



ECOLOGICAL DESIGN AS A RESULT OF ENVIRONMENTAL POLLUTION AND ITS EFFECTS ON TODAY'S FURNITURE

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ABSTRACT

When the process of formation of furniture is examined, it is seen that it dates back to the beginning of human history. With the development process of humanity, furniture has also developed, it is no longer just a necessity and has become a big market, a socio-cultural symbol. In the present century, the consumption of world reserves has increased with the human population, and as a result, the response of the ecosystem has been confronted. Realizing that they cannot fight with nature, human beings have started to search for new production systems by cooperating with it. Understanding the importance of preserving ecological balances has started the process of designing today's ecological furniture. Ecological designs; while balancing the human-nature relationship by trying to protect the environment as pure as possible, on the other hand, it has become a communication object by providing the designer with different aesthetic opportunities. Design criteria have changed in this direction and priority has been set as "environment" and "nature". When the history of furniture is considered, it is seen that the furniture made in the early ages has a more advanced understanding than the present in terms of ecological features. Today, apart from wood, there are technological materials that dissolve quickly in nature, do not give toxic gas to nature while decomposing and their core structures are based on nature data, and these materials are processed and shaped into ecological furniture. However, it should be a prerequisite that the materials which undergo technological processes in the production stage can be called "ecological" » do not harm the nature in the processing stage. In this research, ecological furniture types, new materials and production techniques will be examined in the context of design and the formation and development processes of ecological furniture will be examined.

Key Words: Furniture Design, Ecological Design, Environmental Pollution, Environmental Awareness

1.INTRODUCTION

Since the existence of mankind, people have always aimed more than what they have achieved and have managed to move forward by using the natural resources available on the world. Today, it has been faced with the consequences of many problems arising from the unawareness regarding the use of natural resources and its effects on the environment and the time that is necessary for the nature to renew itself.

The rapid growth of the population and the inevitable increase in consumption in contradiction with the gradually decreasing world reserves caused the environmental issue, one of the most important issues in the global market and competition environment, to remain in the background. It would not be wrong to say that with the commodification of human beings in the present century, it has become an object of consumption. Society does not question the necessity of the product consumed, how much energy and how much resources it consumes in its process until it becomes usable. It is also of great importance in this cycle after the product has reached the end of its service life. The subject that the consumer behaves unconsciously is how the consumption object returns to nature as waste, where it accumulates if it does not disappear spontaneously and how it affects the air, water and soil in this place. Environmental pollution, which has become one of the main problems of today with the acceleration of industrialization in the 18th century; As a result of depletion of natural resources and deterioration of natural life balance, it has started to harm human life, health and future. In time, people who are conscious about the environment want to maintain the order they are accustomed to, on the other hand by taking various measures to minimize the use of natural resources and the damage to the environment. Many countries have imposed various usage requirements on production and consumption, and have begun to attach importance to different and new design ideas in areas such as recycling and recovery / functionalization.

Of course, meeting human needs is a top priority, but can't we minimize the damage to nature in meeting these needs? This question has led to the re-consideration of all stages of industrial production in many areas, from the design stage to the consumer and the process of extinction in nature. Eco-friendly designs have emerged with different perspectives.

2. CAUSES OF ENVIRONMENTAL POLLUTION

The main factor affecting environmental pollution is the pollution caused by developed countries rather than population growth. "The share of population growth in environmental pollution and natural resource consumption is only 10%. Considering that 70% of the world's income is used by 30% of the world population, the main reason of environmental pollution is consumption increase, not population increase." (Polatli, 2005). Environmental pollution, which emerged as a result of modern life, developing industry and technology, is one of the most emphasized but unsolved problems.

2.1. Formation Process of Environmental Pollution

Environmental pollution is a problem that has started to be seen from the 16th century upon the beginning of industrialization. During this period, major developments in medical science, industry and agriculture directly led to the increase of world population. The increasing population brought urbanization along with the growing needs of the crowded cities. In order to meet these needs, the production rate has increased in industrial and agricultural areas. This triggering of each other in the cause-effect relationship, more production has brought more pollution which can not be prevented. Heavy industrialization has formed the basis of today's environmental pollution with the accumulation of non-recyclable and non-recyclable substances in air, water and soil by releasing harmful wastes to the environment.

