and Züst, R. (1999). Barriers for a successful integration of environmental aspects in product design. *Proceedings of First International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 1999, 527-532.

Ritzén, S. and Beskow, C., (2001). Actions for integrating environmental aspects into product development. *Journal of Sustainable Product Design*, 1, 91-102.

Robért, K.H., (2000). Tools and concepts for sustainable development, how do they relate to a general framework for sustainable development, and to each other. *Journal of Cleaner Production*, 8, 243-254.

Ryan, C. (2004). Learning from a decade (or so) of eco-design experience, part II: advancing the practice of product eco-design. *Journal of Industrial Ecology* 8(4), 3-5.

Sağır and Yuksel, (2002). *Iktisat IV. Central Bank of The Republic of Turkey*. Last accessed June 19, 2008. Available at: www.tcmb.gov.tr/yeni/iletisimgm/gulsagir.htm - 680k/

SBA, (2004). Good housekeeping: eco-efficient environmental actions. Last accessed July 19, 2008. Available at: <http://www.epfl-das-tratenv.ch/spec/sba/download/Tools/GHKGuideEnglish.pdf>

Schischke, K., Larsen, B., Berner, C., Müller, J. and Poulsen T.S. (2005). *Teaching Material on Environmentally Benign Product Design*. Awareness Raising Campaign for Electrical & Electronics SMEs.

Sherwin C. and Evans S. (2000). EcoDesign innovation: is 'early' always 'best'. *Proceedings of the 2000 IEEE International Symposium*, San Francisco, CA, 8-10 May 2000, 112-117.

Shrivastava, P. (1995). Environmental technologies and competitive advantage. *Strategic Management Journal*, 16, 183-200.

Simon, M., Poole, S., Sweatman, A., Evans, S., Bhamra, T. and McAloone, T. (2000). Environmental priorities in strategic product development. *Business Strategy and the Environment*, 9, 367-377.

SPO, (2006). *Ninth development plan (2007-2013)*. Prime Ministry of State Planning Organization. Last accessed June 19, 2008. Available at: http://www.dpt.gov.tr/konj/DPT_Tanitim/index1.html

Stevels, A. (1999). Integration of ecodesign into business, a new challenge, *Proceedings of First International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 1999, 27-29.

Stevels, A. (2001). Application of ecodesign ten years of dynamic development. *Proceedings of EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 2001, 905- 915.

Suel, A.B. (2006). The role of the in-house industrial designer in Turkish industry: perceptions of manufacturers and designers. *MS Thesis*. Middle East Technical University, Turkey.

Tac, N. and Aglargo, O. (2007). Turquality: an innovative unique model for making global brands out of Turkish products. *South-East Europe Review*, 1, 127-137.

Temiz Uretim, (2008). *Cleaner production workshop- integration of sustainable development into sectoral policies*, UNDP. Last accessed August 2, <http://www.enve.metu.edu.tr/people/gndemirer/links/temizuretim/tuck2008.htm>

Trakya Cam, (2006). *Environmental policy*. Last accessed August 12, http://www.trakyacam.com.tr/TrakyaCam/en/cevre_politikasi.htm

TÜBİTAK, (2008). *Direct public R&D and innovation funds (Turkey)*. Statistics of TÜBİTAK. Last accessed: August 1, 2008, Available at: <http://www.tubitak.gov.tr/home.do?ot=1&sid=1006&pid=547>

TUIK, (2008). *Foreign trade*. Last accessed August 19, 2008, Available at: http://www.tuik.gov.tr/PreTablo.do?tb_id=12&ust_id=4

Tukker, A. G., Ellen, J., and Eder, P. (2000). *Eco-design: strategies for dissemination to SMEs, Part I: overall analysis and conclusion*. Joint Research Centre study, European Commission.

U Nations (2002). *Johannesburg Summit 2002 Turkey, Country Profile*. Report of Government of Turkey.

UNECE, (2007). *UNECE countries*. Last accessed June 12, 2008, <http://www.unece.org/stats/profiles2007/Welcome.html>

UNIDO, (2002). *Industry and sustainable development in Turkey*. Last accessed. Available at: June 11, 2008. Available at: www.unido.org/fileadmin/import/userfiles/timminsk/rio10-ind-turkey-eng.pdf

Vercalsteren, A. and Jansen, B. (2001). Ecodesign demonstration project LIFE – examples of ecodesign in Belgian industry. *Proceedings of EcoDesign 2001: Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo, Japan, 82-86.

Vestel, 2008. *Quality certifications*. Last accessed 11 July, 2008 Available at: <http://www.vestel.com.tr/Dev/Kurumsal/kalitebelgeleri.htm>

Yılmaz, H. (2008). An empirical evaluation of cleaner production practices in Turkey. *Journal of Cleaner Production*, 16(S1), 50-57.

Yuksel, H. (2003). İşletmelerin çevreye duyarlı üretim faaliyetlerinin ampirik bir çalışma ile değerlendirilmesi. *Endüstri Mühendisliği*, 2.

