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REVIEW ARTICLE / DERLEME MAKALESİ

Furniture Wastes and Their Environmental Impacts as Being a Different Problem of Our Time

Günümüzün Farklı Bir Problemi Olarak Mobilya Atıkları ve Çevresel Etkileri

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Abstract
Since people could easily and quickly access the items they used, the use-dispose approach was adopted instead of the repair-use process. An outcome of this consumption madness and curiosity related to vanity has been associated with furniture usage. Furniture is in good condition but is replaced by the belief that they are not in trend disposed of without considering any ecological and economic issues. This discarded furniture is typically deposited in solid waste landfills with other household waste and decreases those sites' capacity. Furniture waste, described as giant waste volume, is ecologically harmful because of its chemicals they contain and also causes significant economic losses. Although there are many examples in the world where furniture waste is collected, repaired, and reused, very few municipalities in Turkey can collect such waste and include recycling and reusing it. Besides, there is no inventory in Turkey relating to this waste. Furniture waste examples in the world are presented in this study, and damages to the environment are examined. Furniture waste status is determined by the qualitative research observation method for Istanbul, Turkey's largest furniture and urban low-income market, and Kocaeli, which has been identified as having the highest income inequality in the Eastern Marmara region. In these cities, the methods of using furniture waste were investigated. The aim was to draw attention to the possible damage to the environment by calculating the volume of furniture waste. With this work shaped by the descriptive analysis process, it is intended to lead to other academic studies on accompaniment, complete literature research that is insufficient on the issue and increase awareness of the environmental problems of the increasing consumption of furniture in Turkey. The lack of literature on the amount of furniture and waste disposal in Turkey increases the study's importance.
Keywords: Bulky waste, Environmental Problems, Furniture, Furniture Waste, Waste Management

Öz
İnsanların kullandıkları eşyalara kolay ulaşımı nedeniyle tamir et- kullan düşüncesi yerine kullan-at mantığı yerleşmiştir. Bu tüketim çılgınlığı ve gösteriş merakının bir sonucu da mobilya kullanımıdır. Kullanılabilecek durumda olan ancak modası geçtiği bahanesiyle değiştirilen mobilyalar hiçbir ekolojik ve ekonomik kaygılara bakılmaksızın atılmaktadır. Atılan bu mobilyalar genellikle katı atık depolama sahalarında diğer evsel atıklarla beraber depolanmakta ve o sahaların kapasitelerini düşürmektedir. İri hacimli atık olarak da belirtilen mobilya atıkları hem içerisinde barındırdıkları kimyasallar nedeniyle ekolojik yönden zararlı olmakta hem de önemli ekonomik kayıplara sebep olmaktadır. Dünyada mobilya atıklarının toplanıp tamir edilerek yeniden kullanımı konusunda birçok örnek bulunmasına rağmen Türkiye'de çok az belediye bu atıkları toplayarak geri dönüşüm-yeniden kullanım sürecine sokabilmektedir. Ayrıca Türkiye'de bu atıklar konusunda herhangi bir envanter de bulunmamaktadır. Yapılan bu çalışmada mobilya atıkları konusunda dünyadaki örnekler verilmiş, söz konusu bu atıkların düzensiz olarak bertarafı sonucunda çevreye olan zararları irdelenmiştir. Mobilya sektörü istihdamı ve Türkiye'de gelirin en yüksek olduğu İstanbul ve gelir eşitsizliğinin en düşük olduğu Doğu Marmara Bölgesinin gelirin yüksek olduğu illerinden biri olan Kocaeli'de mobilya atıklarının durumu nitel araştırmalardan gözlem yöntemi ile tespit edilmiş ve sonuçları ortaya konmuştur. Bu illerde mobilya atıklarının değerlendirme şekilleri araştırılmış, mobilya atıklarının hacminin hesaplanması ile çevreye verebilecekleri zarara dikkat çekilmesi amaçlanmıştır. Betimsel analiz yöntemiyle şekillenen bu çalışma ile Türkiye'de son yıllarda giderek artan mobilya tüketiminin yol açacağı çevre sorunlarına farkındalık oluşturmak, konuyla ilgili diğer akademik çalışmalara yol açmak ve konu hakkında eksik olan literatür çalışmasının tamamlanması amaçlanmıştır. Türkiye'de mobilya atıklarının miktar ve bertarafı konusunda literatür bilgisine rastlanılmamış olması çalışmanın önemini artırmaktadır.
Anahtar Kelimeler: Hacimli Atık, Çevre Sorunları, Mobilya, Mobilya Atıkları, Atık Yönetimi