Especially the increase in production and consumption due to technological developments in the early 1970s led to a serious change in ecological balances. At the beginning of the 1970s, while environmental pollution was defined only as pollution of air, water and soil, and while the environment was considered to be a free commodity accepting all kinds of waste, these

value judgments were completely changed, the environment was also considered as a resource, and it has been understood that there is a cost”(Halkman).

Human being in constant interaction with the environment; In the ecological cycle, unlike other species, it is the only organism that can benefit from its environment by shaping its environment in line with its own needs. However, since it is not in harmony with the environment in which it lives, the pollution it creates cannot be cleaned by the ecological system in a natural cleaning process and causes deterioration in nature. There is no such thing as the complete destruction of the pollution that occurs on Earth. Today, if all modern life is abandoned and a natural life starts, the result will be only prevention of further pollution. And since there is no such possibility, the only option for preserving the ecological balance is to start to implement it in a short time by conducting research to prevent more pollution and to try to minimize the effects of the existing pollution. When environmental pollution is considered as a whole and considering the socio-economic and socio-cultural structures in the world, it is seen that it is impossible to completely prevent the pollution. In the developed and developing countries, the main causes of pollution should be researched and discussed together with the issues such as re-evaluation of wastes and future preventive solution methods should be considered. *Environmental conditions are classified in order to more clearly determine the causes and effects of environmental problems. This classification;*

- *Physical conditions affecting the growth and development of the individual or community,*
- *Social and cultural conditions that affect the nature of the individual or community,*
- *It includes the definition of the environment of a lifeless element in social value and everything around it as environment “(Gilpin, 1995).*

Today, there are environmental friendly technologies that emerge with economic and social development activities, which minimize the negative conditions threatening the environment and human health and make the most efficient and sustainable use of natural resources. These are classified under four main headings;

1. **Wastewater Treatment Technologies:** Technologies for eliminating the harmful effects of a process: Technologies that interfere with the wastes and other harmful substances produced by the production process without making any changes in the production process.
2. **Clean Product-Clean Consumption Technologies:** These are the technologies that minimize the raw material, auxiliary material, natural resource inputs and waste outputs by going through process changes. They may be intended to change the production process and product type. Products using less energy, water and chemicals, working more efficiently, producing less or less harmless waste in quality and quantity can be grouped under this heading.
3. **Recycling and Reuse Technologies:** Technologies that enable the reuse of wastes and waste materials into new materials, prevent them from being harmed by being thrown into the environment and reducing the consumption of natural resources.
4. **Traditional Manufacturing Technologies:** Some traditional technologies such as solar energy, which have been known since ancient times, are environmentally friendly and environmentally friendly due to their characteristics. "(Halkman)

Clean production technologies ensure that the sensitive balance between human and environment is not disturbed by increasing efficiency, eliminating waste at source and thus reducing risks on the environment. The principle for ensuring pollution control is "preventive

measures to prevent pollution, not cleaning it". The aim of using such technologies is to emphasize that clean production is not only a technology application and to contribute to the formation and development of new approaches and behaviors for the way the industry looks at the environment and its relations with the environment. To list the basic elements in the formation of environmental pollution; urbanization and industrialization are the two most important elements.

2.1.1. Urbanization in Environmental Pollution

Many factors such as economic conditions, making more use of developing technology and accessing all kinds of facilities needed faster and more easily lead to migration from rural areas to cities in societies. Contrary to this behavior, settlements are also seen in urban areas due to factors such as noise, pollution, stress and unhealthy living conditions, but this situation is carried out by too few people to be called migration. Migration from rural areas is not the main reason for the increase in urban population. Developments in industry, trade, tourism and service sector and the fact that these developments exist in cities rather than rural areas can be considered as a second reason for migration. In particular, the increase in the need for additional labor required for the execution of these services is one of the influential factors and causes migration to become larger every day. (Aytis, Özçam, 2010).

The pollution created by the increasing population of the city reaches a level that the infrastructure of a standard population city cannot bear. Therefore, environmental pollution cannot be prevented. This situation causes urbanization to be an environmental problem which has a great impact on environmental pollution.

2.1.2. Industrialization in Environmental Pollution

"The development of industry and trade depends on the provision of cheap production inputs. The residual values that will be formed in this way lead to the establishment of other industries. One of the most easily intervened prices is the labor force according to the supply-demand connection in the production process. The development of industry and trade in all industrialized countries is always cheap provided with strength" (Polatlı, 2005). However, the cheap labor force has caused negative effects on the regions where industry and trade are intense and the population has increased inexorably. The problem mainly caused by industrialization has a direct impact on environmental pollution.