APPENDIX A

COMPLEMENTARY STUDY

Cevreye duyarli urun tasarimi konusunun, Turkiye'deki etkili paydaslari arasinda yer aldigini dusundugum kurum, kurulus ve kisiler arasinda'nin da bulunduğunu dusunuyorum.

Size yazma nedenim, bu paydaslardan biri olarak asagidaki sorulara cevap alabilmek. Tercihinize bagli olarak uygun gordugunuz bir tarih ve zamanda yüz yüze ya da telefon gorusmesiyle ya da e-posta ile dusuncelerinizi paylasmayi cok isterim.

- 1) Turkiye'de cevreye duyarli urun tasarimi acisindan etkili oldugunu dusundugunuz paydaslar (kisi, kurum ve kurulus vb.) kimlerdir ya da kimler olmalıdır?
- 2) Bu konuda paydaslar ne gibi roller ustlenebilirler ve cevreye duyarli tasarimi desteklemek icin ne gibi inisiyatifler alabilirler?
- 3) Cevreye duyarli urun tasarimi acisindan ya da daha genis kapsamda ulke ekonomisindeki surdurulebilir kalkinmaya destek olarak yuruttuđunuz (.....olarak) desteklediginiz ya da planladiginiz calismalar, projeler var mi? Nelerdir kisaca aciklar misiniz?
- 4) Cevreye duyarli tasarimin Turkiye icin onemli oldugunu dusunuyor musunuz? Yanitinizin nedenini aciklar misiniz?
- 5) Bu konu kapsaminda Turkiye endustrisindeki gozlemlediginiz gelimseler nelerdir?

APPENDIX B

FIRST PART OF THE QUESTIONNAIRE

Aşağıdaki anket Orta Doğu Teknik Üniversitesinde yüksek lisans tez çalışması kapsamında hazırlanmış olup herhangi bir ticari amaç güdülmeden, Türkiye endüstrisinde elektrik&elektronik ve ambalaj sektörlerindeki 'çevreye duyarlı ürün tasarımı' (ecodesign) kavramını anlamaya yönelik hazırlanmış bir çalışmadır. Zaman ayırdığınız için teşekkür ederiz...

Şirket Adı:

I. Bölüm

1. Şirket içinde izlediğiniz çevre politikanız var mı? Varsa, bu politika ürün ve ürün geliştirme safhalarını da kapsıyor mu? Lütfen kısaca anlatınız?
2. Şirketinizde çevreye duyarlı tasarlanmış ve pazara sunulmuş kaç ürününüz mevcut?
3. Çevreye duyarlı ürün tasarımı süresinde uyguladığınız metotlar var mı, bunlar nelerdir? (Örn: Yaşam döngüsü değerlendirmesi(Life Cycle Assesment-LCA), MET matrix-Malzeme devri (M), enerji tüketimi (E), ve zehir emisyonu (T) vb.)
4. Şirket içerisinde çevreye duyarlı tasarım sürecinde kimler rol oynamaktadır? (Örn: karar verici, takip eden, tasarımcı, bu konuyla ilgili sorumlu gibi)

APPENDIX C

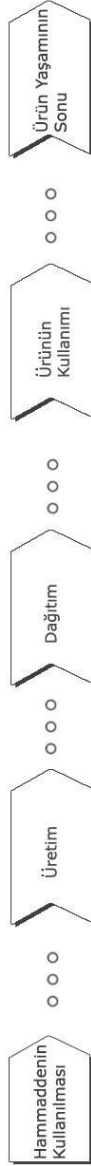
SECOND PART OF THE QUESTIONNAIRE

II. Bölüm

Şirket içindeki pozisyonunuz/konumunuz aşağıdakilerden hangisidir?

Tasarımcı Üretim müdürü Genel Müdür Diğerleri (Lütfen belirtiniz.)

Yeniden bir ürün geliştirirken ya da yeniden tasarlarken ürünün yaşam döngüsünde şekilde görülen stratejilerden hangilerini şirket olarak uyguluyorsunuz? Lütfen işaretleyiniz.



- Malzeme kullanımının azaltılması
- Çevreye daha az zarar verecek malzemelerin seçilmesi
- Malzemenin içindeki tehlikeli ya da kimyasal maddelerin kullanımının azaltılması
- Yeniden dönüştürülebilir malzeme kullanılması
- Dönüştürülmüş malzeme kullanılması
- Diğer (Lütfen belirtiniz.)

- Üretim malzeme girdisinin azaltılması
- Üretimde tehlikeli maddelerin kullanımının azaltılması
- Enerjinin verimli kullanılması
- Üretimdeki atıkların azaltılması
- Üretim sırasındaki hava kirliliğinin azaltılması
- Sürdürülebilir su kullanılması
- Diğer (Lütfen belirtiniz.)