I. INTRODUCTION

With the increasing population, an increase is seen in the consumption quantities and habits. These consumptions come in front of us both in the form of raw materials and as energy. Besides the positive advantages of these consumptions on the communities, they also negatively impact the environment. Human beings have used nature, which they considered an infinite source, loutishly, and have destroyed it, and they have neglected environmental assets most of the time [1]. While on one side of the world, the resources are rapidly consumed, on another side,

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in some regions, even the most fundamental requirements cannot be met, and this particular constitutes the basis for the concept of sustainable consumption [2]. The rapid consumption of resources brings with it some environmental issues. With the changing of consumption habits, problems such as air, water, soil pollutions, and solid waste issues also come out. When literature and legislation are examined, it is seen that there are various definitions for the concept of solid waste. Solid wastes are defined as solid materials that are no more useful for the consumer but have not lost their economic value and need to be collected and disposed of as per the principles of engineering for the community [3, 4]. Solid waste that is not required and desired to be removed is classified as domestic solid wastes, medical wastes, hazardous solid wastes, agricultural wastes, a waste relating to garden and construction wastes (excavation, etc.) [5].

Since ancient times when humans have chosen a settlement lifestyle, it is mentioned about the concept of furniture [6]. The word furniture originates from Italian concerning its meaning. It was used to define "General name given to movable objects that are used for furnishing places where people sit, eat their meals, work, and sleep; furniture" in the current Turkish dictionary of Turkish Language Society [7]. Furniture is the common name given to fixed and movable objects, which can be used at various places relating to all areas of our daily lives, such as sitting, sleeping, dining, traveling, resting areas and areas where all kinds of objects can be placed and preserved [8]. A furniture is a movable object that enables the living areas to be decorated and furnished for various reasons [9].

Furniture at places such as homes, offices, and schools, that completed their economic lifetimes or became out of fashion, are being randomly disposed in Turkey, or they are placed next to the waste containers to be taken by relevant municipalities. These wastes are categorized as Bulky Wastes (Coarse Wastes) with code no 20 03 07, under the heading of "Other Municipality Wastes" on the list of wastes being provided in Waste Management Regulation date 02.04.2015 with no 29314 (Waste Management Regulation, 2015). Bulky waste is defined as giant wastes being composed of domestic objects such as refrigerators, washing machines, and seats that are not usable and volumetrically large [10]. It is essential to determine the negative environmental effects of this waste, analyse the disposal methods and impacts, assess the working interest in the matter under investigation in the world, and Turkey, to bring a different viewpoint to the solid waste issue that has become important today.