Undoubtedly, offering a high quality product or service to the market at a cheaper price in industry and trade provides a great advantage. While buyers are interested in the price and quality of the product in the market, they are rarely interested in how much environmental pollution this product generates in the production process, and how much it disrupts the ecological balance. In this case, the removal of wastes generated during the production process creates additional costs in production for the enterprise and thus leads to disadvantage in the market competition.

2.2. Mass Production Concept

After the industrial revolution, the concept of design has changed with the development of mass production systems, and the products which can be described as good design are expected to meet the needs of the users in terms of form and function besides the productability and marketability features. Nowadays, products that are suitable for mass production are evaluated as good industrial designs and they are measured by considering the ecological system which is rapidly changing and becoming one of the most important determining factors. Producers and consumers have access to a wide range of information on environmental issues, especially in the context of new regulations and standards, all over the

world. While both parties' efforts to adapt to the new conditions and the transformation are affecting the production and consumption, they create new configurations and business models and lifestyles change.

When we look at the industrial societies in general, it is seen that the products exist in an order to meet the demands of today's modern lifestyles, from raw material procurement to waste. The industrial system works similarly with a circular system like nature. The output of both systems is the input of another system. However, industry and production, which is still a human activity, are not a natural cycle and are therefore incompatible with nature. Unlike nature, the industrial cycle harms the world. At this point, ecological design comes into play. If industrial production is carried out in accordance with ecological principles, products that do not harm the nature can reach the consumer.

3.ECOLOGICAL DESIGN

Before looking at the expansion of ecological design, it would be more accurate to define the ecological environment. Ecological environment; it is a collection of all beings on the living or non-living world, from the smallest micro-organisms that involve each other and have interdependence to animals and humans. Ecological design (green design), on the other hand, can be defined as the designs in which product, production systems and production processes are in harmony with the environment, nature and ecosystem throughout their life cycles. (Kabuloğlu Karaosman, S., Ayna, A., 2011). The basic principle of ecological design is the minimization of harm to nature and therefore to human. But even more so, the main goal is to reduce the damage to zero. Factors that help and guide the process can be listed as saving, transforming, reusing, recycling and giving priority to the environmentally friendly and healthy. In order for the interaction with the environment to be healthy and accurate, the balance of the ecosystem approach that forms the basis of the environmental phenomenon needs to be well balanced. Basic characteristics of ecosystem approach;

- *It covers not only parts of the system but the whole system.*
- *Focuses on internal relationships between elements; relations between the components of the system gain importance.*
- *Consider the dynamic nature and nature of the ecosystem.*
- *It includes the concepts of carrying capacity, flexibility and sustainability, proposing limitations on human activities.*
- *Uses a broad definition of the environment (such as natural, physical, economic, social and cultural environment) (Kabuloğlu Karaosman, S., Ayna, A., 2011).*

As mentioned above, to do ecological Design correctly; production and the material that is used should be ecological. From the simplest objects of daily use and consumption to ecological design, from home to buildings, even to urban design; all inputs and outputs are brought together correctly. Ecological design is not only about the limits of the product's existence and consumption; then, it is aimed at restoring the life cycle or disappearing as if it never existed. The importance of ecological material is crucial in this system. Long-lasting, easy to repair and renewable, providing less energy use during production, easy to reach, and most importantly biodegradable materials can be listed as necessary elements for ecological design.

Recycling centers or forests that grow sustainable products, which are specifically established in the provision of such materials and produce materials in line with ecological principles, are expanding the area of ecological design. Resources that can be reused, recycled or destroyed in nature and rapidly renewed are considered as the most basic needs of today's primary

priority, environmental pollution. In the context of ecology, materials can be classified into two groups; technical and biological materials. Materials of technical origin, such as metals and plastics, which are produced by humans, do not contain organic ingredients, but are therefore non-melting in nature but must therefore be used repeatedly without deteriorating their quality. Biological materials, on the other hand, belong to the group of materials of organic origin, such as wood, wool, paper, felt-based materials, which are consumed by other micro-organisms or by other living organisms and which do not form waste in nature (Özgüç Erdönmez, Aslan).