- Ambalaj kullanımı ve miktarının azaltılması
- Ambalaj için dönüştürülmüş ya da dönüştürülebilen malzeme kullanılması
- Lojistik optimizasyonu
- Taşıma şekline karar verilirken çevresel faktörlerin göz önünde bulundurulması
- Diğer (Lütfen belirtiniz.)

- Tüketim sırasında daha az enerji harcanması
- Temiz enerji kaynaklarının kullanılması
- Daha az tüketim mallarına ihtiyaç duyulması (Örn: ürünün işlevselliğini arttırmak)
- Ürünün daha uzun süre kullanılabilmesi
- Yüksek kalite ve dayanıklılık prensiplerine uygun olması
- Kolay bakım ve onarım yapılabilmesi
- Diğer (Lütfen belirtiniz.)

- Ürünün kısmen ya da tamamen tekrar kullanılması
- Malzemenin geri dönüşümünün sağlanması
- Ürünün parçalarına kolay ayrılabilmesi
- Malzemenin biyolojik olarak parçalanabilmesi
- Yeniden üretilebilmesi
- Ürünlerin kısmen ya da tamamen çevreye duyarlı bir şekilde yok edilmesi
- Diğer (Lütfen belirtiniz.)

APPENDIX D

THIRD PART OF THE QUESTIONNAIRE

III. Bölüm

1. Aşağıdakilerden hangilerini şirketiniz içinde çevreye duyarlı tasarımın uygulanmasını teşvik eden nedenlerden biri olarak görüyorsunuz?

İşaretlediğiniz nedenlerden şirket içi ve şirket dışındaki bölümleri kendi içinde önem sırasına göre sıralayabilir misiniz?

Şirket dışı nedenleri:

- sıralama
- Yönetmelik ve mevzuat
 - Tüketici talebi
 - Rekabetçi firmaların çevreye duyarlı ürün tasarımını zaten uyguluyor olmaları
 - Yan sanayi talebi
 - Sivil toplum örgütlerinin baskısı
 - Medyanın baskısı
 - Diğerleri (Lütfen belirtiniz.)

Şirket içi nedenleri:

- sıralama
- Yurt dışına ihracat yapılması
 - Şirketin çevreye duyarlı üretim anlayışını destekleyen bir politikasının olması
 - Maliyetleri azaltması
 - Marka geliştirilmesi
 - Yeni pazar alanakları yaratması (Pazar paylarını yükseltme ve yeni pazar alanları oluşturmaları)
 - Ürünün işlevselliğini artırması
 - Ticari fayda sağlanması (Örn: üretim verimliliğini artırma, ürünün depolanması veya dağıtımında iyileştirmeler sağlanması gibi...)
 - Uzun vadede yenilikçi bir yaklaşım sağlanması (inovasyon)
 - Diğerleri (Lütfen belirtiniz.)

2. Aşağıdakilerden hangilerini şirketiniz içinde çevreye duyarlı tasarımın uygulanmasını engelleyen nedenlerden biri olarak görüyorsunuz?

İşaretlediğiniz kriterleri önem sırasına göre sıralayabilir misiniz?

sıralama

- Çevresel bir yarar sağlayacağına inanılmaması
- Şirketin kendini bu konuda sorumlu hissetmemesi
- Çevreye ilgili üst yönetime ait bir söylemin bulunmaması
- Şirket için bir inovasyon olarak görülmemesi
- Şirketin bu yönde bir değişime açık olmaması
- Şirketin uzun vadeli bir stratejisinin olmaması
- Çevresel yasalarla zorunlu kilindiği takdirde şirketi ilgilendirebilecek bir konu olması
- Pazar talebi olduğu takdirde şirketi ilgilendirebilecek bir konu olması
- Zaman yetersizliği
- Bilgi yetersizliği
- Ekonomik yetersizlikler
- Kullanılan yöntemlerin yetersizliği
- Teknik yetersizlikler
- Diğerleri (Lütfen belirtiniz.)

3. Aşağıdakilerden hangilerini şirketiniz içinde çevreye duyarlı tasarımın uygulanmasını hızlandırabilecek düzenlemelerden biri olarak görüyorsunuz?

İşaretlediğiniz kriterleri önem sırasına göre sıralayabilir misiniz?

sıralama

- Çevreye duyarlı ürün geliştirme politikası hazırlanıp uygulanması
- Konuyla ilgili sorumlu kişi ya da kişiler belirlenmesi ya da bir bölüm oluşturulması
- Bu konunun paydaşlara aşılınması
- Bu konuyla ilgili gerekli doküman ve bilgi sağlanması (bunların devamlı kullanılması ve yenilenmesi)
- Konuyla ilgili şirket içi ürün tasarımına yardımcı yöntemler geliştirilmesi
- Pazara bu ürünlerin tanıtılması
- Tüketicilere bu ürünlerin tanıtılması
- Konuyla ilgili bilincin toplumda ve endüstride artırılmasına yönelik yarışma, seminer düzenleme, vb. etkinlikleri desteklenmesi
- Diğerleri (Lütfen belirtiniz.)