II.MATERIAL AND METHOD

To the determination of furniture waste quantity, diversity, and influence in the world and Turkey and environmental aspects, and socio-economic effects, taking into account the social aspect of this issue, mainly used qualitative research methods in this study. With the Documentary Method's help, which is one of the qualitative research methods, the literature on the subject has been researched and revealed. The standard dimensions of the furniture used in the houses were found, and the volume of the solid waste landfills was determined. Determining the area to be covered by furniture waste in terms of volume in storage areas means that it will affect the waste storage areas' number and life. Therefore, such a study is essential regarding raising awareness of the role of furniture waste concerning environmental pollution. One of the main factors influencing the furniture consumption, household income levels taking into account in Turkey, observation method of qualitative research was applied in Istanbul and Kocaeli, the highest household income level o in the East Marmara Region. According to the 2019 TUIK data, the region with the lowest income inequality is the Eastern Marmara region. The most high-income province is Istanbul in Turkey (average annual equivalent household used capita income of 40 thousand 749 pounds). Also, Kocaeli is the city with the closest Gini coefficient to zero. These two cities are the two significant metropolises of the Eastern Marmara Region [11]. According to the furniture sector employment data in Turkey, Istanbul in ranking (4353 establishments) first, Kocaeli is the sixth (315 premises) [12]. Furniture change and consumption are significant in these two provinces with high-income levels. Because employment in the furniture sector also includes production and sales, considering the statistical values. The share of spending on furniture after the rent, food, and transportation expenditures of Istanbul rank are first with 5.6 percent. East Marmara Region and Kocaeli have a vital place with 7 percent when the household spending ratios in 2018 are examined [13]. For this reason, furniture wastes have been observed within the boundaries of Kadıköy district of Istanbul province and İzmit district of Kocaeli province, where housing settlement is predominant, at different time intervals from November 2018 until the end of February 2019, using a general screening model and random observation method, documented and interpreted. Thus, the observation (empirical) method, which is one of the qualitative research methods, and the descriptive analysis method, as well as the documentary method, were used to obtain literature data. The data obtained by getting the literature information were analysed. Thus, it was aimed to reveal the environmental effects of furniture waste. It was sought to answer the following questions with the help of solid data obtained from the literature review with direct quotations and revealing the causes and consequences of the investigated situation by using the descriptive analysis method, which is defined as presenting the data obtained during the research of a problem in real life, current context or environment. "What kind of damage does furniture cause to the environment when it has

completed its life and is disposed of as garbage? What kinds of practices should be done to reduce harmful effects on the environment?" As a result, the cause and effect relationships of a current situation are mentioned.

Existing data on household income and furniture production and other information on furniture form the concrete theory, and the analysis of these data and the interpretation of the relationship between furniture waste and the environment constitute the descriptive analysis phase. Because no studies were done on this subject in Turkey, the literature has not been found knowledge about the amount of furniture and disposal of waste. It aims to lead to other academic studies on the subject and is intended to complete the missing literature on the topic and raise awareness of environmental issues about furniture consumption sourced ecological pollution with this study's help.

III.FURNITURE, FURNITURE TYPES AND FEATURES, THEIR USAGE AREAS

Furniture originates from the Italian word “mobili” and French word “meubles,” and generally, it has been defined as movable objects and house objects which are used to furnish the sitting areas and for various other useful purposes. As being different from European languages, its usage in English is in the active form of “furnish” and in the name form of “furniture” being derived from the French word “fourniture” [14, 15]. Furniture can be described as durable consumer goods manufactured with various materials and was gained function and form to meet individual requirements in our daily lives [16, 17].

If it is desired to classify furniture, many different types come out. Furniture can be separated as indoor and outdoor furniture according to the places where they are used, as movable and fixed furniture according to their positioning style, as wood, metal, plastic, stone, glass, composite furniture according to the material used, as furniture for individual and collective use according to their usage, as kitchen, living room, office, school furniture according to venues, as living, storage, service, hospital, furniture for the disabled, lighting furniture according to their functions, as movable, semi-mobile and fixed furniture according to their own features in the space, as disassembled (removable) or mounted furniture depending on the installation situation, as children furniture, youth furniture, adult furniture, elderly furniture according to user age groups, as ergonomic furniture, non-ergonomic furniture according to their ergonomic evaluation, as commercially available commercial furniture, normal-standard furniture, high quality expensive furniture according to their economic values [15, 18, 19].

When the materials that are most frequently used in furniture production are evaluated, it is seen that they are wood, paper-cardboard, steel, aluminium, iron, copper, brass, bronze, glass, plastic, marble, MDF (Medium Density Fibre Board-Medium Density Fibreboard), and chipboard [20, 21]. In particular, massive materials are used in residential fittings such as tables, cabinets, bedsteads, bedside tables, and bookcases; in various office accessories, school desks, and tables. Other materials, such as steel, aluminium, glass, and plastic, are also used in furniture production [22]. Apart from all these, there is also furniture which is manufacture by using reused or recycled materials. Furniture sizes show variations depending on their usage types and places. Average dimensions in the furniture area and the volumes they cover are given in Table 1.