4. ENVIRONMENT-ARCHITECTURE AND ECOLOGICAL DESIGN

Architecture, which is open to technological developments and new applications, is constantly renewing itself and adapting to the developing age. Architectural structures, designed and implemented without considering the ecological environment, cause the urban skylines to deteriorate, increase infrastructure problems and create visual pollution. At the beginning of designing an architectural structure, first the environment in which the building will be built should be examined and the most harmonious application should be decided. Thus, efforts will be made to prevent environmental problems that have become one of the most important problems of our time. Architecture has developed in parallel with humanity and technology since ages. Increasing opportunities, technological and industrial developments along with ease of application has created. This rapid development process, as in all fields, has caused the sectors providing raw materials and resources to start production with an attitude not considering the environment and therefore, increase the environmental problems. (O, Berktañ, 2006).

The easy production techniques brought by the fabrication production that started with industrialization, the convenience provided by the use of newly developed strong chemical raw materials and the increase in production brought the end of the architectural applications made with traditional methods. The high level of technology has led to an increase and accumulation of harmful wastes and the destruction of the environment and an increase in the environmental damage. With the revitalization of traditional architecture, the conscious use of wooden materials, the reduction of harmful raw materials or environmentally sensitive arrangements to be made in production will make the prevention of the factors possible that cause environmental pollution. The negative effects caused by environmental pollution and the extent of the harm to human health have recently been realized and become an inevitable problem of the era. In recent years, societies have become more aware of the importance and use of ecological products. In architecture and interior design, many companies have started to produce with environmentally friendly technologies by giving importance to the use of ecological products in their designs. *“Heating and hot water requirements of the buildings were met by using solar and wind energy. Natural heating and cooling techniques have been developed with the spaces built in primitive construction technique. Although their value is increased and expensive as a result of the decrease in resources, natural materials (wood, natural stone, water-based ecological interior paints) began popular again. The most primitive building technique, which is considered as the mudbrick wall forming, came to the agenda again and it is developed and applied. In the same way, the reed roofing technique, which is unique to many traditional architects in Benelux and some European countries as a roofing material, has also taken its place in modern architectural applications.”* (O, Berktañ, 2006)

Evaluation of technical or biological materials is used in many areas of design. The materials which can be called cyclic, continuously reproduce and consume and then

renew or regenerate themselves are utilized in all kinds of daily use objects, furniture, technological products and even housing design. Examples of this type of design are the ecological dwellings of « Earthship Biotecture » company.



Figure 1: s Earthship Biotecture ”, Ecological Housing Designs.

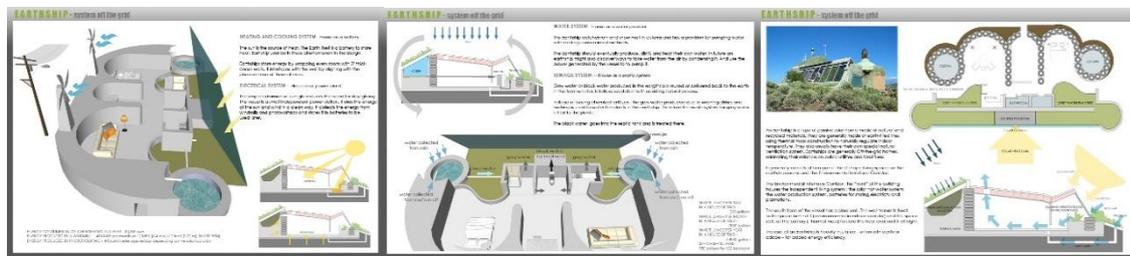


Figure 2: “Earthship Biotecture ”, Ecological Housing Designs.

Self-sufficient environmentally friendly houses that produce their own energy are also capable of thermal insulation. On the ground and exterior walls, car tires filled with soil and clay were used, and on the inner walls, waste bottles and canisters combined with concrete were used.



Figure 3: « Earthship Biotecture ”, Ecological Housing Designs.

“It is seen that buildings are very effective in the changes occurring on the ecosystem, they consume 50% of the energy used, 40% of the raw material, 50% of the chemicals harmful to ozone, 80% of the land suitable for agriculture and 50% of the usage water. « Ecological architecture can be described as the method which provides economic, social and environmental benefit depending on the location, water and energy efficiency, material and the usage of the resources as well as the management of the building. It takes the physical environment with the cultural and psychological aspects as a whole. From design to demolish, all input and output of the building is compatible with the ecosystem and doesn't leave and harmful wastes.” (Aytis, Özcam, 2010).

When the ecological furniture designs are examined, it is seen that traditional furniture designs are produced using natural materials such as wood, stone, wicker and fabric. However, the fact that the furniture produced and designed in the traditional way cannot meet the increasing demand of the population and thus the increasing demand for furniture has forced manufacturers to search for and develop different materials. In this process, it is seen that wood byproducts are used first in furniture design. Products such as plywood, particle board and fiber board are able to respond to industrial production and at the same time, cheap and easy to produce environmentally friendly materials have started to be developed. In this way, efforts to prevent unnecessary use of wood material began to be supported. In particular, the use of aluminum-based metal material, which is recyclable, has played an important role in the formal freedom and renewal of furniture design.

4.1. Ecological Furniture

The development of new materials in conjunction with industrial production has been an impressive factor in furniture design. The designers, who are in search of an original, have started to attract attention with their various experimental works. The inevitable increase in the world population and consequent destruction and destruction in nature have led to an increase in environmental communities, especially in developed countries. The increasing importance of environmentally friendly design has led to the departure of traditional value judgments and the emergence of a new design approach. Many designers have guided this process with the furniture they create.

Most environmental problems are caused by contamination due to mass production products, production systems and the choice of materials used. That is to say, many products are produced from non-substitutable natural sources. As a creator or principal determinant of a product, a designer is a person who influences and directs harmful and negative problems that may arise during the production of the product. Therefore, it is the person who determines which material is used where and how to produce it. With the increasing importance of industrial product design that started in the 60s, the increasing production of expensive, socially useless products that paved the way for new products created new problems. New styles have emerged and fashion has been created, such as the discarding of the old after each product produced, and this approach has been strongly criticized by environmentalists. Today's designers have started to design products to solve environmental problems while serving in many areas.

- **Robert Wettstein ve Frank Ghery**

Murdock eliminated the weaknesses of his design with the design he developed. Wettstein designed a furniture in a method in which the layers of the cardboard were formed by bending the formed layers. The carrying capacity was increased by increasing the cross-section of the paper material. Ghery was impressed by Murdoch's folding, spotted and disposable chair model designed for children called Spooty. Gray produced the seat and chair with the material obtained by pouring and pressing the paper pulp to the low carrying capacity.

In order to provide durability and flexural construction, he formed folds that are opposite to each other between the layers of cardboard. These products, which were obtained from laminated cardboard construction, took their place in furniture stores. This model takes the form of a single material consisting of thick laminate layers. The market price was also very low because it was possible to get this cheap, recyclable and flexible

model of Gray at a low cost. On the other hand, this laminate material can be formed into straight and curved shapes.(YÜKSE, 2012).



Figure 4:Frank Ghery,"Rocking Chair",“Little Beaver Chair And Ottoman”

- **Herman Miller**

Many of Herman Miller's products are designed to be ecologically sound, and many are good examples of eco-design techniques (achieving sustainability, preserving materials, producing energy efficiently, recycling and recycling content, disassembly, etc.).

Henry miller assisted in the establishment of the United States Green Building Council and commissioned architect William McDonough and his partners to design a factory in line with green design principles. This building is known as the house Greenhouse Factory ve and is an example of a successful green building. The building has also won many ecological awards

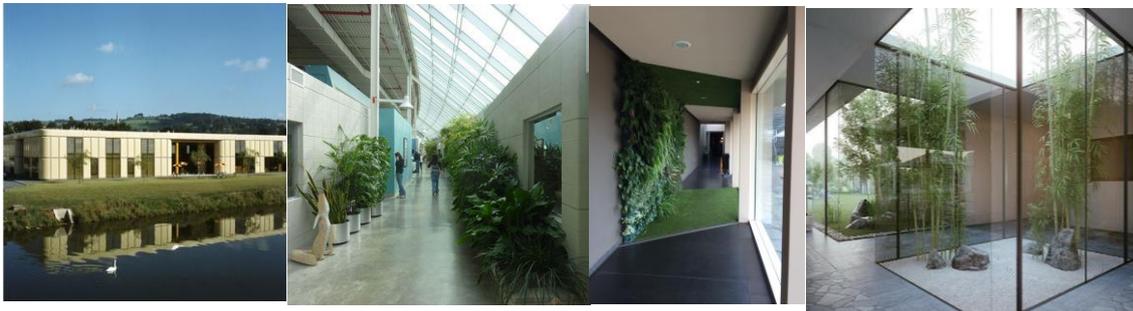


Figure 5: Herman Miller, Green House Factory Building, Interior and Exterior Images

- **Gunnard Andersen ve Peter Murdock**

At the same time, Andersen and Murdock designed the paper material as a seating element with the help of a one-piece structure. Seating elements made with extraordinary and ecological materials were both low cost and nature friendly. Although not very useful in terms of design, they were interesting designs. The materials used can then be regarded as the precursors of paper material that will improve industrial production.