Table 1. Various types of furniture and their average measures [23]

Furniture	Width (cm)	Length (cm)	Height (cm)	Volume (m^3)
Single bed	100	200	35	0.7
Double bed	160	200	35	1.12
Double bed (box spring)	200	200	50	1.60
Commode	35	50	60	0.105
Dressing Table	46	114	78	0.409
Puff	48	48	50	0.1152
Laundry Cabinet (dresser)	50	110	100	0.55
Dress cabinet	60	165	190	1.881
Dining Chair	47	44	46	0.0951
Study desk	85	200	78	1.326
Office desk	85	200	85	1.445
Book Cabinet	35	120	180	0.756
Work Chair	54	50	118	0.31
The resting couch	62	65	83	0.334
Sofa (for 3 people)	87	215	84	1.57
Sofa bed	90	215	83	1.606
TV unit	46	128	175	1.0304

IV. FURNITURE WASTES IN THE WORLD AND IN TURKEY

Furniture used in areas such as houses, offices, schools that have reached the end of their lives or are broken in a state that cannot be used is discarded and treated or disposed of differently depending on the country. These wastes are being used or disposed of in various ways by the relevant countries. According to research being conducted, it was determined that 80-90% of the furniture that is purchased is disposed of after the first six months period of owning them [24]. When furniture wastes in literature are examined, it is seen that wastes come out during the production phase and the usage phase. For example, it is being stated that nearly one-fourth of total furniture wastes being produced in the world are produced in European Community countries. More than 10 million furniture is being disposed of by

producers each year and consumers in EU countries, and these wastes are disposed of at regular storage fields or burned [25]. In the year 2010, 4.1 megaton wood waste has occurred in England; these are reported to be 0.4 megatons of furniture waste [26]. 88% of the wastes generated during the production phase in furniture factories in Brazil have been reported as wood and the rest as metal, plastic, fabric, paper/cardboard [27]. In France, 2 million tons of furniture wastes occur each year, and most of these wastes are being burned or disposed of in common storage areas [28]. According to a study being conducted in Ireland, it has been stated that most of the furniture wastes being part of urban wastes have features enabling them to be reused [28]. In Belgium, nearly 50 thousand tons of wastes occur each year, including house goods and furniture [29]. In a study conducted in metropolitan regions of Australia as covering more than 2500 pieces of households, it was reached to the data that 24 kgs of furniture wastes occur each year per household. It was determined in a study that when these data were transformed into figures, they were equivalent to 800 thousand sofas, 1.65 million dining tables, 3.4 million coffee tables, and 6.85 million chairs [30]. When it was looked at the United States of America, it is seen that in the report being prepared by EPA (the United States Environmental Protection Agency), it is predicted that 9.8 million tons of furniture wastes come out each year. When the sources in literature are examined, it is seen that it is specified that nearly 100 thousand tons of furniture wastes occur each year in Finland and that 70-80% of these wastes have features enabling them to be improved and reused [31, 32].

When Turkey's situation is reviewed, a similar study about furniture wastes could not be found in the literature. Within the survey's scope, furniture waste found at random times and random points in Istanbul and Kocaeli was photographed and given in Figure 1.

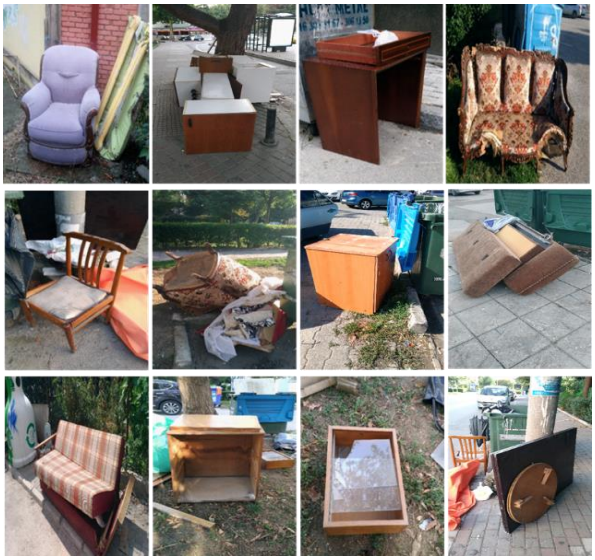

Figure 1. Furniture wastes found at different times and random points in Istanbul and Kocaeli [33].

When Figure 1 is examined, it is seen that furniture is composed of types such as sofa, sofa bed, chair, and cabinet and that some of them could be used with a small repair being done. Others are so damaged that they cannot be used. These wastes are taken by municipalities and delivered to common storage areas, and they occupy spaces as per their volumes. In some observed samples, it was determined that furniture that was thrown away by people was broken down and collected for fuel purposes. As a result, these wastes shorten the disposal sites' planned life, or they mix into the atmosphere as harmful gases as a result of their burning. Besides, it causes environmental pollution and visual pollution at the place where the wastes are collected. Wood, metal, plastic, and textile contents are noteworthy in furniture that cannot be used, and these can be used as raw materials after recycling. Pieces of furniture, mostly metal and glass accessories, are dangerous in being hurtful to the living creatures around.

V. FURNITURE WASTES AND THEIR ENVIRONMENTAL IMPACTS

In the woodworks and furniture sector, usage of raw materials, production process, and distribution of products, their being burned after completion of their usage lifetimes, or their being reused for various purposes causes very different environmental impacts. The life cycle of furniture takes place in successive stages, from the forest to the end product furniture production, and the aging of furniture during its use. Afterward, these materials can be burned or used by recycling. Furniture that is considered among durable consumption goods is produced in various numbers and types, and their usage lifetimes show variations. This period is 10-15 years on average, but it can be as much as 50 years. After cutting trees, which are the raw materials of furniture products, chemicals such as wax emulsion, polyvinyl emulsion, and aluminium are used on the timber ends.

Furthermore, to avoid trees being impacted by bacteria and fungi during storage and transporting, certain chemical materials are being used. On the other hand, environmental damages occur in furniture production, especially in glue and surface treatments. Since urea, phenol, and melamine ($C_3H_6N_6$), formaldehyde (CH_2O) adhesives harden due to chemical reaction, a large amount of formaldehyde is released drying. In various colouring solutions being used for surface treatments, multiple substances can cause cancer or have carcinogenic features. Auramine ($C_{17}H_{21}N_3$), benzidine ($C_{12}H_{12}N_2$), aminoazobenzol, and amino naphthalene are in this group. Benzol (C_6H_6), dichloroethane ($C_2H_4Cl_2$), dichloromethane (CH_2Cl_2), dioxin, tetrachloromethane (CCl_4), and trichloroethylene (C_2HCl_3) are also substances having carcinogenic effects among melters and thinners which are used for both colouring and protection during surface treatments. Binders used for particle boards, which can

also be used in furniture production, are based on urea-formaldehyde or melamine-formaldehyde resin. Glues that are used in furniture works also contain the same substance. Formaldehyde is a colourless, toxic chemical substance with a strong odour used in the production of glues in wood-based panels such as medium density fibreboard (MDF), particleboard, and plywood. The formaldehyde emission caused by wooden-based materials bears importance due to its environmental and health impacts [34, 35]. Besides all of these, in furniture, there are fire retardants, which are collected in five main groups: bromine, chlorine, phosphorus, nitrogenous and inorganic compounds according to their chemical structure and polybrominated diphenyl esters (PBDE), which are mainly used in flooring and are fire retardant [36]. It is required for specific standards to be complied as mandatory to avoid fires, named 'Small Open Flames', which can originate from matches, candles, and oil lamps related to furnishing materials used in furniture. For this purpose, there are 16 different types of chemicals available in the USA. These chemicals are hexabromocyclodecane ($C_{12}H_{18}Br_6$), Decabromodiphenyl oxide ($C_{12}Br_{10}O$), alumina trihydrate ($AI_2O_3+3H_2O$), magnesium hydroxide ($Mg(OH)_2$), zinc borate ($B_2O_6Zn_3$), ammonium polyphosphate ($(NH_4PO_3)n\ (OH)_2$), phosphonic acid (H_3PO_3), tetrakis (hydroxymethyl) phosphonium chloride ($[P(CH_2OH)_4]Cl$), antimony trioxide (Sb_2O_3), ammonium pentoxide, sodium antimonate ($NaSbO_3.3H_2O$), calcium and zinc molybdate, Organic phosphonates, cyclic phosphonate esters, trichloro phosphate and chlorinated paraffin [37]. For example, on an average couch there are 63% chipboard, 9% foam, 8% wool-cotton, 8% timber, 8% low-alloy steel, 3% polyester, 1% flame retardant and 1% melamine [38].