Figure 6: Peter Murdock, “Spooty Chair”, 1952, Gunnard Andersen, “Chair” and “Lounge Chair”, 1952

Looking at Marcel Bruer's design approaches, it can be seen that any object can be used as a seating element. From the same point of view, Ron Arad designed an unused car seat and seat element with rusty bent metal pipes and his work was among the most important examples. When we look at Mark Maden's “Topos” seat design, it is a good example of recycling, although it is not functional, where the waste pieces of hard textured wood materials are cut in certain curved forms. (Yükse, 2012).



Figure 7: Ron Arad, “Rover Chair”, “Moroso Matrizia Sofa”, Mark Maden, “Topos Chair”

Today, measures are being taken against environmental pollution in the field of industrial design. Although recycling, reprocessing, or reducing resource consumption in the product life cycle is crucial to environmental protection, environmental damage is increasing day by day because the inputs to the production process are not completely renewable. In a sense, reducing demand for consumption can have a significant impact. Environmental product design has gained importance in the field of industrial product design. It is a traditional idea that a good designed product is functional. However, a good design is expected to be functional as well as environmentally friendly. It is important that which energy will a product will use and how will it be recycled. The less heavy materials are the right decision for reuse. Designers are expected to achieve these balances in a product.

According to Marcel Duchamp's understanding that « Everything is a work of art, even the smallest design is a work of art » and this interpretation has gained importance. Naturally, such an approach showed that a design can be made by using any kind of material. Thus, instead of environmentally friendly materials, the number of materials that can be used as an alternative increases. Duchamp's approach has supported environmentalist approaches, and the understanding of the art of furniture making from industrial waste products has led many architects and designers. (Yükse, 2012).

Designers Andrea Forti and Eleonora Dal Farra created organic furniture by covering natural materials with resin on where different shapes are formed over time. The holes around the tree stool, called The Fish Eye, were created by Teredo Navalis (a kind of tree worm) in the Venetian canals. These holes created circular patterns on the surface of the oak timber, and the designers filled the holes and cracks with transparent resin. With the same design approach, they designed a cubic seating and shelf system and became a good example of how the organic forms found in nature can be used without processing. (Karakoç, 2016).



Figure 8: Andrea Forti and Eleonara Dal Farra, “The Fish Eye”, “Dolomyth” and “Undergrowth” Products

CONCLUSION

With the increase in environmental problems and the emergence of the damages of industrial materials, a return to traditional production in furniture design has been achieved. The fact that the furniture made with traditional production does not contain harmful materials and the natural origin of the materials used makes it possible for the furniture to be long lasting and robust, and it brings new searches in its design. In the history of furniture design, it is very difficult to talk about today's environmentally friendly furniture design. Only a few of the designers were interested in this issue. In addition to the classic or known products that have been valid for every period in the history of design, there have been designs that are interesting, alternative or unusual. Generally, practicality, functionality and aesthetics are given importance in design.

Today, individual designs have become more prominent. Therefore, art, industry and technology are intertwined. Thus, the concept of design and ideas came to the fore. In recent years, however, environmentally friendly design has become increasingly important. Although furniture design of eco-friendly materials is considered as a new concept, we can say that designers have dealt with this issue before. Thus, it has had a significant benefit in improving the environmentally friendly properties of the materials and in the more sparing use of resources in a way that is less harmful to the environment. Creating original and useful furniture by using the original works of the designers or designs with unusual forms helps to support the environment in which we live in an environmentally friendly way. Therefore, the use of materials developed for recycling purposes will give more beneficial results to the environment. As we emphasized in this study, we tried to prove that the designs for the use of industrial wastes, unusual forms, ready and recyclable materials are environmentally friendly.

The opinions of the designers and trends in which we have examined the conclusions and approaches above are also supported by this thesis. Eco-friendly products are increasing day by day and designers and users understand how important it is to provide the necessary measures and incentives to use environmentally friendly materials.

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