When furniture containing chemicals, as mentioned above in their structures, are randomly disposed of, it will be inevitable for these chemicals they have to mix with water and soil in time. Besides, it is known that various chemical substances would be released into the atmosphere due to the combustion of these wastes at waste storage areas or their being disintegrated by people to be used for heating purposes. Products that could be released due to the combustion of some of the chemicals mentioned above have been defined in the below equations.

For example, as a result of burning an item of furniture made with glue containing chemicals such as melamine and formaldehyde;

$$C_3H_6N_6+\frac{21}{2}O_2\rightarrow 3CO_2+3H_2O+6NO_2 \quad (1)$$

(depending on temperature)

$$CH_2O+O_2\rightarrow CO_2+H_2O \quad (2)$$

Emissions would mix with the atmosphere.

As another example, while burning of furniture in the production of which colouring and/or thinning substances containing chemicals such as auramine, benzidine, benzol have been used;

$$C_{17}H_{21}N_3+\frac{50,5}{2}O_2\rightarrow 17CO_2+\frac{21}{2}H_2O+3NO_2 \quad (3)$$

(depending on temperature)

$$C_{12}H_{12}N_2+16O_2\rightarrow 12CO_2+6H_2O+2NO_2 \quad (4)$$

(depending on temperature)

$$C_6H_6+\frac{15}{2}O_2\rightarrow 6CO_2+3H_2O \quad (5)$$

would come out.

Furthermore, components such as dioxin would form with the burning of furniture containing substances having carcinogenic impacts such as dichloroethane ($C_2H_4Cl_2$), dichloromethane (CH_2Cl_2), dioxin, tetrachloromethane (CCl_4), and trichlorethylene (C_2HCl_3). Dioxins are by-products containing C, H, O, and Cl in their structures, which are colourless, odourless, and non-water soluble and released during burning process in an environment low with oxygen as not being desired [39]. Due to the application of chemicals to make the wooden materials used in furniture to become durable, recycling and reuse of furniture wastes were prevented [40]. Besides, with the burning of these wastes, emissions such as NOx, heavy metal, PCDD/F (Polychlorinated dibenzo–p-dioxins, polychlorinated dibenzofurans) would increase.

If these wastes are delivered to common storage areas, they could occupy volumes specified in Table 1, and they would shorten the lifetimes of storage fields. For example, if a sofa bed is thrown, it will occupy an average space of 1.6 m^3, a single-seat would occupy an area of 0.334 m^3, a dining chair would occupy a space of 0.0951 m^3, and a library would occupy an area of 0.756 m^3. As a result, in place of storage areas, whose lifetimes would be quickly expired, it would be required for new areas to be found, which would give rise to environmental and economic problems.

VI. REUSAGE AND RECYCLING OF FURNITURE WASTES

Waste policies of countries in the world have been generally adopted as being "zero waste economy." Economic issues, climatic, and environmental protection laws are essential in how the wastes will be disposed of [26].

Disposal of furniture waste, which contains various chemicals, causes various problems to occur. Furthermore, waste wooden materials may constitute a

potential resource for the production of different materials and products. However, one of the factors influencing the usage of these wastes is related to energy consumption during their carriage and processing, and the pollution created in this respect [41]. Besides, as the furniture is produced from different materials, the prediction of environmental impacts beforehand is quite difficult. On the other side, the dissemination of disposable culture constitutes an important reason which increases non-quality aspects of furniture. Generally, many of the new furniture cannot be used after a few years.

Furthermore, when these products are exposed to moisture, many of them are quickly swelling and getting decayed [30]. One of the factors that make it harder to recycle furniture and wooden wastes is the difficulty of separation. Besides, only a small amount of recyclable materials can be obtained from these wastes [42].

Furthermore, non-quality materials used in the manufacturing of furniture both shorten their lifetimes and make it impossible for them to be reused. The unconsciousness of consumers and lack of spare parts of furniture are among the factors which increase waste amounts in general. Besides, the chemical substances used in furniture cause additional difficulties and costs for people dealing with recycling works. Collection, carriage, and repair of furniture are quite costly processes. Even if all of these would be realized, low demand for second-hand furniture constitutes another reason why waste amounts get increased [25].

Recycling and reusage of furniture wastes cause various positive outcomes, both concerning economic and environmental aspects. For example, reusage of 1 ton of sofa avoids releasing 1.45 tons of CO_2 equivalent greenhouse gas into the atmosphere. These equals 55 kgs CO_2 equivalent greenhouse gas per couch. When it is looked at in England, it is seen that nearly 100 thousand pieces of dining tables are reused each year. 17% of waste tables are being disposed of, and the remaining portion of 83% is being used through recycling. In this way, with 1 ton of dining table, it is avoided for 0.38-ton CO_2 equivalent greenhouse gas to be released into the atmosphere—this equivalent to 10 tons of CO_2 equivalent greenhouse gas per table [43]. Besides, 200000 pieces of office tables (nearly 5000 tons) are being reused in England each year. As a result, releasing 3600 tons of CO_2 equivalent greenhouse gas is being avoided each year. When it is looked at office chairs, it is seen that 295.000 pieces of office chairs are being reused each year. With the reusage of one ton of office chairs, releasing 3 tons of CO_2 equivalent greenhouse gas is being avoided, and releasing 35 kgs of CO_2 equivalent greenhouse gas per chair the same way [43]. CO_2 equivalent emission release savings achieved through furniture recycling can be foreseen as given in Table 2.

Table 2. CO_2 equivalent emission release savings achieved through furniture recycling [44]

Furniture Waste Management	Dining Table (ton)	Sofa (ton)	Office Chair (ton)	Table (ton)
Reusage	0.38 ton	1.45 tons	2.96 tons	0.4 ton
Repair-reusage	0.76 ton	1.05 tons	2.65 tons	0.2 ton

As shown in Table 2, the usage of different furniture without processing or repairing them has prevented releasing a significant amount of CO_2 equivalent greenhouse gas.

Reusage of furniture products bears significant importance concerning providing employment opportunities besides providing environmental benefits. For example, the employment rate is created due to the reusage of one ton of material, exceeding the recycling rate [28]. Furthermore, this enables the purchasing of second-hand materials for people being forced to buy new furniture, with the reused furniture sector. It is stated that with the reusage of wastes, savings worth 720 million Sterling were generated in England, and those savings worth 40 million Euro were generated in Australia [28]. With the regulation being issued in France, it is aimed to achieve reusage and recycling with a ratio of 45% for house furniture and 75% for workplace furniture [28].

Reusage of waste furniture is not only related to wastes, and it has also become a project considered to be necessary to reduce poverty in EU countries. It is considered to be a fundamental requirement to make waste furniture reach those in need. According to the EU scenario, it aims to reuse 30% of waste furniture until the year 2025 and reuse 35% of them until the year 2030 [44].

Furniture banks are being established in various countries. These are a vast storage place where all waste furniture is accepted, repaired, and delivered to those in need. These places collect the used furniture and give them to those in need, such as families with low incomes or disaster victims. But the problem here is related to a lack of hygiene concerning the furniture. For this reason, furniture is being cleaned by using methods such as heat treatment, pressure CO_2 application, vacuuming, steam application [45].

It is seen that these wastes are classified as bulky wastes and that they are administered accordingly when the situation relating to furniture wastes in Turkey is reviewed. There are also studies on furniture waste in Istanbul and Kocaeli provinces where the observation study was conducted. The Istanbul Metropolitan Municipality has initiated delivering furniture wastes

after the Furniture and Recycling Workshop's necessary procedures to needy families through the centre's teams [46]. A facility has also been established by the Istanbul Metropolitan Municipality, where different usage objects are produced from furniture that has completed its life cycle [47].

Kocaeli Metropolitan Municipality and district municipalities started collecting and recycling furniture wastes in public institutions and schools within the scope of the Zero Waste Campaign. For example, 352 thousand 130 kgs of voluminous waste (Armchair Sofa, Furniture, etc.) disposed of by the Körfez Municipality were recycled [48]. It is stated that Kocaeli Kartepe Municipality picks these wastes and that they are delivered to IZAYDAS, being located in the same city for them to be disposed of [49]. However, it is not specified whether furniture wastes are separated or not. Again, it is stated that the sofa bed, armchair, table, and chairs are taken from the relevant addresses by the teams that are part of the Gebze Municipality in Kocaeli [50]. However, there is no information about how it is disposed of this collected furniture waste. It has similar trials in other big cities in Turkey.

With the URBANREC Project carried out by the Bornova Municipality of Izmir and Izmir Institute of Technology together, it is enabled for significant domestic waste to be transformed into recycling products with economic values. It is stated that large volume products such as house furniture, plastic garden furniture, and home textile products can be used this way. Among the wastes collected within this project's scope, those that can be used are being delivered to the citizens in need through the conventional bank of goods. Those whose usage lifetimes have expired are transformed into new raw materials [51, 52]. Waste electrical and electronic equipment and bulky wastes such as armchairs and sofas are being collected from houses, commercial, and corporate workplaces by Gaziantep Şehitkamil Municipality, and they are gained for recycling [53]. Local governments have initiated furniture waste in Turkey to impart the recycling effort to create awareness of environmental protection is a significant development.

VII. DISCUSSION AND CONCLUSION

Due to the increasing technological know-how, the designs, functions, and places of use of furniture are highly developed and nowadays furniture is a consumption object rather than a need. As a result, although they are functional, furniture is dumped in the environment or garbage dumps, thinking that they are out of fashion. However, as can be seen, furniture is a significant hazardous waste. Also, the furniture consists of many chemicals. When the furniture is manufactured, various chemicals are being used. When this furniture is thrown, they mix with water, soil, and air in time. In the studies investigated within the scope of the study, the damage of furniture to the environment is clearly seen. Furthermore, if these wastes are burned for heating purposes, some emissions can mix with the atmosphere.

When furniture wastes are collected by local administrations and disposed of at solid waste storage areas, they occupy spaces equalling their volumes and they shorten the planned lifetimes of these fields. As a result of all these particulars, scheduled lifetimes of storage areas expire much earlier, and it is required to search for new sites. In many countries in the world, furniture wastes are being used. In various countries, furniture banks are being established, and they take a waste of furniture from the houses and repair them, if required, deliver them to those in need. With the recycling and reusage of furniture wastes, positive outcomes are achieved concerning economic and environmental aspects. When it is examined by economic respect, a significant employment rate can be performed with the reusage of furniture products.

According to this research, there are very few attempts to manage waste furniture in Turkey. However, the introduction of-return studies about furniture made by local waste management can be considered a positive result in creating awareness of Turkey's environmental protection. Municipalities should establish furniture banks in each city as per the examples existing in the world. Accordingly, each municipality should pick up the waste furniture from their places, and they should repair them if required, and by meeting hygiene conditions, they should deliver them to those in need. New and different furniture can be produced from the type of furniture that cannot be used, and recyclable wastes such as metal, plastic, and fabric materials can be used as raw materials for different purposes. In this regard, it is required for furniture designers and furniture producers to give more weight to environmentally friendly furniture designs and production. Besides the furniture that is not consumed quickly, that does not become out of fashion fast and that are functional and modular, the designing and production of furniture that will be reused after their function is completed or the wastes of which will be reused bears significant importance concerning the particular of sustainability. As it is also revealed with this study, designing, manufacturing, after manufacturing situations of furniture necessitate an interdisciplinary work to be done.

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